SPIRES ESTATE PHASE 2 - LOCAL STRUCTURE PLAN

LOTS 312 & 313 FIFTY ROAD; LOTS 2, 4, 7 & 8 EIGHTY ROAD AND LOTS 3 & 5 BALDIVIS ROAD, BALDIVIS

January 2025

We acknowledge the Aboriginal and Torres Strait Islander peoples as the first Australians and traditional custodians of the lands on which we work. We pay our respect to their Elders past and present

AMENDMENT NO. 7 -

SPIRES ESTATE PHASE 2 - LOCAL STRUCTURE PLAN

ENDORSEMENT

This structure plan is prepared under the provisions of the City of Rockingham Town Planning Scheme No. 2

IT IS CERTIFIED THAT THIS STRUCTURE PLAN WAS APPROVED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

15 OCTOBER 2014

In accordance with Schedule 2, Part 4, Clause 28 (2) and refer to Part 1, 2. (b) of the *Planning and Development (Local Planning Schemes) Regulations 2015*.

Date of Expiry: 19 OCTOBER 2033

TABLE OF AMENDMENTS TO STRUCTURE PLAN

Amend No.	Summary	Date approved by the WAPC
1	Inclusion of Lot 774 Fifty Road, Baldivis into the Structure Plan area and for the purpose of residential development. (BDG Ref: 141028_ Spires Estate LSP(Part One Only) _Updated to Include Lot 774)	Does not require WAPC endorsement under Clause 4.2.7 of TPS2
2	Updated POS Schedule within Part Two (relevant to Lots 312 & 313 Fifty Road, Lots 2, 4, 7, 8 Eighty Road, and Lot 5 Baldivis Road, Baldivis).	Does not require WAPC endorsement under Clause 4.2.7 of TPS2
3	Updated road network, replacing the cul-de-sac with a through road between land coded R40 and the northern portion of the land zoned Commercial and delete the nib road abutting the southernmost area of land between R60 coded land and the public open space reserve.	Does not require WAPC endorsement under Clause 4.2.7 of TPS2
4	Inclusion of R100 Residential Density Coded land surrounding the Neighbourhood Centre.	3rd February 2017
5	Increase of Density from R40 to R60 Grouped Housing Lot for Amazon Drive and Cnr Nairn Drive and Amazon Drive (Lot within both Phase 1 & Phase 2 LSP).	19th May 2017
6	Introduction of a Special Use site and increase density of some land from R25 to R40 and R100.	19th April 2022
7	Inclusion of Lot 3 Baldivis Road, Baldivis into the Structure Plan area and for the purpose of residential development and public open space.	25th August 2025

EXECUTIVE SUMMARY

The Spires Estate Phase 2 Local Structure Plan has been prepared to guide the subdivision and development of some 58.63 hectares of land on Lots 312 & 313 Fifty Road; Lots 2, 4, 7 & 8 Eighty Road and Lots 3 & 5 Baldivis Road, Baldivis within the City of Rockingham municipality.

The Structure Plan will create a framework for the future urban subdivision and development of an anticipated 950+ dwellings, which will ultimately house a new community in the vicinity of 2,660+ people and the provision for a Neighbourhood Activity Centre.

Summary Table

ITEM	DATA	SECTION NUMBER REFERENCES IN Part 2 of REPORT
Total Structure Plan Area	58.63 hectares	1.3
Area of each land use proposed: - Residential - Industrial - Commercial	 33.431ha 0 2.657ha	5.3
Estimated Lot Yield	650 + lots	5.3
Estimated Dwelling Yield	950+ lots	5.3
Estimated Residential Density	~ 25 Dwellings /site hectare 1 ~ 15 Dwellings/gross urban zone	5.3
Estimated Population	~2,660+ @2.8pp/dwelling	5.3
Number of High Schools	0	-
Number of Primary Schools	0	-
Estimated area and number: - Neighbourhood Parks - Local Parks	9 sites ~5.8ha (98%) ~0.2ha (2%)	5.8

Note: All information and areas are approximate only and are subject to survey and detailed design

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Addendum 3. Amendment No. 6: Introduction of a Special Use site and increase density of some land from R25 to R40 and R100

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PART ONE: IMPLEMENTATION

1.1 STRUCTURE PLAN AREA

This Structure Plan applies to the land contained within the inner edge of the line denoting the Structure Plan boundary on the Structure Plan Map (Refer to Plan 1).

The Structure Plan is identified as the *Spires Estate Phase 2 Local Structure Plan*.

1.2 OPERATION

Pursuant to clause 28, Schedule 2 of the *Planning and Development (Local Planning Schemes) Regulations 2015* ('the Regulations'), this Structure Plan came into effect on the day in which it is approved by the Western Australian Planning Commission and is valid until 24 October 2030, unless the period of approval is otherwise extended in accordance with the Regulations.

1.3 STAGING

The development is being staged from east to west, with lots being released based on market demand.

1.4 SUBDIVISION & DEVELOPMENT REQUIREMENTS

1.4.1 Land Use Permissibility

Land use permissibility within the Structure Plan area shall be in accordance with the corresponding Zone under the Scheme, except for the 'Special Use' zone, where the following will apply:

The following uses are permitted, subject to advertising (A):

- Tavern
- Restaurant/café
- Reception Centre
- Brewery

The following uses are permitted providing they are incidental to the primary use (IP):

- Liquor Store Small
- Betting agency

1.4.2 Hazards & Separation Distances

Lots within the 100m Poultry Farm buffer are deemed to be affected by an odour impact as identified in Appendix F of the accompanying Environmental Assessment under **Part Three – Appendix 1**. The Poultry Farm ceased operation in 2023, as such no further odour buffers will apply.

This Structure Plan is supported by a Bushfire Hazard Assessment (BFHA) and a Bushfire Management Plan (BMP), contained under **Part Three – Appendix 4 and Appendix 13E**. Any land falling with 100m of a bushfire hazard identified in the BFHA/BMP is designated as a Bushfire Prone Area for the purpose of the Building Code of Australia.

A Pipeline Risk Management Plan is required pursuant to the WAPC's Planning Bulletin 87 '*High Pressure Gas Transmission Pipelines in the Perth Metropolitan Region*' and in accordance with the Environmental Protection Authority's *Ministerial Statement No. 580*. The preparation of a Risk Management Plan will be imposed as a condition of subdivision approval.

1.4.3 Special Use Zone

The following reports are to be prepared and submitted within a Development Application over the 'Special Use' site:

a) A detailed acoustic assessment be prepared to mitigate any noise generated from the permitted activities and demonstrating compliance with the Environmental Protection (Noise) Regulations.

b) A Waste Management Plan be prepared as part of a Development Application for the proposed Tavern, detailing the location, size and number of bin stores proposed.

1.5 LOCAL DEVELOPMENT PLANS

Local Development Plans (LDP), are required to be prepared and approved pursuant to clause 47, Schedule 2, of the Regulations in regard to the following:

a) Lots with rear-loaded garage access;

b) Lots with direct boundary frontage (primary or secondary) to an area of Public Open Space;

c) Lots with a direct boundary frontage (primary or secondary) to Fifty Road and Nairn Drive;

d) Land zoned Commercial;

e) Land zoned Special Use;

f) Lots impacted by Nairn Drive and Baldivis Road in respect of noise mitigation; and

g) Lots coded R40 and R100.

Notes:

With reference to (e), affected lots are identified spatially in Appendix E of the accompanying Acoustic Assessment, under **Part Three – Appendix 9** of the Structure Plan.

1.6 OTHER REQUIREMENTS

1.6.1 Notifications on Title

In respect of applications for the subdivision of land the Council shall recommend to the Western Australian Planning Commission that a condition be imposed on the grant of subdivision approval for a notification to be placed on the Certificate(s) of Title(s) to advise of the following:

a) The lot being situated in the vicinity of the Nairn Drive and Baldivis Road, with the potential to be affected by transport noise as identified in the Acoustic Assessment under Part Three – Appendix 9;

b) Construction standards to achieve higher noise standards in accordance with State Planning Policy 5.4 Road and Rail Transportation Noise and Freight Considerations in Land Use Planning (as amended) as identified in the Acoustic Assessment under Part Three – Appendix 9;

c) Lots within the 300m buffer of market gardens, as prescribed by the WAPC Planning Bulletin 63 Policy for Dealing with Potential conflicts between Residential Subdivision and Market Gardens in East Wanneroo.

d) Building setbacks and construction standards required to achieve a Bushfire Attack Level -29 or lower in accordance with Australian Standards (AS3959-2009): Construction of buildings in bushfire prone areas as identified in the Fire Management Plan under Part Three – Appendix 4 and Appendix 13E.

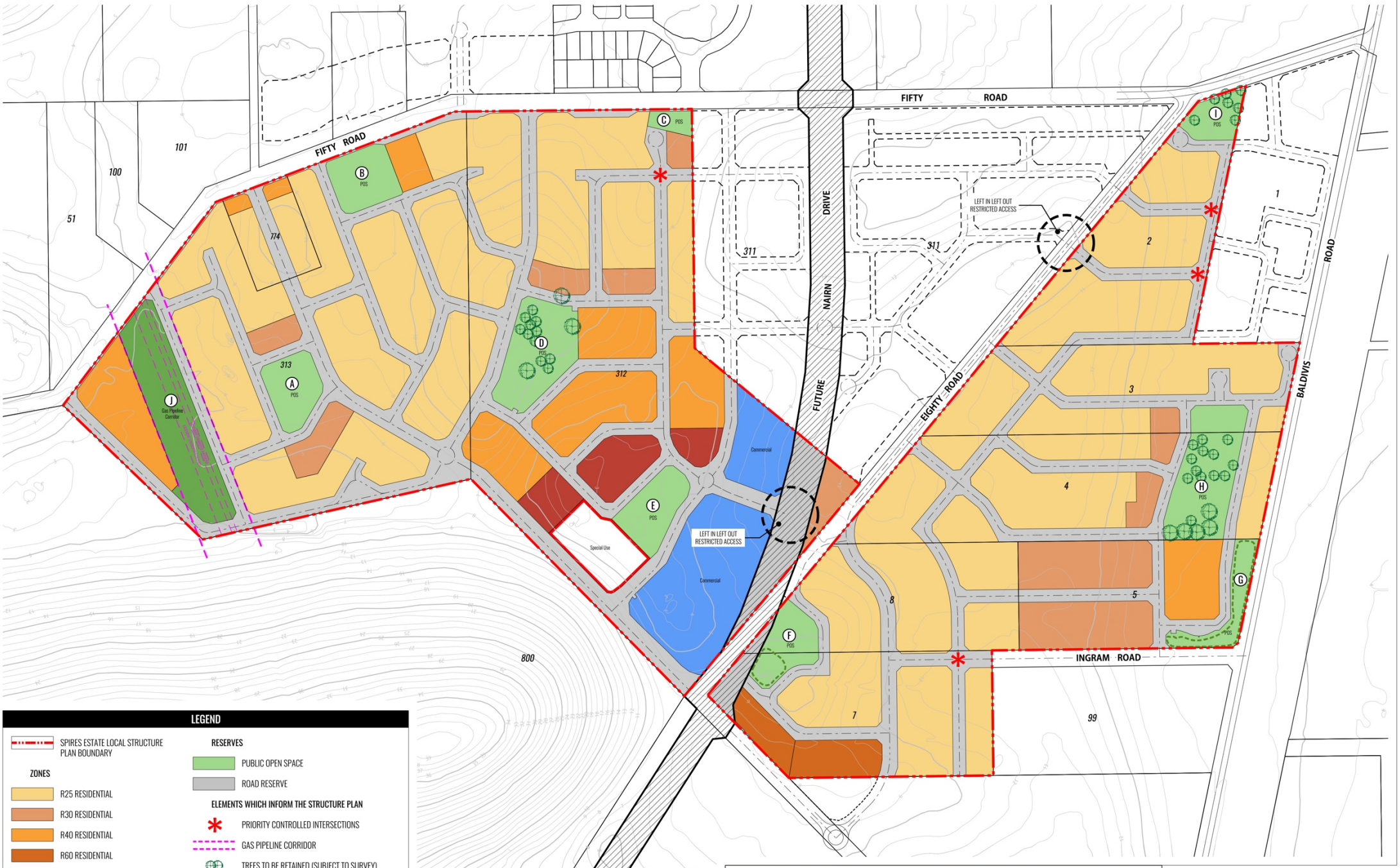
1.6.2 Bushfire Protection

This Structure Plan is supported by a Fire Management Plan (FMP) (Refer to Part three Appendix 4 and Addendum report appendices). Any land falling within 100 metres of a bushfire hazard identified in the FMP is designated as a Bushfire Prone Area for the purposes of the Building Code of Australia.

1.6.3 Information to be submitted with an application

The following technical reports/strategies are to be prepared and submitted as a condition of subdivision approval (where applicable*)*

Additional Information / purpose	Approval stage	Responsible agency (consultation required)
Urban water management plan	Subdivision	City of Rockingham
Bushfire Management Plan	Subdivision	City of Rockingham
Landscaping Plan	Subdivision	City of Rockingham
Local Development Plan	Subdivision	City of Rockingham
Tree Protection Management Plan	Subdivision	City of Rockingham



LEGEND

- SPIRES ESTATE LOCAL STRUCTURE PLAN BOUNDARY

ZONES

- R25 RESIDENTIAL
- R30 RESIDENTIAL
- R40 RESIDENTIAL
- R60 RESIDENTIAL
- R100 RESIDENTIAL
- COMMERCIAL
- SPECIAL USE

RESERVES

- PUBLIC OPEN SPACE
- ROAD RESERVE

ELEMENTS WHICH INFORM THE STRUCTURE PLAN

- PRIORITY CONTROLLED INTERSECTIONS
- GAS PIPELINE CORRIDOR
- TREES TO BE RETAINED (SUBJECT TO SURVEY)
- REMNANT VEGETATION TO BE RETAINED SUBJECT TO ENGINEERING AND DETAILED DESIGN

NOTE: Lots within 100m of classified vegetation identified by Bushfire Management Plan (BMP), require a detailed BAL assessment at Building License stage.

PLAN 1 - SPIRES ESTATE STRUCTURE PLAN (PHASE 2)

Various Lots, Fifty & Eighty Road, BALDIVIS

Aerial supplied by: Nearmap
Aerial Date Stamp: N/A
Survey supplied by: N/A
Plan Number: NPS1022 - 005
Revision Number: A
Drawn By: JP
Client: Spatial Property Group

0 80 160 240 320 400 480m

Scale: 1:4000 @A3 | Date Issued: 29.01.2025 | ©Niche Planning Studio

DISCLAIMER:
Town Planning compliance is subject to approval from the City of Rockingham and a suitable town planner will need to be appointed.
All Dimensions, Areas and Calculations are subject to Detailed Survey and Design before Town Planning Permit application.
Built Form is illustrative only and subject to Architectural Design and approval from an RAIA qualified architect. This plan has been prepared for illustrative purposes only and should not be used as a means to judge any properties value or yield potential.

NICHE STUDIO

PART TWO – EXPLANATORY SECTION

SPIRES ESTATE

LOCAL STRUCTURE PLAN

SPATIAL
Property Group™

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PART TWO – EXPLANATORY SECTION

1 INTRODUCTION

1.1 Purpose

The purpose of this Structure Plan is to provide a statutory framework to guide future subdivision and development of Lots 312 and 313 Fifty Road, Lots 2, 4, 7, 8 Eighty Road & Lot 5 Baldivis Road, Baldivis generally for residential purposes. The Structure Plan identifies the pattern of development by depicting specific matters such as the location of roads, residential densities, public reserves, commercial land and pedestrian/cycle networks.

The Structure Plan represents a design and land use response to the principles and objectives of State and Local Government policy and guidance, including Directions 2031, Liveable Neighbourhoods and Baldivis (North) District Structure Plan.

The information contained in this section provides justification and support for the comprehensive and co-ordinated design response provided for the Structure Plan.

1.2 Background

The Structure Plan area has been recognised through both strategic and statutory planning, as part of a substantial residential cell within Perth's metropolitan south-west corridor. Forming part of the Baldivis North District Structure Plan, the Structure Plan represents an extension of the existing and proposed urban areas surrounding the site. The area surrounding the site has recently been the subject of various Structure Plan and subdivision approvals, with development of residential landholdings north and south of the site currently underway. Land east of the Structure Plan area is currently the subject of a conditional approval under the East Baldivis District Structure Plan and advancement of various Local Structure Plans.

1.3 Land Description

1.3.1 *Location*

The Structure Plan area is located ~40 kilometres south of the Perth Central Business District, ~6 kilometres east of the Rockingham City Centre and ~2 kilometres north of Baldivis District Centre (**Plan 2** refers). The Structure Plan is bisected by the future Nairn Drive reservation.

The Structure Plan area abuts Fifty and Eighty Roads to the north, Baldivis Road to the east, Ingram Road and existing development to the south, and a Parks and Recreation Reserve to the south and west. It is located opposite Baldivis North Estate to the north, and abuts the existing Spires Estate to the southeast.

1.3.2 *Ownership, Area and Legal Description*

The Structure Plan area comprises seven (7) landholdings totalling approximately 54.57 Ha in area.

The relevant Certificates of Title are attached in **Appendix 8.**

Table 1: Title Details and Land Ownership

Lot Number	Owner	Certificate of Title	Area (Ha)
312	Piperpoint Pty Ltd	38/2A	18.63
313	Mainday Holdings Pty Ltd	1955/395	14.97
2	Arrowest Pty Ltd	1282/475	4.05
4	Arrowest Pty Ltd	1324/476	5.76
5	Finepoint Investments Pty Ltd	1388/918	3.41
8	Arrowest Pty Ltd	1411/708	3.43
7	Arrowest Pty Ltd	2201/100	4.32
		Total Area	54.57

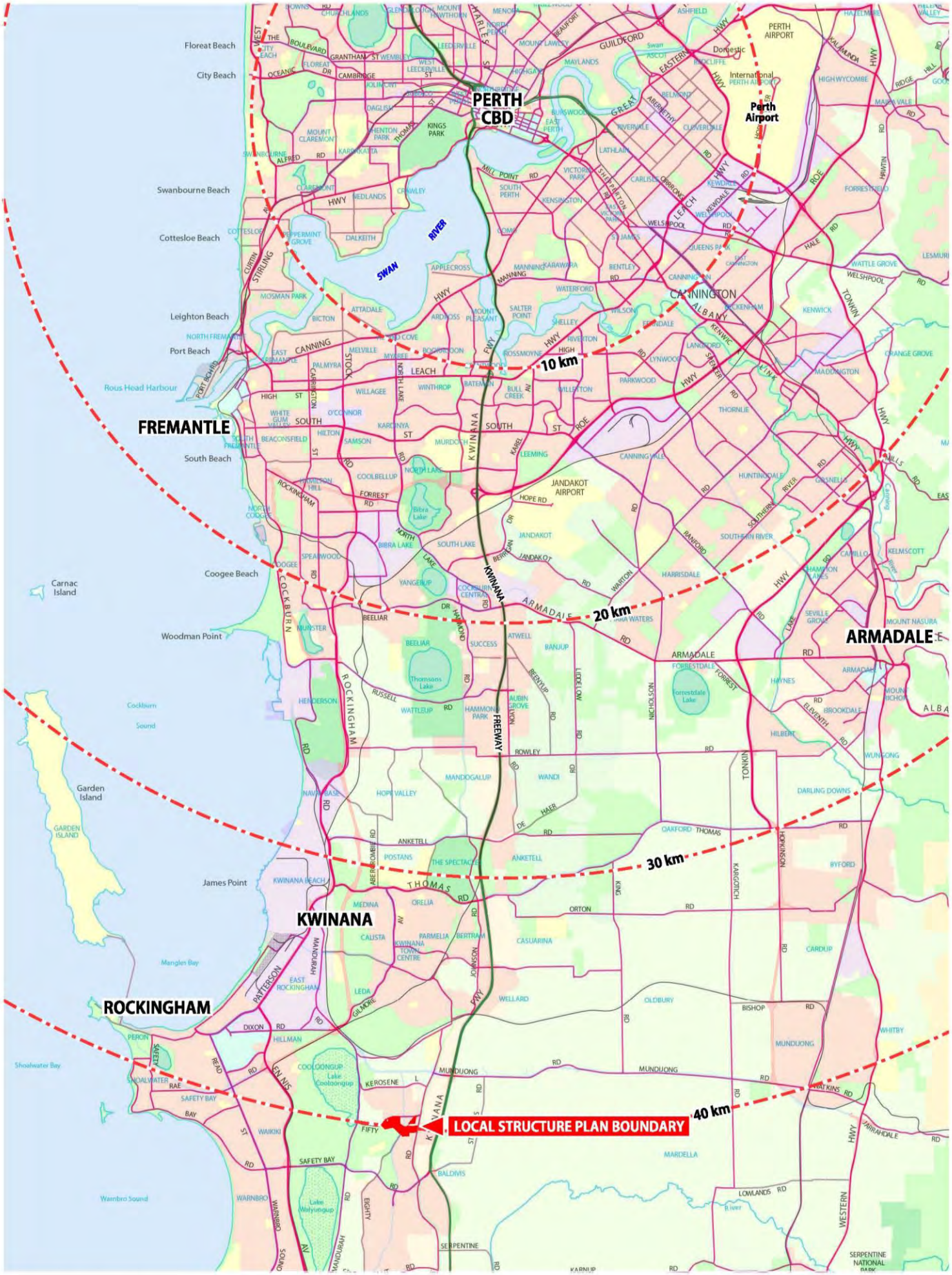
1.3.3 *Land Use*

The Structure Plan area is largely parkland cleared, with pockets of remnant vegetation remaining in some areas. There are two land uses in addition to vacant landholdings that are still currently active, these include:

- Lot 313 Fifty Road– market garden; and
- Lots 4, 7 and 8 Eighty Road– rural residential lifestyle properties.

Lot 3 Baldivis Road abuts the Structure Plan area, and currently operates as a Poultry Farm. Poultry farms have buffers associated with them due to the potential impacts on the surrounding land. Section 2.2.2 of this report outlines the State Government policy requirements relating to poultry farms and their buffers, with a Structure Plan response contained in Section 3.7. The poultry farm can continue until such time that the land owner decides to cease operation; thus in the interim, the land within the buffer will be subject to residential development restrictions. The Structure Plan nominates land uses that will be developed once the poultry farm cease. Accordingly, development of the Structure Plan area will proceed on a staged basis.

Markets gardens located on land zoned 'Urban' under the MRS have no prescribed buffers, however the WAPC requires a number of actions to be implemented at the subdivision stage to manage the impacts of the market garden on residential land. The policy requirements are detailed in Section 2.2.3 of this report, and Section 3.7 contains the Structure Plan response.



PLAN 2 - Location Plan

Various Lots Fifty and Eighty Road, BALDIVIS

for: Spatial Property Group

NORTH

Scale 1: 200 000 @ A4

0 1 2 3 4 5km

COMPILED: DPS		DRAWN BY:	JNP
DATE:	22/11/2012	REVISED:	
GRID:	MGA 50	DATUM:	AHD
DRAWING NUMBER:	CARBD-5-007	JOBCODE:	CARBDLSP
FILE ID: M:\CARBD\Base\Report Diagrams\CARBD-5-007.dgn			

Development Planning Strategies

28 Brown St, East Perth WA 6004

PO BOX 6697 EAST PERTH 6892

T (08) 9268 7900

F (08) 9268 7999

E dps@dpswa.com.au

PLAN 3 - Site Plan and Orthophoto

Various Lots Fifty and Eighty Road, BALDIVIS

for: Spatial Property Group

NOTES :

- LOCAL STRUCTURE PLAN BOUNDARY
- AREAS AND DIMENSIONS SUBJECT TO SURVEY
- CARRIAGEWAYS ARE DIAGRAMMATIC ONLY
- BASE DATA SUPPLIED BY LANDGATE / DEPT OF PLANNING

NORTH

Scale 1: 4000 @ A3

0 25 50 75 100 125 150 metres

COMPILED: DPS, NEARMAP		DRAWN BY:	JNP/RF
DATE:	14/07/2014	REVISED:	
GRID:	MGA 50	DATUM:	AHD
DRAWING NUMBER:	CARBD-5-008	JOBCODE:	CARBDLSP
FILE ID: M:\CARBD\Base\Report Diagrams\CARBD-5-008.dgn			

dpd Development Planning Strategies
28 Brown St, East Perth WA 6004
PO BOX 6697 EAST PERTH 6892
T (08) 9268 7900
F (08) 9268 7999
E dps@dpswa.com.au

2 STATUTORY, STRATEGIC AND POLICY CONSIDERATIONS

2.1 Zoning and Reservations

2.1.1 *Metropolitan Region Scheme*

Under the provisions of the Metropolitan Region Scheme the Structure Plan area is currently zoned 'Urban' (**Figure 1** refers).

2.1.2 *City of Rockingham Town Planning Scheme No.2*

Lots 312 and 313 Fifty Road, Lots 2, 4, 7, 8 Eighty Road and Lot 5 Baldivis Road are zoned 'Development' under the provisions of the City of Rockingham Town Planning Scheme No.2 (TPS2) (**Figure 2** refers).

Land zoned 'Development' under TPS2 is required an approved Structure Plan before the Council can recommend subdivision or approve the development of land within that development area.

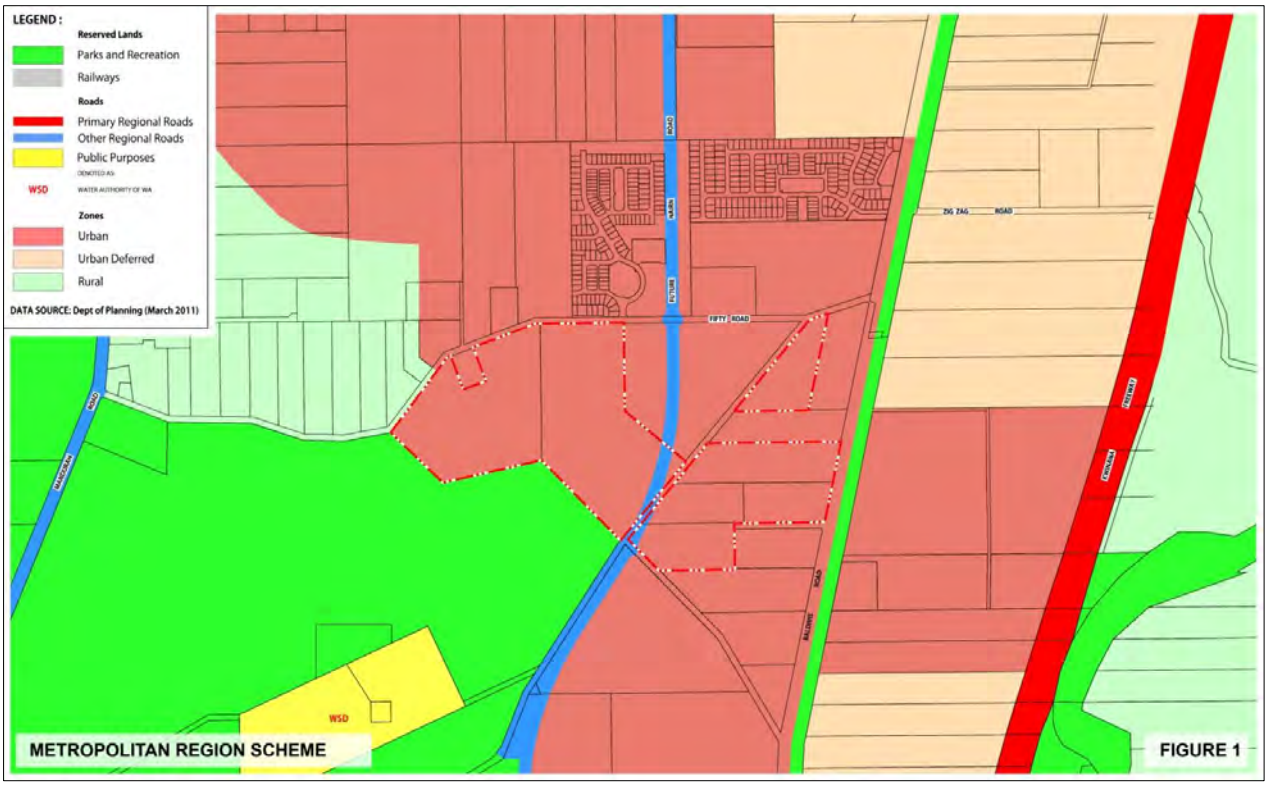
This Structure Plan area is contained within Development Areas No. 9 and 22 which is shown on the Scheme Map and contained within Schedule No. 9.

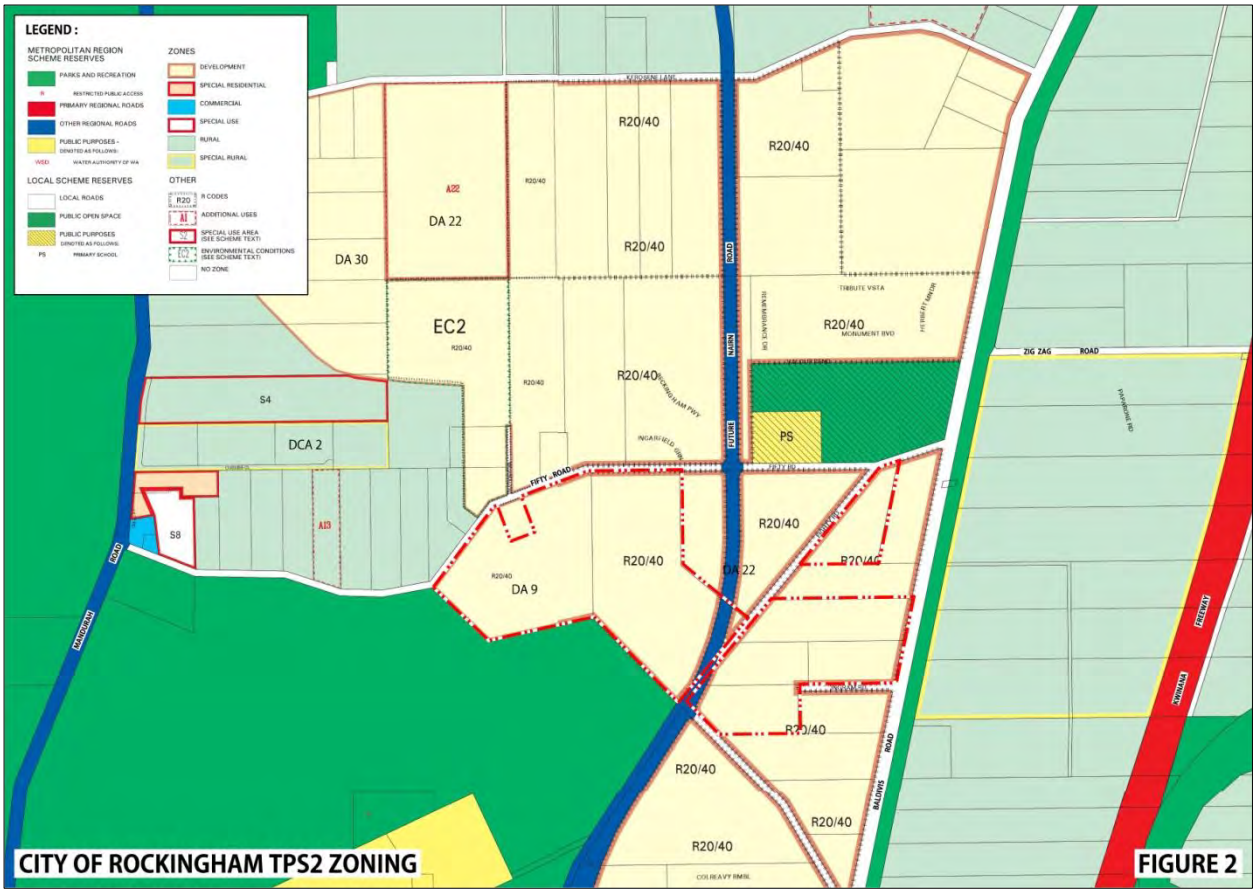
2.1.3 *Baldivis (North) District Structure Plan*

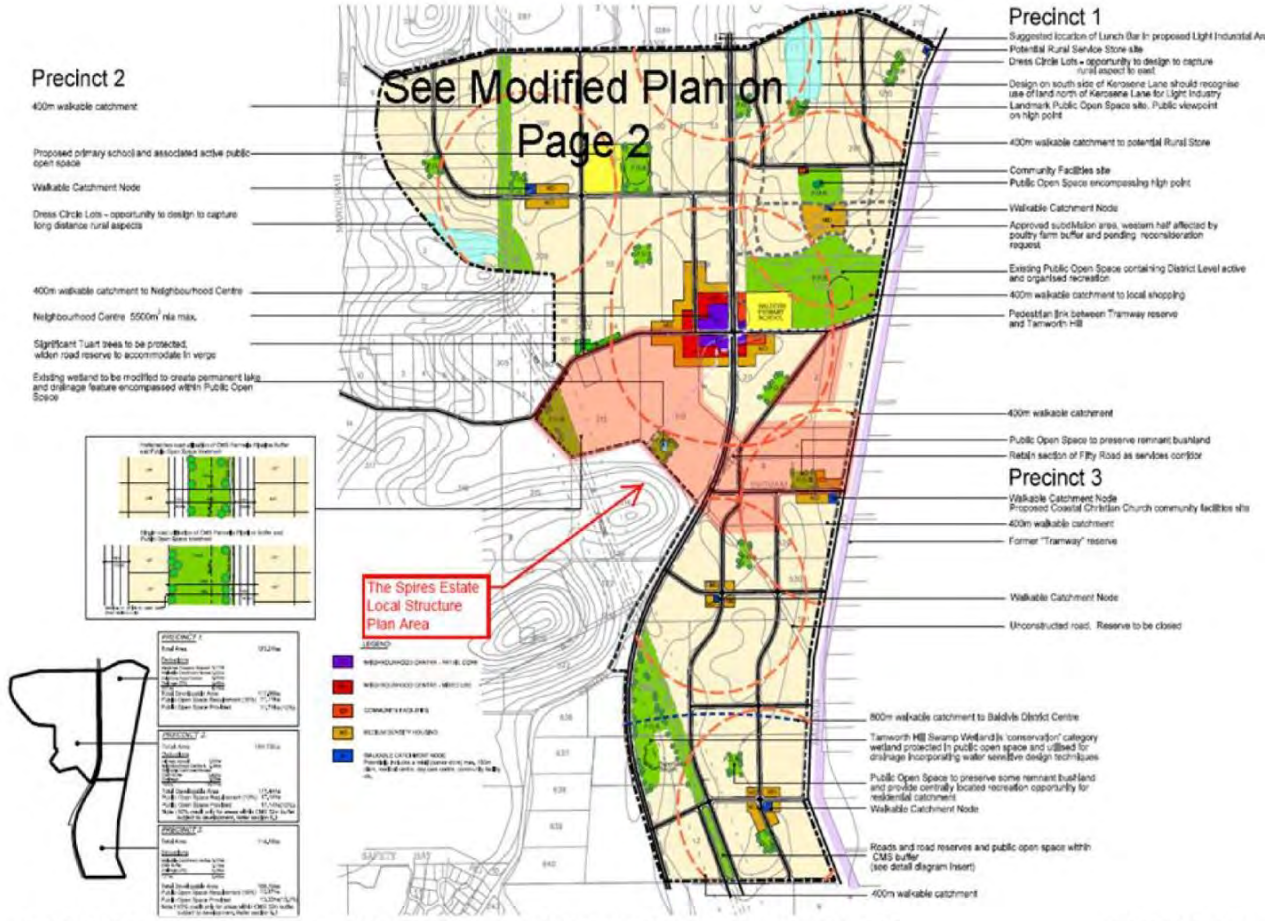
Endorsed by the Western Australian Planning Commission on 18th August 2000, the City of Rockingham's Baldivis (North) District Structure Plan (DSP) guides the preparation of Local Structure Plans by broadly defining preferred land uses and the district road network for the North Baldivis urban cell (**Figure 3** refers). **Figure 4** refers to Modification 1 adopted by the City on 26th September 2006.

The DSP establishes a development framework for the location of major land uses, public transport, road layout, schools, open space and major infrastructure with respect to the physical and contextual opportunities for the site and community aspirations.

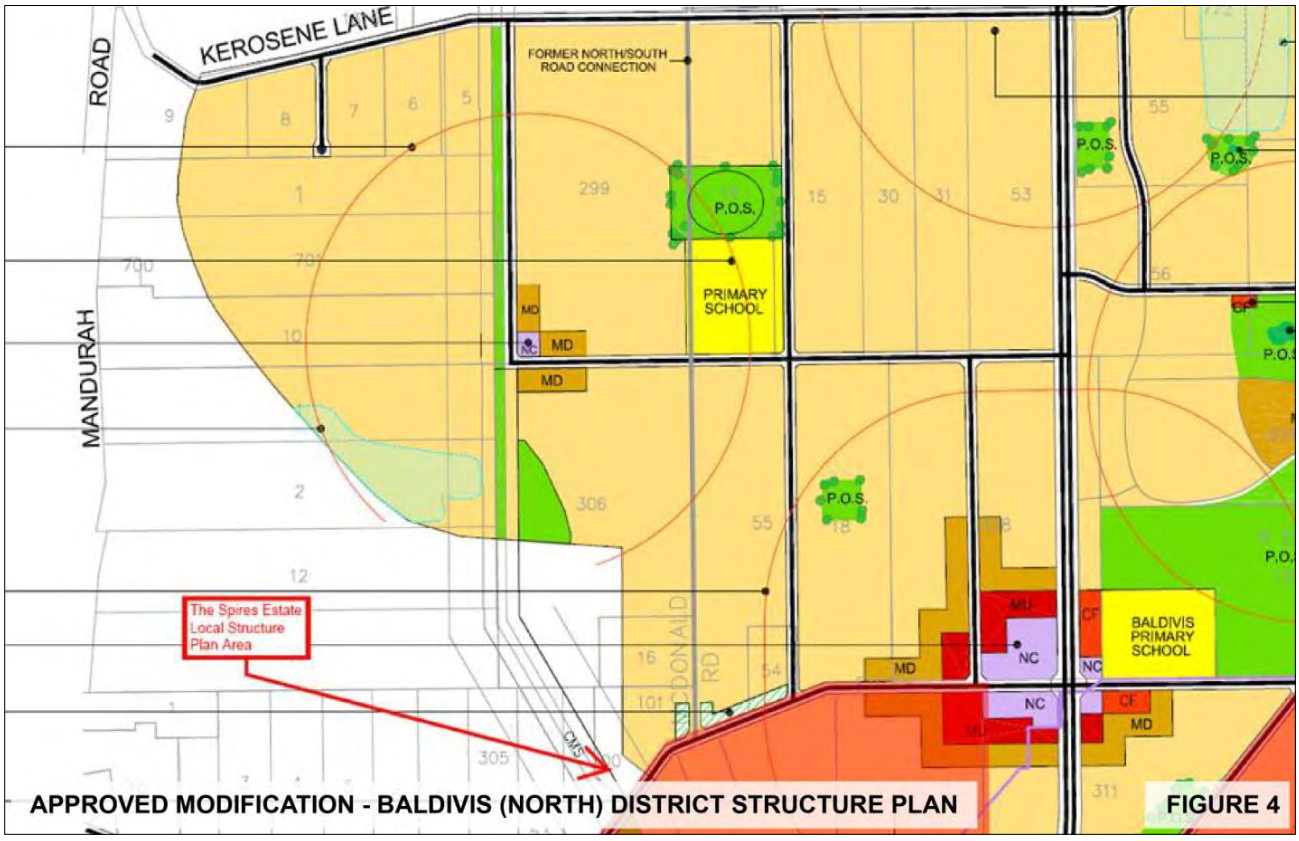
The DSP separates North Baldivis into three precincts, with the Structure Plan area located both in 'Precinct 1' and 'Precinct 2'. In accordance with the objectives of the DSP, this Structure Plan provides a greater level of detail in respect to the Structure Plan design. Development associated with urban land use is progressing across all three precincts identified in the DSP.


LEGEND :
Reserved Lands
Parks and Recreation
Railways
Roads
Primary Regional Roads
Other Regional Roads
Public Purposes
WSD
WATER AUTHORITY OF WA
Zones
Urban
Urban Deferred
Rural
DATA SOURCE: Dept of Planning (March 2011)
WSD
FIFTY ROAD
ZIG ZAG ROAD
METROPOLITAN REGION SCHEME
FIGURE 1


LEGEND :
METROPOLITAN REGION SCHEME RESERVES
PARKS AND RECREATION
PRIMARY REGIONAL ROADS
OTHER REGIONAL ROADS
PUBLIC PURPOSES
WSD
ZONES
DEVELOPMENT
SPECIAL RESIDENTIAL
COMMERCIAL
SPECIAL USE
RURAL
SPECIAL RURAL
LOCAL SCHEME RESERVES
LOCAL ROADS
PUBLIC OPEN SPACE
PUBLIC PURPOSES
PS
OTHER
R CODES
ADDITIONAL USES
SPECIAL USE AREA (SEE SCHEME TEXT)
ENVIRONMENTAL CONDITIONS (SEE SCHEME TEXT)
NO ZONE
DA 22
DA 30
EC2
S4
DCA 2
S8
DA 9
R20/40
PS
FIFTY ROAD
ZIG ZAG ROAD
CITY OF ROCKINGHAM TPS2 ZONING
FIGURE 2



APPROVED BALDIVIS (NORTH) DISTRICT STRUCTURE PLAN **FIGURE 3**



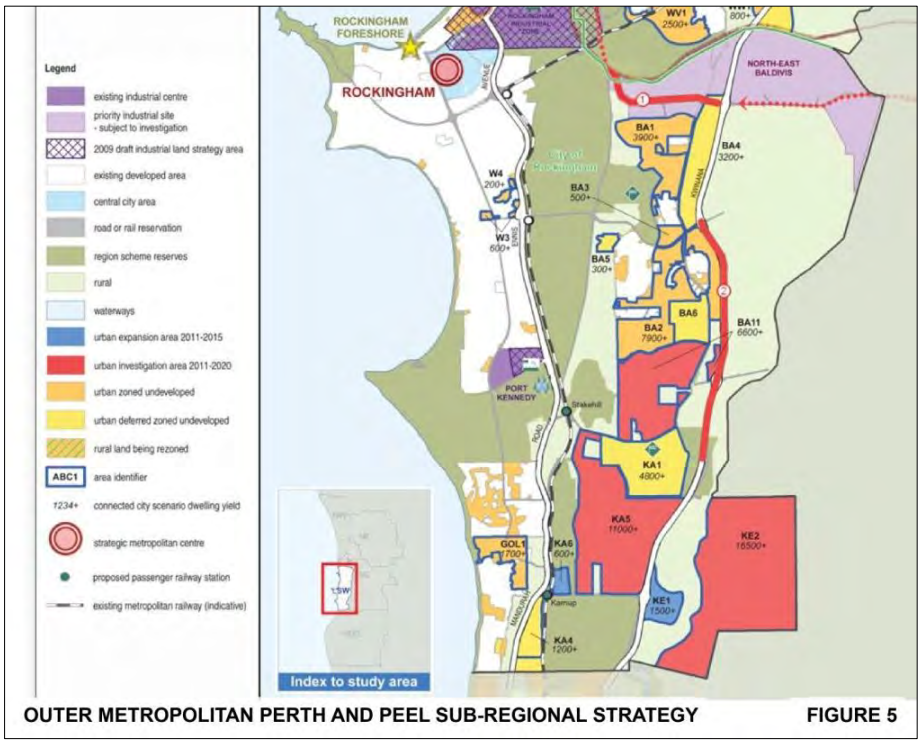
APPROVED MODIFICATION - BALDIVIS (NORTH) DISTRICT STRUCTURE PLAN **FIGURE 4**

2.2 Government Strategies and Policies

2.2.1 *Directions 2031* – Spatial Planning Framework for Perth and Peel

Directions 2031, the WAPC's strategic planning framework document for Metropolitan Perth and Peel, promotes the urban development of the Structure Plan area. Specifically, the Structure Plan area is identified as 'Urban Zoned – Undeveloped' under the associated *'Outer Metropolitan Perth and Peel Sub-Regional Strategy'* prepared by the Western Australian Planning Commission (WAPC). Encompassed by 'BA1' in Directions 2031, this broader cell is forecast to provide approximately 3,900+ dwellings by 2031 (**Figure 5** refers).

The Structure Plan will create a framework for the future urban subdivision and development of an anticipated 800+ dwellings, which will ultimately house a new community in the vicinity of 2,240+ people and provision for a Neighbourhood Shopping Centre.



OUTER METROPOLITAN PERTH AND PEEL SUB-REGIONAL STRATEGY FIGURE 5

2.2.2 *State Planning Policy 4.3* – Poultry Farms

SPP 4.3 seeks to appropriately plan for residential development in areas where poultry farms already exist, and mitigate any potential issues. A poultry farm is currently in operation within the Structure Plan area on Lot 3 Baldivis Road, and conducts hatchery operations and egg production.

The EPA's Guidance Statement No. 3 – *Separation Distances between Industrial and Sensitive Land Uses (2005)* recommends separation distances from industrial based land uses (including poultry farms) to sensitive based land uses such as residential. The Guidance Statement identifies a generic separation distance of 300m - 1000m from poultry farms to residential development; with on-site investigations to determine the actual required buffer to prevent noise and odour impacts to residential development.

An Odour Assessment prepared for the Structure Plan prescribes a 100m buffer from the existing Poultry Farm (**Appendix 1** refers). Section 3.7 outlines how this policy has been addressed by the Structure Plan.

2.2.3 *Planning Bulletin No.63* – Policy for Dealing with Potential Conflicts between Residential Subdivision and Markets Gardens in East Wanneroo

This WAPC policy requires a number of measures to be implemented at the subdivision stage to protect residential land from impacts of market gardens. For residential subdivision and development in the vicinity of market gardens on land zoned 'Urban' or 'Urban Deferred' in the MRS, the WAPC will accept:

- for residential lots abutting a market garden, specially designed fencing of the type specified within Planning Bulletin No. 63, together with a protected and maintained vegetation buffer of one line of evergreen trees or bushed (minimum 1.5m high) for residential lots abutting a market garden;
- for roads and open space abutting a market garden, suitable rural fencing of good standard on the boundary of the market garden;
- prospective purchasers within 300m of the boundary of the market garden being advised of the existence of the market garden on the contract of sale; and
- memorials to be included on titles of all residential lots within 300m of the boundary of the market garden advising of the location and impacts of the market garden or amenity; or
- other measures which it can be demonstrated to meet the objectives of the policy to the satisfaction of the WAPC.

The Structure Plan has been staged to ensure there will be minimal impact from the market garden while it is still operational. **Plan 11** depicts the Indicative Staging Plan of the development. The Structure Plan response to this policy is addressed in Section 3.7.

2.2.4 *Planning Bulletin No.87* – High Pressure Gas Transmission Pipelines in the Perth Metropolitan Region

The Parmelia High Pressure Gas Pipeline runs through Lot 313 in a general north west to south east direction along the western portion of the Structure Plan.

Land uses on the pipeline easement, and within proximity to the easement are guided by both the EPA's conditions on the approval for Lot 313 under Town Planning Scheme Amendment No. 300, and in the Western Australian Planning Commission's Planning Bulletin No. 87 – *High Pressure Gas Transmission Pipelines in the Perth Metropolitan Region* (refer **Appendix 10**).

The Structure Plan requires two land use setback alignments, the smaller at 32m (either side of the gas pipeline) generally prevents dwellings or any other buildings within this setback area. This effectively creates a 64m wide channel within which no physical development can take place. There is opportunity within the 32m setback area to utilise this land for provision of public open space and roads.

The EPA's Ministerial Statement 580 (**Appendix 11** refers) stipulates the minimum setbacks for land uses and developments from the centre of the high pressure natural gas pipeline shall be:

- 96 metres, in the case of sensitive development, as determined by the Local Government on advice of the Department of Environment and Conservation (DEC) and the pipeline operator, and including aged persons' accommodation, child care centres, schools and hospitals;
- 32 metres to the boundary of each residential lot, in the case of residential development; and

- at the Local Government's discretion, following consultation with the DEC and the pipeline operator, in the case of all other land uses and developments which facilitate the gathering of people, within 96 metres of the centre of the pipeline.

Section 3.8 addresses how this policy has been applied by the Structure Plan.

2.2.5 *Planning for Bushfire Protection Guidelines*

The primary focus of these guidelines is to ensure that bush fire hazards are considered in planning decisions at all stages of the planning process; to avoid increased fire risk to life and property.

Given that the Structure Plan area abuts a remnant bushland area to the south west, planning for bushfire protection requires a level of consideration during the Structure Plan and subdivision phases of the development. Consideration of bushfire management at the Structure Plan phase includes identifying potential bushfire hazards and providing adequate separation from these areas through the Structure Plan design.

The Structure Plan road and cell design has resultantly been influenced by a detailed Fire Management Plan (**Appendix 4** refers). The FMP will provide guidance for detailed subdivision design to ensure all fire mitigation strategies, such as appropriate building setbacks, landscaping and interface treatment of the zone between the bushland and residential development is achieved.

Section 5.7 addresses how this has been applied by the Structure Plan.

2.2.6 *City of Rockingham Urban Growth Programme (2009)*

The City of Rockingham *Urban Growth Programme* has been prepared by the City to assist in understanding the likely pattern of urban growth to 2031. The Urban Growth programme recognises the Structure Plan area as being developed for urban purposes, with commencement of development originally forecast between 2017 - 2026.

3 SITE CONDITIONS AND ENVIRONMENT

The Structure Plan has been subject to previous environmental assessments as part of Amendment No.300 of the City of Rockingham's Town Planning Scheme No.1, which was initiated to rezone the associated landholdings from 'Rural' to 'Development'. The rezoning application was addressed by the EPA's *Ministerial Statement No. 580* in 2001, which determined that the proposal could be implemented subject to conditions (**Appendix 11** refers).

Conditions relevant to the Structure Plan area include:

- Condition 1: Drainage a Nutrient Management Plan (now addressed as a Local Water Management Strategy in accordance with the Department of Water's Better Urban Water Management Guidelines);
- Condition 2: Soil and Groundwater Investigation and Remediation Plan;
- Condition 4: Spray Drift Investigation and Management Plan; and
- Condition 5: Vegetation Management Plan.

As part of the Structure Planning process, the abovementioned conditions have been addressed and are outlined in various sections below.

An Environment Assessment Report has been prepared by Coterra Environment for this Structure Plan (**Appendix 1** refers). All the relevant environmental details and response to environmental issues are detailed in this report. A summary of the environmental conditions of the site is provided below, with **Plan 4** illustrating opportunity and constraints mapping for the Structure Plan area. Elements of this plan are covered in further detail in the following sections.

3.1 Flora and Vegetation Assessments

Rural pursuits have rendered large portions of the Structure Plan completely cleared of vegetation. It is considered that urban development is an appropriate land use given the current environmental condition and the proposed management strategies outlined in this report. Areas of the site that remain vegetated are representative of the 'Cottesloe (Central and South)' and 'Karrakatta (Central and South)' complexes. These vegetation complexes are briefly described below:

- Cottesloe Complex (Central and South), described as a mosaic of woodland of *Eucalyptus gomphocephala* and open forest of *Eucalyptus gomphocephala – Eucalyptus marginata – Coryumbia calophylla*: closed heath on the limestone outcrops; and
- Karrakatta Complex (Central and South), described as predominantly an open forest of *Eucalyptus gomphocephala – Eucalyptus marginata – Coryumbiacalophylla* and woodland of *Eucalyptus marginata – Banksia spp.*

The Cottesloe Complex meets the State government target of at least 10% of the original extent proposed for protection (Bush Forever protection area of the Perth metropolitan region), however this figure is at 8% for the Karrakatta complex. Both complexes are locally well represented with a high percentage of the original extent remaining within the City of Rockingham.

Table 3: Regional and Local Conservation Status of Karrakatta and Cottesloe Complex (South and Central)

	Description	*Karrakatta Complex*		*Cottesloe Complex*	
		Area	Percentage of Original Area	Area	Percentage of Original Area
Local Representation (City of Rockingham)	Original extent	4,276 ha	-	2,017 ha	-
	Remaining area	1,552 ha	36 %	1,011 ha	50 %
Regional Representation (Perth Metro Area of Swan Coastal Plain)	Original extent	34,532 ha	-	34,439 ha	-
	Remaining area	6,275 ha	18%	12,362 ha	36%
	Area proposed for protection (Bush Forever)	2,590 ha	8%	6,085 ha	18%

A number of flora and vegetation surveys have been progressed over the Structure Plan area, by Bennett Environmental Consulting Pty Ltd in January, April and October 2011. The surveys confirmed that no Threatened Ecological Communities (TECs) or Declared Rare Flora were encountered within the Structure Plan area, nor any other significant flora or vegetation values. Vegetation condition ranged from 'Completely Degraded' to 'Good'.

Lot 5 was subject to a later Botanical Assessment the findings of the survey are as follows (BEC, 2011):

- Approximately half of the Structure Plan area had remnant vegetation present, with the remainder being utilised as a salvage yard and residential property;

- The dominant vegetation across the Structure Plan area is:
  - Forest of *Eucalyptus marginata subsp. marginata*, *Allocasuarina fraseriana* and *Banksia attenuata* over Open Low Scrub B of *Acacia pulchella* and *Macrozamia riedlei* over Open Dwarf Scrub C dominated by *Hibbertia hypericoides* over Dense Tall Grass dominated by *Ehrharta calycina* over Very Open Herbs dominated by *Phlebocarya ciliata* in grey sand.
  - Vegetation condition: Good to Degraded, due to dense tree cover (up to 40%);
- Other major vegetation unit across the Structure Plan area is:
  - Forest of *Eucalyptus marginata subsp. marginata*, *Allocasuarina fraseriana* and *Banksia attenuata* over Open Scrub of *Kunzea glabrescens* and *Jacksonia furcellata* over Open Dwarf Scrub C of mixed taxa dominated by *Acacia pulchella* and *Gastrolobium capitatum* over Tall Grass dominated by *Ehrharta calycina* over Very Open Herbs dominated by *Phlebocarya ciliata* over Open Low Sedges dominated by *Desmocladus flexuosus* in grey sand. Occasional plants of *Lomandra hermaphrodita* and *Lomandra caespitosa* were recorded.
  - Vegetation condition: Good to Degraded;
- Along eastern boundary of the Structure Plan area is:
  - Open Tall Woodland of *Eucalyptus gomphocephala* (tuart) over dense weeds and bare ground in grey sand.
  - Vegetation condition: Completely Degraded.
- Vegetation condition was rated according to the vegetation condition scale used in Keighery (1994). The vegetation condition of the remnant vegetation at the survey site was degraded with some areas of good, with the salvage yard, including the tuarts on the eastern boundary, completely degraded. Rubbish had been dumped around the perimeter and throughout the bushland.
- Lot 5 had a large area of remnant vegetation remaining but the understorey appeared to have been largely replaced by the grass weed, perennial veldt grass (*Ehrharta calycina*). The tree cover was good, up to 40% cover, but there were many deaths of jarrah (*Eucalyptus marginata subsp. marginata*) and narrow-leaf Banksia (*Banksia attenuata*) recorded across the area.
- It was recommended that the tuarts along the road edge be considered for retention with any proposed development as the trees were of a good height and in reasonable condition. It is also recommended that a section of the remnant bushland along the northern boundary with the adjoining property be retained as public open space.

3.2 Fauna Assessments

A fauna survey completed in accordance with the EPA's Guidance Statement No. 56 – *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004) was undertaken across the Structure Plan area in February 2011. The survey identified that the presence of numerous large, potentially hollow-bearing trees may provide nest hollows for conservation significant fauna such as Carnaby's Black-Cockatoo. No Cockatoo's were encountered during several site visits.

Given the known presence of potentially suitable habitat for the Commonwealth and State listed Graceful Sun Moth (*Synemon gratiosa*), a Graceful Sun-Moth survey was also undertaken in accordance with the DEC's - *Survey Guidelines for the Graceful Sun-Moth (Synemon gratiosa) and site habitat assessments.* Following the completion of a Graceful Sun-Moth survey programme in March 2011 it was concluded that this species does not occur within the Structure Plan area.

3.3 Landform and Soils

The site is generally flat, with a gentle rise toward the north. The site elevation ranges from approximately 3m Australian Height Datum (AHD) to 15 m AHD near the central and southern portions of Lot 312.

The Structure Plan area contains three natural soil types of the Spearwood and Tamala soil systems consisting of:

- Sand (S8): which is described as - very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted, of eolian origin as relatively thin veneer over C2 (clay), M4 (silt) and Mc2;
- Sand (S7): which is described as - pale yellowish brown, medium to coarse grained, sub-angular to well-rounded quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin; and,
- Limestone (LS1): which is described as pale yellowish brown, fine to coarsegrained, sub-angular to well rounded, quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin.

All of the soil types identified are suitable for urban development.

3.4 Acid Sulfate Soils

According to Acid Sulfate Soil (ASS) risk mapping sourced from the CSIRO Australian Soil Resource Information System (ASRIS) database, the site is identified as having a 'no known occurrence of AASS and PASS occurring'. This is consistent with the Perth Groundwater Atlas (DoW, 2004) which maps the site as 'Low to nil risk of acid or potentially acid sulphate soils >3m below the ground surface'. The DEC ASS Risk Map however indicates that the majority of the site has a moderate to low ASS risk.

The site is surrounded by area of high risk ASS associated with Lake Coogee Conservation Category Wetland (CCW) to the west and Resource Enhancement Wetland (REW) to the north. The closest high risk ASS area, the Opwin Swamp Dampland, is located approximately 100m to the north-west of Lot 313.

3.5 Groundwater

Regional groundwater mapping obtained from the Department of Water (DoW) *Perth Groundwater Atlas*, indicates that groundwater occurs at a depth of approximately 2m AHD across the site. Therefore, the separation distance to groundwater from the natural surface level would vary between 1m AHD and 13m AHD within the Structure Plan area. Regional groundwater information indicates that groundwater flow is generally in a westerly direction (DoW, 2004).

3.6 Heritage

A desktop investigation found that the Structure Plan area contains no indigenous heritage sites (DIA 2011). If Aboriginal artefacts or sites are uncovered during construction, works will cease and a suitably qualified expert will be brought in to survey the potential site, and if required, obtain approval under the *Aboriginal Heritage Act* 1972.

3.7 Adjacent Bush Forever Site

The Structure Plan area is located immediately adjacent to Bush Forever Site No. 356. Appropriate interface from the Structure Plan area to the Bush Forever site will consist of dedicated road reserves running the length of the Structure Plan's southern and western boundaries; this to minimise edge effects of development impacting on the Bush Forever Site.

3.8 Poultry Farm and Market Garden

An Odour Assessment was completed by 'The Odour Unit' (2010) to assess any potential odour impacts from the Poultry Farm to proposed development, adjacent to and nearby the poultry operation. It is attached to the Environmental Assessment Report (**Appendix 1** refers).

The Odour Assessment established site specific setbacks of 100m from the poultry farm based on on-site data and modelling of impacts from prevailing wind directions and likely worst case odour levels resulting from the operation (Appendix F under **Appendix 1** refers). The required buffer is relatively small and extends into Lots 2, 4 and 5 as illustrated under Figure 9.1 of the Odour Assessment and Structure Plan Map (**Plan 1)**.

Development within the Structure Plan area will be staged so to avoid the established buffer areas while the poultry farm and market garden are still in operation. **Plan 11** depicts the Indicative Staging Plan of the development. When the land in the vicinity of the market garden is subdivided the measures recommended as per Planning Bulletin No. 63 – *Policy for Dealing with Potential Conflicts between Residential Subdivision and Market Gardens in East Wanneroo* and Section 2.2.3 above will be undertaken.

3.9 Parmelia Gas Pipeline

In consideration of the requirements of Planning Bulletin No. 87 *High Pressure Gas Transmission Pipelines in the Perth Metropolitan Region* (**Appendix 10** refers) as outlined in Section 2.2.4 above, the Structure Plan has been designed to address the required setbacks, and proposes only those land uses permissible in and within proximity to the pipeline alignment. Accordingly, Public Open Space is identified on the Structure Plan over the pipeline easement with residential lot boundaries permitted up to the 32m buffer line.

The developer has undertaken several Pipeline Risk Management Plans for developments impacted by this corridor, and the proposed design and land mirror the findings of these. Consultation with the Parmelia Gas Pipeline operators have been undertaken, and with recognition that the Structure Plan has been prepared in accordance with Planning Bulletin 87 and the EPA's *Ministerial Statement No. 580.*

4 CONTEXT ANALYSIS

An 'Opportunities and Constraints Plan' (**Plan 4**) and a 'Context Plan' (**Plan 5**) provide illustration of the following section.

4.1 Surrounding Land Use

Surrounding land uses comprise the following:

- Market gardens and residential subdivision to the north;
- Baldivis Primary School to the north-east;
- Land recently zoned 'Urban' under the MRS to the east;
- Bush Forever site No. 356 to the south and west; and
- Residential 'Spires Estate' currently being developed to the south of Lot 7.

The Parmelia High Pressure Natural Gas Pipeline traverses Lot 313 in a general north-west to south-east direction along the western portion of the site.

The Structure Plan area is located less than one kilometre west of the Kwinana Freeway, and approximately five kilometres east of the Perth to Mandurah railway.

4.2 Movement Networks

The Structure Plan area is traversed by the unconstructed Nairn Drive reserve identified as an 'Other Regional Road' under the provisions of the Metropolitan Region Scheme. The Structure Plan area is bound by Fifty Road to the north, Baldivis Road to the east and centrally traversed by Eighty Road. Approximately 1 kilometre to the east lies Kwinana Freeway which provides direct access to all regional nodes including both the Perth Central Business District, Mandurah Town Centre and beyond. Alternatively, Mandurah Road is located 1.3 kilometres west of the Structure Plan area, providing excellent north-south access to the broader Perth and Peel Regions.

In terms of public transport, the Perth to Mandurah railway line is located approximately 5 kilometres west of the Structure Plan area. Bus feeder networks to supplement the train network are extending into the Baldivis locality as it urbanises.

4.3 Activity Centres and Employment Nodes

The Structure Plan area is located approximately 6 kilometres south-east of Rockingham Strategic Metropolitan Centre. Several important activity centres and employment generators also exist in close proximity. These include:

- Baldivis District Town Centre, ~2 kilometres south;
- Port Kennedy Business Park ~ 6 kilometres south-west;
- Rockingham Industrial Zone ~ 7 kilometres north-west;
- Kwinana Secondary Centre ~7 kilometres north; and
- Kwinana Industrial Area ~ 8.5 kilometres north-west.

As the Structure Plan area benefits from proximity to a strong regional and district road network this provides future residents direct connections to regional employment centres such as Rockingham, Mandurah, Kwinana, Fremantle, and Perth Central Business District.

Opportunities for local employment will be further enhanced by the development of future nearby industrial areas, including Latitude 32, Nambeelup and North-East Baldivis. These areas are earmarked by Directions 2031 and the Economic and Employment Lands Strategy for Perth and Peel for future expansion of employment land uses.

Consistent with the broad urban structure proposed by the North Baldivis DSP, a Neighbourhood Activity Centre is proposed within the Structure Plan. This site is to be relocated from the adopted North Baldivis Local Structure Plan to avoid conflict with competing land uses; refer Section 5.6 of this report.

4.4 Education

Several educational facilities exist in close proximity to the Structure Plan area.

Existing public primary schools in close proximity to the Structure Plan area include:

- Baldivis, located directly north;
- Makybe Rise, ~4.6 kilometres south; and
- Settlers Hill, ~4.8 kilometres south-west.

In addition, the Baldivis North DSP and East Baldivis DSP respectively identify future public primary schools to be located 1 kilometre north and north-east of the Structure Plan Area.

Public secondary educational needs will be accommodated by the recently opened Baldivis High School south of Safety Bay Road; with alternatives being Warnbro Community High School, and Safety Bay High School, both ~7.5km from the Structure Plan area. The East Baldivis DSP identifies a future high school site directly north-east of the Structure Plan area; this is to ultimately include the North and East Baldivis DSP student population within its catchment.

Several private schools exist within the locality, including:

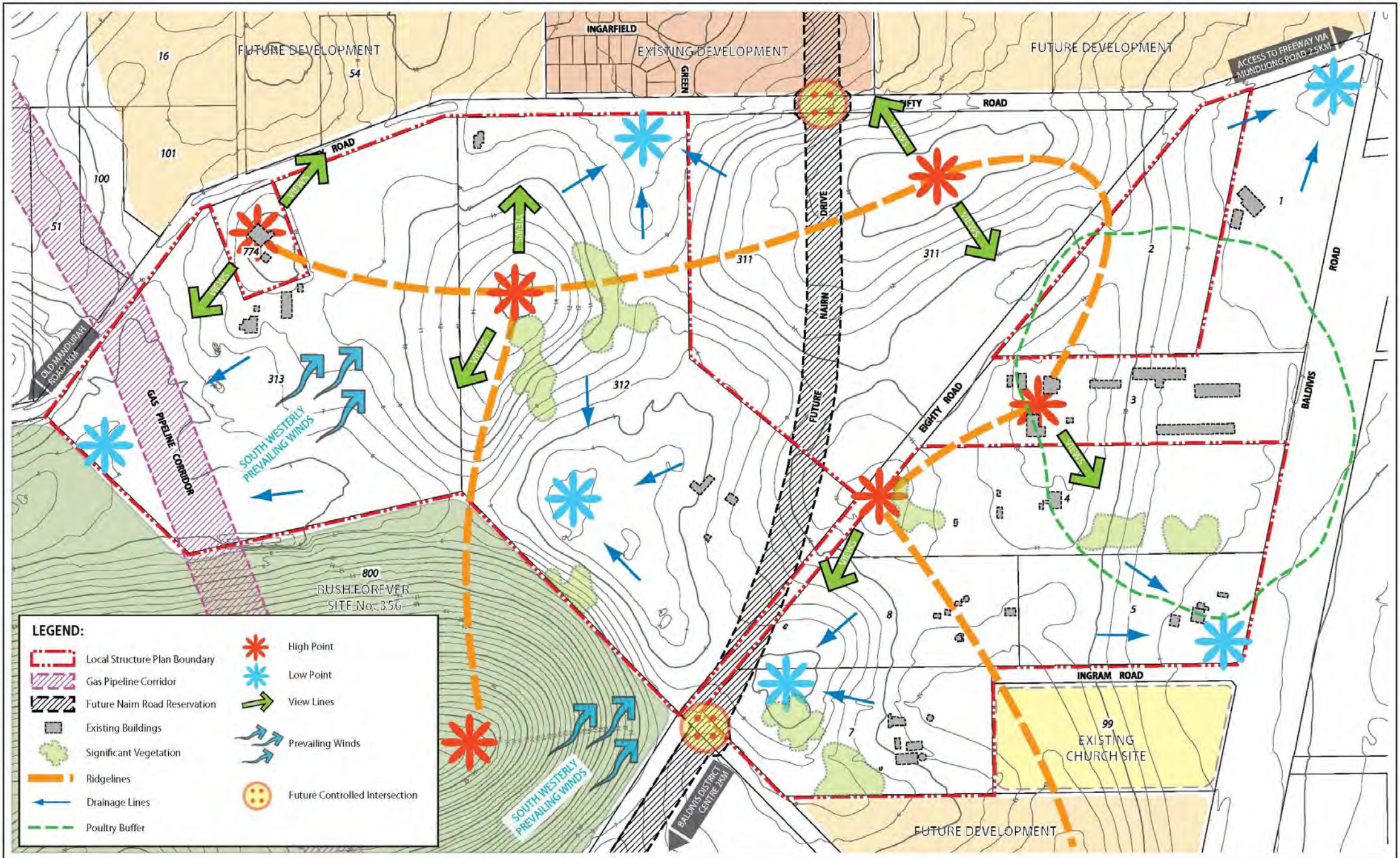
- Tranby College, located ~4.5 kilometres south;
- Marantha Christian Community School, ~5.6 kilometres south-west;
- Kolbe Catholic College, ~6.0 kilometres north-west; and
- Living Waters Lutheran College, ~6.6 kilometres south-west of the Structure Plan area.

The Rockingham and Mandurah campuses of Murdoch University and Challenger TAFE offer an expanding range of nearby tertiary institutions. The site's proximity to the regional road network and Mandurah rail line means that future residents will be able to access the wider variety of universities across the metropolitan region.

4.5 Regional Open Space

The site immediately abuts a large area of bushland protected by Bush Forever Site 356. Leda Nature Reserve, Rockingham Lakes Regional Reserve and Lake Coolongup are also all within 2 kilometres of the Structure Plan area.

The approved Baldivis North DSP also identifies district level playing fields to be located directly north of the Structure Plan area, being Baldivis Reserve and complemented by facilities earmarked with the East Baldivis cell adjacent to the High School site.



PLAN 4 - Opportunities and Constraints Plan

Various Lots Fifty and Eighty Road, BALDIVIS

for: Carcione Group of Companies

NOTES :

AREAS AND DIMENSIONS SUBJECT TO SURVEY

BASE DATA SUPPLIED BY LANDGATE / DEPT OF PLANNING

NORTH

Scale 1: 4,000 @ A3

0 25 50 75 100 125 150 metres

COMPILED: DPS		DRAWN BY:	MDH
DATE:	20/6/2012	REVISED:	
GRID:	MGA 50	DATUM:	AHD
DRAWING NUMBER:	CARBD074	JOBCODE:	CARBDLSP

FILE ID: M:\CARBD\Illustrator\Opps and Consts.ai

dpd Development Planning Strategies

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PO BOX 6697 EAST PERTH 6892

T (08) 9268 7900

F (08) 9268 7999

E dps@dpswa.com.au

PLAN 5 - Regional Context Plan

Various Lots Fifty and Eighty Road, BALDIVIS

for: Spatial Property Group

LEGEND :

LOCAL STRUCTURE PLAN BOUNDARY

NORTH

Scale 1: 30 000 @ A3

0 250 500 750 1000 1250 1500 metres

COMPILED: DPS		DRAWN BY:	JNP
DATE:	22/11/2012	REVISED:	
GRID:	MGA 50	DATUM:	AHD
DRAWING NUMBER:	CARBD-5-009	JOBCODE:	CARBDLSP
FILE ID: M:\CARBD\Base\Report Diagrams\CARBD-5-009.dgn			

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5 LOCAL STRUCTURE PLAN

5.1 Design Philosophy

The Structure Plan proposes a design layout which fosters an efficient and permeable road network and corresponding residential development cells. This is notwithstanding the external challenges of the site, namely the constrained access arrangements and configuration of parent lots.

The design philosophy has been predicated upon the following objectives:

- Provision of a diverse range of residential densities according with the density targets of Directions 2031 to encourage diversity of lot product and affordability;
- Suitable interface with existing roads and future Nairn Drive, the Parmelia Gas Pipeline Corridor and Bush Forever Site 356;
- Creation of an attractive and viable Neighbourhood Activity Centre with suitable surrounding residential density to support its development;
- An integrated design over land in multiple ownership;
- Suitable connectivity to Fifty Road via seven access points, and connectivity to the future Nairn Drive, hence connecting and integrating with existing and future development of the surrounding land;
- Location and provision of public open spaces to ensure accessibility, diversity in types and usability, tree retention where practical, visual aesthetics and the integration of stormwater management;
- Implementation of a suitable engineering and drainage solution for the site;
- Delivery of a safe pedestrian and cyclist environment with pathways linking residential neighbourhoods and associated local parks as well as providing for external connectivity to areas outside of the site;
- Integration with existing and planned developments on adjacent land, particularly in relation to the Spire Estate to the South and Baldivis North Estate to the north; and
- Accommodation of stormwater drainage within public open space areas in accordance with accepted practice and Council/WAPC policy.

5.2 External Design Influences

5.2.1 *Planning for Bushfire Protection*

A Fire Management Plan (FMP) has been prepared by environmental consultants Strategen in support of the Structure Plan (**Appendix 4** refers).

The FMP provides guidance on how to plan for and manage the bush fire risk associated with the project area, in accordance with requirements of *Planning for Bushfire Protection* (PFBFP) Guidelines.

The responsibility to implement the FMP at the time of development applies to the developer, City of Rockingham and subsequently the perspective landowners, to ensure bush fire management measures are adopted and implemented on an ongoing basis to achieve bush fire management objectives.

The FMP is supported by a Bushfire Hazard Assessment (BHA) (Appendix 1 of FMP, **Appendix 4** refers). The FMP demonstrates that the bushfire threat and hazard will be restricted to vegetation surrounding the perimeter of the site, including the Bush Forever site to the south west, remnant vegetation on Lot 311 (future development site) and the historic tramline within Baldivis Road. The FMP provides an indication of the setback distance required between dwellings and bushfire hazards to achieve the Bushfire Attack Level (BAL)-29 or lower.

Guidance provided by the Department of Planning and FESA (2010) *PFBFP* Guidelines, BHA and FMP was used in preparing the Structure Plan design.

Wide road reserves have been incorporated adjacent to the retained remnant bushland to the south-west and east; thus the FMP demonstrates that the bushfire risk can be managed along with dwelling setbacks and construction standards (as required).

Bushfire hazard levels are determined based on the predominant vegetation and are identified as being either of low, moderate or extreme bush fire hazard risk (Figure 8 of FMP, **Appendix 4** refers). With staging of the development and as vegetation is removed in advance of development, the bushfire hazard will be reduced. Permanent hazards will remain around the perimeter, though they can be mitigated through a range of measures as detailed above.

Further, measures to manage bush fire risks will be required at the subdivision phase, and may include:

- Ensuring that water is available to the development to enable life and property to be defended from bush fire, including the availability of shared fire hydrants;
- The design and setback of dwellings within each lot in relation to bushfire hazard, to minimise the level of potential bushfire risks;
- Buildings within the development shall be designed and constructed in accordance with the Building Code of Australia, to ensure adequate compartmentalisation and separation for fire protection; and
- Development to be undertaken in accordance with AS3959-2009 as identified in Section 5.4.1 of the FMP Report.

5.2.2 *Noise Mitigation*

Herring Storer Acoustics was commissioned to carry out a road traffic noise assessment for the Structure Plan (**Appendix 9** refers). The traffic noise assessment has been carried out in accordance with the WAPC's Statement of Planning Policy 5.4 *Road and Rail Transportation Noise and Freight Consideration in Land Use Planning.* The purpose of this study was to assess noise received at future residence within the Estate from vehicles travelling on the surrounding road network, specifically Nairn Drive and Baldivis Road.

SPP 5.4 identifies a 'Noise Target' and 'Noise Limit', which sets out acceptable noise levels for residential use. The noise modelling indicates that without any noise amelioration, noise received at the residence located adjacent Nairn Drive would exceed the "Noise Limits". For this development a 2.2 metre high barrier located at the boundary of the Nairn Drive reserve is recommended. With this barrier, the lots requiring "Quiet House" design and Notifications on Titles (Figure E1, Appendix E of Acoustic Assessment, **Appendix 9** refers).

Modelling shows that noise received at the residence located adjacent to Baldivis Road would in the future marginally exceed the "Noise Targets". For these residences, our analysis indicates that compliance with the above internal noise levels would be achieved with standard construction. Hence, no upgrade in the

construction is required for these residences. It is also recommended that for those residence that either back on to or side on to Baldivis Road, that a 1.8m high barrier be constructed.

Finally, it is noted that under the policy, that for those residence where noise would exceed the "Noise Target", notification of vehicle noise will need to be stated on the titles.

Dwellings located in areas that exceed the 'target' and 'limit' will also have to comply with construction standards (glazing, fencing, fittings) as expanded upon in the Acoustic Assessment (**Appendix 9** refers).

5.3 Residential Densities and Dwelling Forecasts

5.3.1 *Dwelling Forecasts- Directions 2031*

The Structure Plan is encompassed by area 'BA1' of the *Outer Metropolitan Perth and Peel, Sub-Regional Strategy (OMSRS);* the total site (south of Mundijong Road) is projected to yield approximately 3,900+ dwellings, based on a 'Connected City' development model of 15 dwellings per gross urban zoned hectare; or 3,100 dwellings based on a 'business as usual' scenario of 10 dwellings per gross urban zoned hectare.

A dwelling yield projection prepared by the project team and based on *generic* lot sizes prescribed by the *Residential Design Codes* (R-Codes) suggests a yield of ~950+ dwellings. This figure includes landholdings immediately adjacent however excluded from the Structure Plan boundary (i.e. Lots 311 Fifty Road and 1 and 3 Baldivis Road).

The current Structure Plan boundary comprises 54.57ha. Excluding the ~1.01ha land parcel designated as 'Other Regional Roads', the *gross urban zone* area equates to 53.56ha. Based on the dwelling targets of *Directions 2031* and accompanying OMSRS, the Structure Plan area is projected to generate the following dwelling yields:

Table 4 – Directions 2031 Dwelling Targets:

Directions 2031 Scenario	Projected Dwellings:
'Connected City' @ **15 dwellings** per *gross urban zone*	804 dwellings
'Business as usual' @ **10 dwellings** per *gross urban zone*	536 dwellings

The Structure Plan proposes in the order of 600+ lots, however inclusive of several Grouped Housing sites planned (ranging between R25 – R60), the total dwelling yield will be in the order of 800+ dwellings. The dwelling yield projections thus address the 15 dwellings per gross urban zone targets of *Directions 2031*, and will potentially accommodate a population in the order of 2,240+ people, at a rate of 2.8 persons per household.

The projections are subject to the final design for respective subdivision stages; this based on detailed drainage and environmental constraints, including landowner preference for retention of remnant native vegetation. Preferred lot mix and market demand at the time of land release will also influence final dwelling yields.

5.3.2 *Dwelling Forecasts- Liveable Neighbourhoods*

The majority of the Structure Plan area has been assigned a R25 Residential Density Coding; with medium density R30 - R40 development proposed in proximity to Public Open Space and primary roads and nodes. Higher density (R60) residential development is proposed in proximity to (and potentially within) the future Neighbourhood Activity Centre adjacent the future Nairn Drive.

The R25-R60 density codings offer a minimum and average lot product considered suitable for this location within the outer-metropolitan area of Perth; being a combination of lot product ~120m^2 – 600m^2 in area as prescribed the R-Codes. Estimated dwelling yields based on average lot sizes are in the order of:

- Residential R25: ~480+ dwellings
- Residential R30: ~80+ dwellings
- Residential R40: ~140+ dwellings
- Residential R60: ~100+ dwellings

Based on the *Liveable Neighbourhoods* 'Site Hectare' definition, the overall density for the Structure Plan equates to ~25 dwellings per site hectare; thus exceeding the 22 dwellings per site hectare target of this document.

5.4 Streetscape and Built Form Environment

5.4.1 *Density*

The following provides a summary of locational criteria for residential land uses within the Structure Plan area, and offers rationale for the density codings (R-Codings) provided.

5.4.1.1 'LOW DENSITY' - RESIDENTIAL R25 (BASE)

- Residential R25 will be the minimum base coding over the Structure Plan area; thus allowing for the provision of traditional single dwelling lots from minimum 300m^2, averaging minimum 350m^2.

5.4.1.2 'MEDIUM DENSITY' – RESIDENTIAL R30-R60

Generally surrounding, but not limited to:

- areas of high amenity, such as Public Open Space, major public transport routes, primary connector roads and/or Neighbourhood Activity Centre; and
- locations that enhance passive surveillance of public spaces

The proposed R30 and R40 pockets are generally located in close proximity to public open space and on the major transport corridor, with densities of R40 and R60 proposed in close proximity to the *Commercial* zoned area. This is consistent with *Liveable Neighbourhoods Elements 3* requirements which states that smaller lots and lots capable of supporting higher density should be located close to town and neighbourhood centres, public transport routes and adjacent high amenity areas such as parks.

5.4.2 *Housing Typologies*

A diversity and flexibility of housing products will be provided that are appropriate to the variations in lot sizes and proposed densities presented in the Structure Plan.

The housing typologies envisaged will include Single and Double-Storey; Traditional Loaded and Rear Loaded Cottages; Terraces – Attached and Semi-Detached and potential Multi-Storey dwellings in the *Commercial* zoned land.

The character of these typologies will differ depending on the nature of the lot and surrounding environment.

5.4.3 *Public Open Space Interface*

The standard treatment for all lots directly abutting POS will include elevation preferably 0.5 metres above park level, as well as uniform open style Estate fencing along the POS boundaries. Importantly, the POS areas will all be developed to a high standard to ensure high levels of amenity for all residents, and will include suitable built form surveillance measures to enhance the use of these spaces.

5.4.4 *Solar Orientation*

When the orientation of the lot makes it possible, dwellings will be orientated north to achieve good solar passive design. However, where contours and landform have taken priority in determining lot orientation, northern orientation cannot always be achieved. In this instance, lot orientation is predominantly north-south/east-west (or within 15 degrees thereof) where practical to facilitate solar passive design of homes.

5.4.5 *Variations to Residential Design Codes*

Part One of the Structure Plan facilitates variations to 'Deemed to Comply' provisions of the R-Codes, this is namely with respect to private open space and primary street setback provisions, including:

Table 1 – 6. Open Space (min total % of site)

Current R-Codes Provision (2013)	Proposed Structure Plan Variation
R25 – minimum 50%	R25 – minimum 45%
R30 – minimum 45%	R30 – minimum 40%
R40 – minimum 45%	R40 – minimum 40%

Table 1 – 7. Minimum Setbacks (Primary Street)

Current R-Codes Provision (2013)	Proposed Structure Plan Variation
R25 – 6m	R25 – 4m

The variations sought within this Structure Plan are considered minor, however address the needs of the demographic and target market with the Baldivis locality, whilst also facilitating housing affordability, and are a sound resolution to comprehensive consultation with the building and development industries. Furthermore, the variations sought are based on existing trends and current housing designs within other Baldivis Estates and broader municipality; namely those with a similar demographic to the target market as the Structure Plan area.

Clause 7.3.2 of the R-Codes states:

Notwithstanding clause 7.3.1, the local government may, with the approval of the WAPC, amend any other deemed-to-comply provision within the R-Codes by means of a local planning policy, local structure plan, or local development plan where it can be demonstrated to the satisfaction of the WAPC that the proposed amendment requires any variations to be justified in accordance with three criteria, these being:

- *Is warranted due to a specific need related to that particular locality or region;*
- *Is consistent with the objectives and design principles of the R-Codes; and*
- *Can be properly implemented and audited by the decision-maker as part of the ongoing building approval process.*

The proposed development addresses the above criteria by means as justified below:

5.4.5.1 SPECIFIC NEEDS OF THE PARTICULAR LOCALITY

The variations being sought within the Structure Plan are warranted due to specific needs and market demand related to the Baldivis locality. 'Market demand' is not commonly considered appropriate planning justification by State and Local government authorities, however as the State Government have set dwelling targets under guidance of *Directions 2031*, which will be met through understanding and providing housing opportunities that meet demand.

In Baldivis (North), *profile.id* (2014) sourced statistics identify that:

- up to 90% of dwellings are Single Houses;
- up to 90% of dwellings are owner occupied; and
- 88% of dwellings are 3 or more bedrooms.

This strongly suggests family orientated homes are being built in the locality, identifying a specific demand in the locality of Baldivis.

In green field sites such as the Structure Plan area where there is no established character, the market demand is the driving factor behind lot and house product being developed, and this is ever increasingly being closely linked with affordability.

Further to this, the private open space and minimum setback provisions have been reduced in an attempt to deal with the limitations of the R-Codes which in many circumstances require 2-storey development on smaller residential lots; this due to the restrictive nature of some provisions that challenges opportunities for affordable housing options.

This is an ongoing issue that has been observed by the building and development industries, and a variation to open space has become 'the norm' to enable greater flexibility in developing 'functional' single storey dwellings on lots that are steadily declining in size.

Recognising the affordability issues, the City has consistently granted similar R-Codes variations to Estates throughout the municipality, including the original part of the Spiers Estate encompassed by Spiers LSP No. 1. Accordingly, the variations sought will not adversely affect the built form, streetscapes or amenity of residents in adjoining residential Estates, nor any future development within the Structure Plan area based on the prevailing and perpetual R-Codes variations already granted elsewhere in the locality.

5.4.5.2 OBJECTIVES AND DESIGN PRINCIPLES OF THE R-CODES

The minor variations provided are '*consistent with the objectives and design principles of the R-Codes*' pursuant to Clause 5.1.4 of the R-Codes, as detailed below.

- The minor reduction in private open space provision is consistent with other green field Estates developed in the broader Rockingham municipality, with variations of 5-15% to private open space having been approved locally, including nearby The Chimes, Spires – No.1 , Baldivis North, and Baldivis Central Estates.
- Sunlight and ventilation would be obtainable and protection of privacy is facilitated through the design of the outdoor living areas. Well-articulated building facades also enable building bulk to be managed and maintained. The built form can still adequately offer compliance (or in fact exceedence) of minimum outdoor living areas prescribed by the R-Codes, and in doing so provide functional outdoor spaces at the design discretion of the homebuyer and ultimately the City via Planning or Building Licence approvals.

- The streetscape will not be detrimentally affected by the reduced private open space provision, with the frontage of the dwelling not reliant on or visible to the depth/overall footprint of the dwelling.
- The reduced private open space provision and incorporation of dedicated outdoor living areas or other 'courtyard' spaces ensures utilisation of the outdoor spaces and access around the lots as required by the R-Codes.
- The built form resultant of the 4m primary street setback variation (in lieu of 6m for R25 density coding) is somewhat controlled by other R-Codes provisions, including garages that maintain a minimum setback of 4.5m. This will assist to control building setbacks, averaging of the building line and ensure articulation of buildings for the benefit of the broader streetscape.

The requirement to have the dwelling adhere to current provisions of the R-Codes (i.e. 50% open space for R25 density coding) will not increase the usability of these outdoor spaces, but will simply be detrimental to the homebuyer's 'preferred' usability of the internal spaces of the residential dwelling at the expense of a larger outdoor living area. *Within reason*, this should be at the discretion of the first occupants of the dwelling; and acknowledging any future purchasers of said dwelling have the choice to buy this property with a smaller area of private open space, or seek a smaller dwelling with larger private open space by means of other properties available on the market.

5.4.5.3 IMPLEMENTATION

Clause 7.3.2 of the R-Codes requires that variations sought '*can be properly implemented and audited by the decision-maker as part of the ongoing building approval process*'.

Under a Structure Plan – Part 1 process, inclusion of R-Codes variations to 'General Development Standards' will negate the need for numerous Detailed Area Plans to be prepared and implemented.

Building Licence, or Planning Applications as applicable, are required to be submitted to the City for approval, at which time assessment against the requirements of Part One of the Structure Plan would be undertaken.

5.5 Detailed Area Plans

The objective of Detailed Area Plans is to protect and enhance the amenity of the residents, provide for an attractive streetscape and to ensure that small lot developments have a coordinated approach to achieve good urban design outcomes.

In addition to the R-Codes variations granted under Part One of the Structure Plan, Detailed Area Plans (DAPs) are to be prepared in accordance with Clause 4.23 of the Scheme in the following instances:

- Lots with rear-loaded garage access;
- Lots with direct boundary frontage (primary or secondary) to an area of Public Open Space;
- Lots with a direct boundary frontage (primary or secondary) to Fifty Road and Nairn Drive;
- Land zoned *Commercial*;
- Lots impacted by Nairn Drive and Baldivis Road in respect of noise mitigation; and
- Lots within a 100 metre catchment of a Bushfire Hazard Zone thus deemed at risk from bushfire pursuant to the Planning for Bushfire Protection Guidelines (2010).

DAPs may be prepared as part of a subdivision application or imposed as a condition of subdivision approval.

Lots affected by noise mitigation are identified spatially in Appendix E of the accompanying Acoustic Assessment, under **Part Three – Appendix 9** of the Structure Plan.

Lots affected by the Bushfire Hazard Zone are identified spatially in Figures 9a and 9b of the accompanying Fire Management Plan, under **Part Three – Appendix 4** of the Structure Plan.

5.6 Neighbourhood Activity Centre

The Baldivis (North) District Structure Plan (DSP) prepared in 2000 identified the need for Neighbourhood and Local Activity Centres in the North Baldivis area. The DSP (as amended) identified a Neighbourhood Activity Centre (NAC) situated at the future intersection of Nairn Drive and Fifty Road. The Spiers Estate Structure Plan proposes to relocate the NAC site ~500m further south, and to be situated at the future intersection of Nairn and Amazon Drives. The Structure Plan Map (**Plan 1**) identifies ~2.8 hectares of *Commercial* zoned land abutting the north-western side of the intersection.

A modification to the *Baldivis North Local Structure Plan* was approved in March 2014, to address the proposed relocation of the NAC to the Spiers Estate Structure Plan. The relocation of the NAC and departure from the DSP was justified on the following grounds:

- The City's *Local Commercial Strategy* recognises that there are planned NAC in the City which have not eventuated, nor reached their predicted size, thus the planning, size and location for such centres is important to ensure their viability. The relocation of the NAC further south along Nairn Drive is a sound outcome as the site will be more central to the expanding North and East Baldivis residential communities. This will significantly increase the commercial catchment in the Baldivis cell and assist both the short and long term viability of the NAC;
- Early development of the original NAC site would have been ahead of much of the surrounding residential area, thus suggesting the large landholding would be kept vacant for many years until considered commercially viable to develop. It is considered an unreasonable impost to require the proponent to land bank such a large landholding for 5 – 10 years before the development of a large NAC became commercially viable and attractive to investors;
- The proposed NAC site has the same high standard and opportunities for access and connectivity to the surrounding area as that originally allocated in the DSP. The site retains a Nairn Drive frontage and will continue to have exposure to high volumes of passing trade. The residential catchment for the proposed relocated NAC is also comparative;
- The owner of the land upon which the NAC was originally planned on the DSP has agreed to relocate the site to the proposed location within Lot 312, as illustrated by the Structure Plan Map (**Plan 1**). A written agreement between the land owners is attached under **Appendix 3** ; and
- The proponent of the Structure Plan undertakes that the NAC will provide similar land uses as intended by the Baldivis North DSP. A letter of undertaking signed by the proponent as land owner of Lot 312 outlining the use has been prepared (**Appendix 3** refers).

The proposed ~2.8ha of *Commercial* zoned land will be provided across two landholdings on the western side of Nairn Drive. In accordance with development intentions under the Baldivis North Local Structure Plan, a projected Nett Lettable Area (NLA) of ~5,500m^2 will be provided, and with potential for the *Commercial* zoned land to accommodate residential and/or mixed use development.

Should portions of the *Commercial* zoned land be developed exclusively for residential purposes, then additional Public Open Space may need to provided in accordance with the 10% requirement prescribed in WAPC's *Liveable Neighbourhoods*. Notwithstanding the above, retention of the *Commercial* zoning across any residential development is imperative to ensure an adequate landholding is available for expansion of commercial or mixed use purposes in the long term.

The built form outcomes of the *Commercial* zoned land will require careful consideration by the developer, particularly in relation to the interface and relationship with Nairn Drive, adjacent internal road network and residential land uses.

5.7 Movement Network

A Transport Assessment has been prepared by Transcore (**Appendix 6** refers); and the key findings are summarised in the following section. Detailed cross sections have been prepared to correspond with the overall design philosophy of the Structure Plan area. These road cross-sections accompany the 'Internal Road Hierarchy' Plan (**Plan 6**).

The movement network proposed by the Structure Plan is consistent with the Baldivis (North) District Structure Plan and all documentation and supporting traffic studies associated with this approved DSP. In addition, the proposed movement network links well with that proposed by the East Baldivis District Structure Plan.

5.7.1 *Structure Plan Access*

Transcore has developed a comprehensive EMME/3 transport model for the Structure Plan, which was used to investigate various access system options for the area in order to design an optimal solution. The future scenario modelled in this area reflects the land use aspirations of *Directions 2031* as detailed in the *Outer Metropolitan Perth and Peel Sub-regional Strategy*.

The proposed access system was developed to achieve the following outcomes:

- Balance the internal traffic flows;
- Distribute the impact from traffic to minimise the traffic load onto Baldivis Road and Nairn Drive;
- Ensure alternative access/egress options are available for safety reasons; and
- Enable ease of access (and egress) to the proposed Neighbourhood Activity Centre.

The Structure Plan design fosters an interconnected and legible road network with six access points provided along Fifty Road and one additional access to future Nairn Drive in the southern portion of the Structure Plan. Existing Eighty Road will be reconfigured to integrate with the proposed road network of the Structure Plan.

A detailed SIDRA Intersection Analysis and layout plans are included in ***Appendix B*** of the Transport Assessment Report; key findings are summarised in the following section:

5.7.1.1 NAIRN DRIVE

The main access points of the Structure Plan area will be provided via by future 4-way signalled intersections at Nairn Drive/Fifty Road to the north, and Nairn Drive /Amazon Drive south of the proposed NAC. Whilst other 4-way intersections along Nairn Drive have been constructed as two-lane roundabouts, these two 4-way signalled intersections will potentially have significant pedestrian demand because of the adjacent Primary School and NAC sites respectively.

Traffic signals provide better opportunity for pedestrians and cyclists to cross such intersections, thus traffic signals would be the preferred intersection treatment. Should roundabouts be ultimately constructed, it is recommended that additional facilities be provided to assist pedestrians and cyclists to safely cross Nairn Drive nearby to the Primary School and NAC sites.

The NAC intersection would at least require appropriate pram ramps and grab rails at suitable locations, however could ultimately be upgraded to a signalised pedestrian crossing should the volume of pedestrian movements and future traffic flow warrant it. Further information regarding suitable crossing infrastructure for the above two locations is provided in **Appendix 6**.

5.7.1.2 BALDIVIS ROAD

The future planning for Baldivis Road includes upgrading to a two-lane boulevard (i.e. one lane each way with a central median island), thus consistent with road upgrades for established development south of the Structure Plan. This is the typical cross-section identified in *Liveable Neighbourhoods* for *Integrator B* or *Neighbourhood Connector A* roads) Future traffic volumes of 9,000 – 10,000 vpd adjacent to the Structure Plan area, as modelled in the transport assessment, is consistent with this road standard.

Two intersections are proposed on Baldivis Road within the Structure Plan area; these being the existing T-junctions at Fifty Road and Ingram Road. Initially these will function satisfactorily as priority-controlled T-junctions.

Structure planning within the East Baldivis development cell (east of Baldivis Road) indicates that both the Baldivis Road / Ingram Road and Baldivis Road / Eighty Road intersections will become 4-way roundabout intersections; with planned Neighbourhood Connector road connections extending east into this development cell. Subdivision development to the east will be the trigger for intersection upgrades at these two intersections.

5.7.1.3 FIFTY ROAD

The Structure Plan proposes several new intersections along Fifty Road and most will operate satisfactorily as priority-controlled T-junctions (i.e. Stop or Give Way sign control). The proposed 4-way intersection at McDonald Road is recommended to be constructed as a single-lane roundabout given the higher traffic volumes forecast at this location.

5.7.2 *Road Configuration and Hierarchy*

The projected traffic volumes prepared under the EMME/3 strategic transport model for the internal Structure Plan road network were used to determine the road hierarchy and the generic road reservations. Traffic modelling indicates traffic volumes of approximately 6,400 vehicles per day (vpd) for the residential component and 5,600 vehicles per day generated by the NAC.

The general road hierarchy and traffic volumes are represented under **Plan 6** and **Table 4**. The road hierarchies are guided by *Liveable Neighbourhoods*.

The proposed road configuration is based on a 'modified grid' system of circulation which responds to the natural topography of the Structure Plan area. Road reserves proposed are 15.0 m for 'Access Roads' and 18.0 m for 'Neighbourhood Connector' roads. The 'Internal Road Hierarchy' Plan is generally based on the *Liveable Neighbourhoods* standard cross sections. Reduced verge widths are permitted by *Liveable Neighbourhoods* where adjacent to Public Open Space.

Table 4: Road Hierarchy

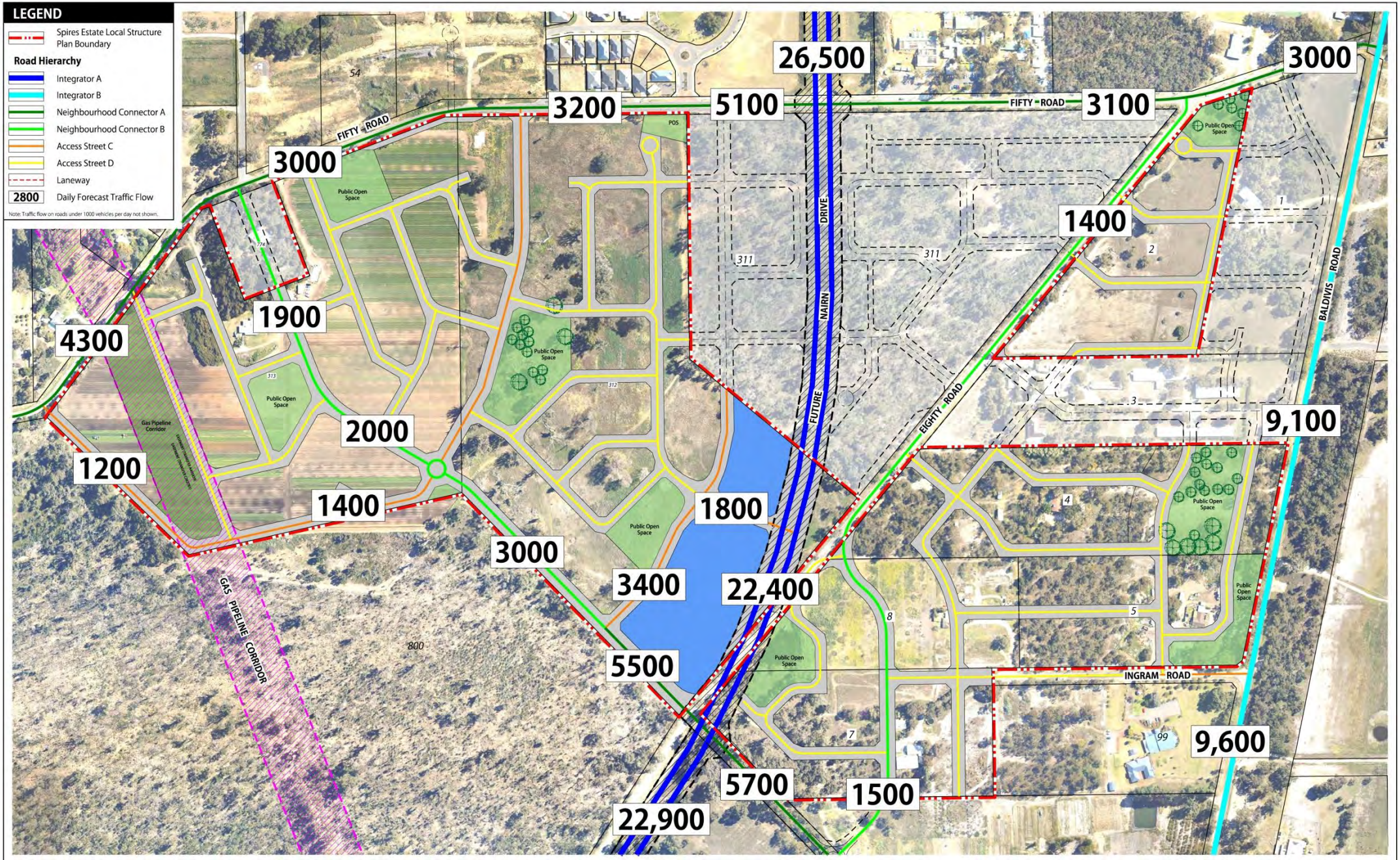
Road Classification	Indicative upper volume (vehicles per day)	Indicative road reserve width	Indicative road pavement width
Integrator A	35,000	40m	2 x 8.5m
Integrator B	15,000	29m	2 x 5m
Neighbourhood Connector A	7,000	23m - 24m	2 x 5m
Neighbourhood Connector B	3,000	18m – 20m	7.4m
Access Street C	3,000	14m – 16m	6m
Access Street D	1,000 (D)	13m – 15m	6m
Laneway	300	6m	6m

** All road reserve widths comply with Liveable Neighbourhoods, and in most circumstances exceed the specified reserve widths.*

The distribution and assignment of the development-generated traffic was based on the actual location of the subject development, the existing road network and the location of various district attraction nodes. As a result, the resultant external distribution used in this analysis is as follows:

- ~7% Baldivis Road (north);
- ~28% Nairn Drive (north);
- ~5% McDonald Road & subdivision roads (north);
- ~12% Fifty Road (west);
- ~29% Nairn drive (south);
- ~2% Subdivision roads (south;)
- ~10% Baldivis Road (south); and
- ~7% East of Baldivis Road (future subdivision).

Forecast traffic volumes for the Structure Plan area are illustrated in Plan 6.



PLAN 6 - Internal Road Hierarchy

Various Lots Fifty and Eighty Road, BALDIVIS

for: Spatial Property Group

NOTES :

- AREAS AND DIMENSIONS SUBJECT TO SURVEY
- CARRIAGEWAYS ARE DIAGRAMMATIC ONLY
- BASE DATA SUPPLIED BY LANDGATE / DEPT OF PLANNING

NORTH

Scale 1: 4000 @ A3

0 25 50 75 100 125 150 metres

COMPILED: DPS, TRANSCORE		DRAWN BY:	RF
DATE:	28/6/2012	REVISED:	22/09/2014
GRID:	MGA 50	DATUM:	AHD
DRAWING NUMBER:	CARBD-5-001b	JOBCODE:	CARBDLSP
FILE ID: M:\CARBD\Base\Report Diagrams\CARBD-5-001b.dgn			

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5.7.2.1 NEIGHBOURHOOD CONNECTOR ROADS

Traffic volumes will be highest around the future NAC. The *Neighbourhood Connector B* is proposed to be 18 metres in width with a standard 7.4m carriageway and verge width of 4.5– 6.1m subject to landscaping and potential embayed parking (Cross Section 1 refers). *Liveable Neighbourhoods* stipulates an indicative road reserve width of 19.4m, albeit this can be reduced to 18m if certain criteria are met, including embayment parking.

A 23m wide *Neighbourhood Connector A* is proposed on Amazon Drive between Nairn Drive and Eighty Road, and adjacent the NAC. Verge width abutting the Bush Forever site may be reduced by 3 metres subject to detailed design. *Liveable Neighbourhoods* stipulates an indicative road reserve width of 24.2m, however this can be reduced to 23m if certain criteria are met; in this case relaxation of the verge width adjacent the Bush Forever site given this land is not developable and will not include service infrastructure.

Neighbourhood Connector B roads are proposed along Fifty Road, Eighty Road and Amazon Drive, these forming the main roads linking residential cells to the NAC site and broader District Road network.

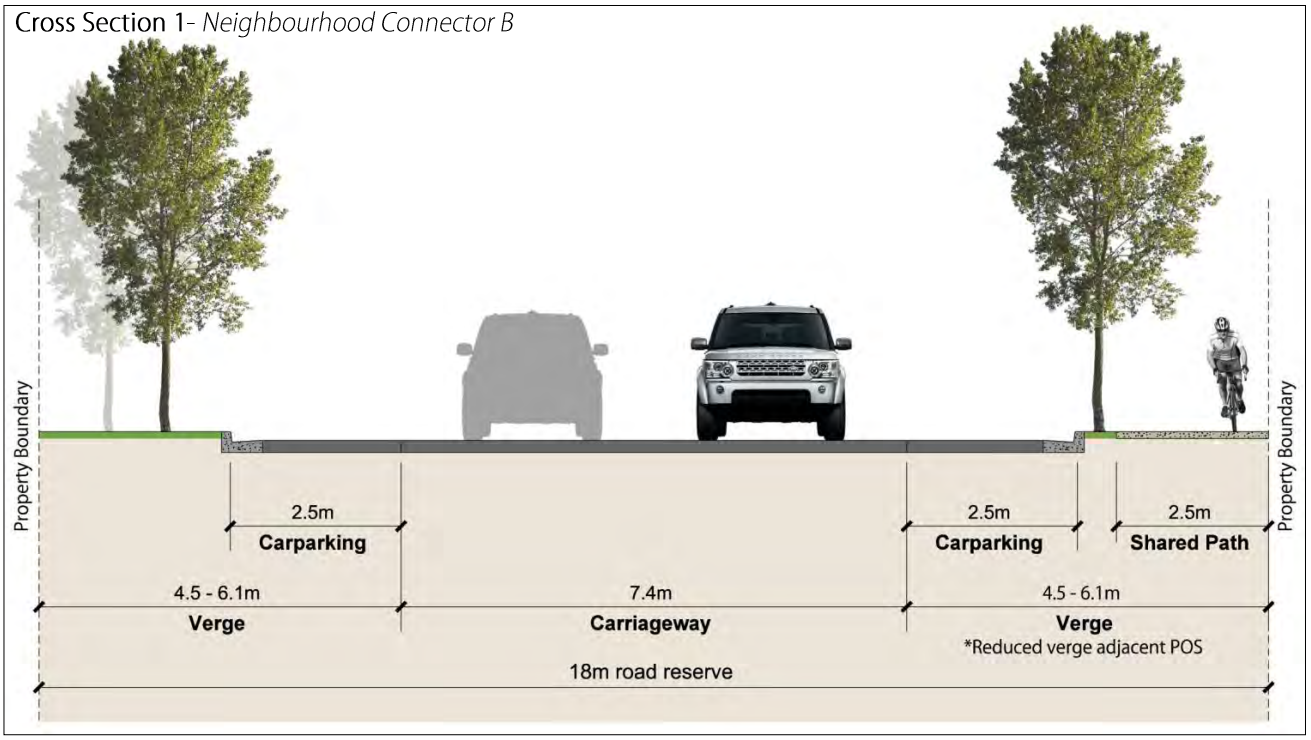
5.7.2.2 ACCESS STREETS

Access Street C roads are proposed adjacent to the NAC, high density R60 residential lots, western boundary fronting the Bush Forever site and section of Ingram Road. These roads may vary from 15 – 16.4m wide subject to the treatment of the road carriageway and verges. Verges of 4.1 – 4.5m verge width may be provided, the latter to include possible parking embayment. Where fronting the Bush Forever Site, an *Access Street C* may be reduced by 2m subject to detailed subdivision design.

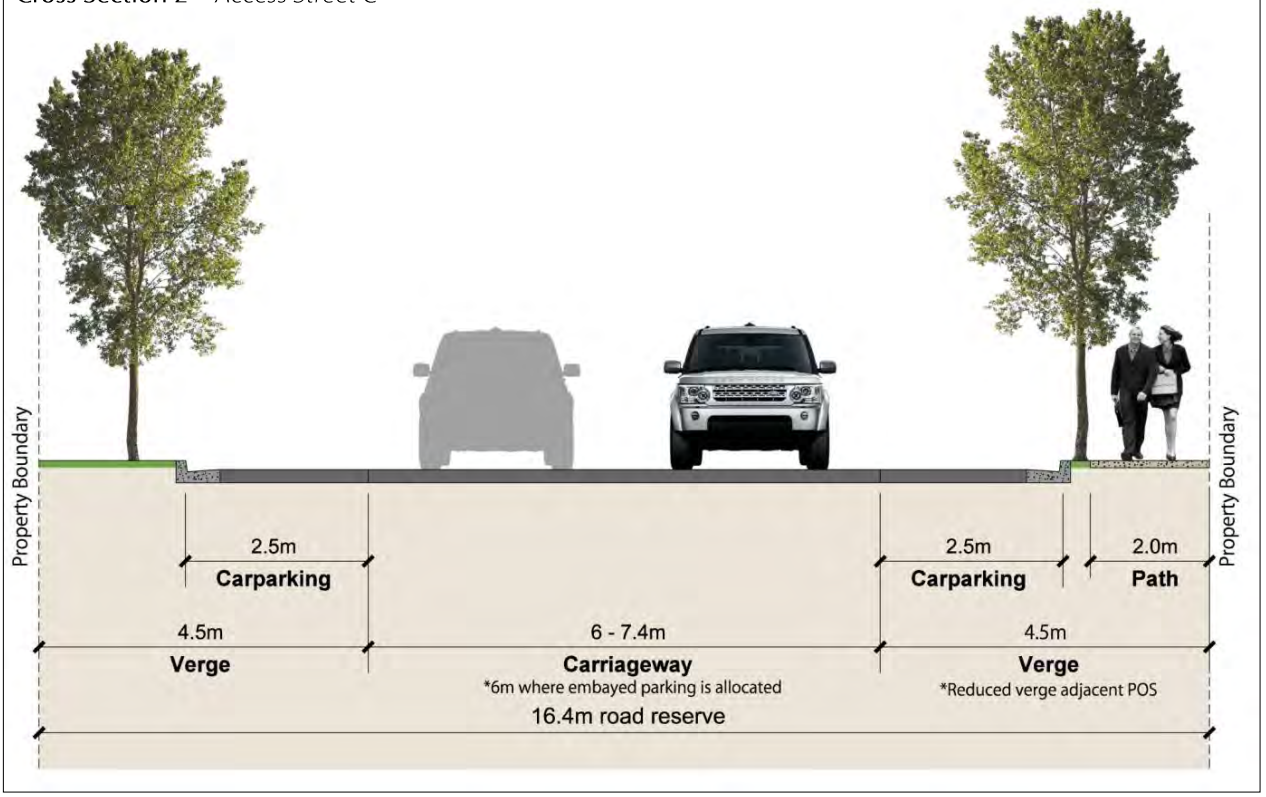
Liveable Neighbourhoods stipulates an indicative road reserve width of up to 15.4m, and with a reduced verge permitted where fronting public parkland.

Access Street D roads area proposed as 15m wide reservations, comprising 6m carriageway and 4.5 metre verges. *Liveable Neighbourhoods* stipulates an indicative road reserve width of up to 15.4m, and with a reduced verge permitted to 1.0m when fronting public parkland.

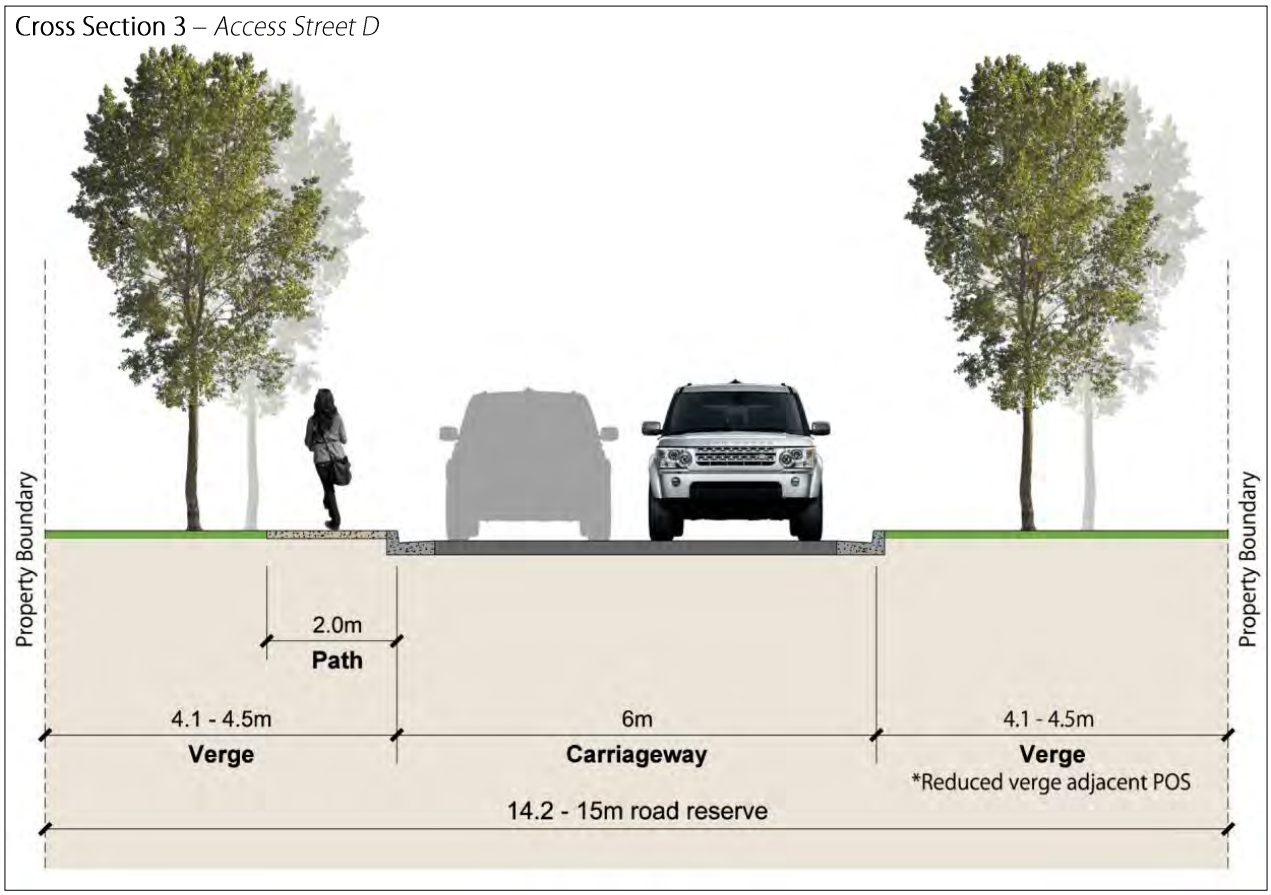
Cross Section 1- *Neighbourhood Connector B*



Cross Section 2 – *Access Street C*



Cross Section 3 – *Access Street D*

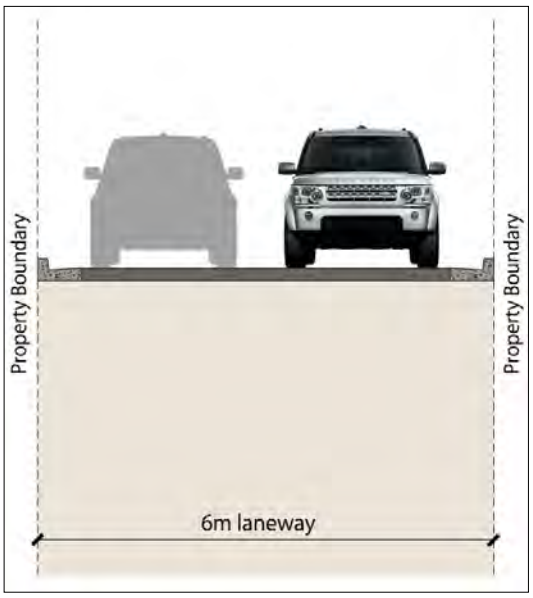


5.7.2.3 LANEWAYS

The typical road reserve for Laneways entails a 6m wide trafficable pavement sufficient to allow two-way movements, rubbish collection, vehicle access into garages located on the rear of properties, flush kerbing and central drainage.

Maximum desirable traffic flow for a laneway is 300vpd.

Visitor parking for all rear-loaded lot product is proposed to be provided to the front or side of the lots, depending on the location.



Cross Section 4 – *Laneway*

5.7.2.4 INTERNAL INTERSECTIONS

The Structure Plan area proposes several four-way intersections, with roundabouts suggested along Amazon Drive and an internal road between the two *Commercial* zoned sites; ***Figure 9*** within the Transport Assessment Report **Appendix 6** refers. Roundabout intersections at these points will help manage crossing traffic flows and assist with speed management at strategic locations.

Several four-way intersections are proposed on low-traffic-volume Access Streets; these are recommended to be constructed as priority-controlled intersections with Give-Way signs on the minor road approaches, as guided by *Liveable Neighbourhoods*. Established threshold treatments on side roads intersecting with Amazon Drive, west of Baldivis Road, are good examples of the type of treatment that could be implemented at these 4-way intersections.

Three other 4-way intersections are indicated in the internal road network as a result of the conceptual layout for future development on adjoining landholdings excluded from this Structure Plan. Two are located on Eighty Road and one on Nairn Drive, as illustrated in ***Figure 9*** of the Transport Assessment Report. In consultation with the City, one intersection on Eighty Road has been identified as a future left in / left out intersection, with the other 4-way intersection on Eighty Road recommended to be constructed as a priority-controlled intersection with Give-Way signs and appropriate threshold treatments on the minor road approaches.

The cost of all upgrades/road works on Eighty Road will be met by the developer.

5.7.3 *Pedestrian and Cycle Network*

The reasonably flat topography of the area and the proposed 'permeable grid' road network creates an excellent opportunity for provision of highly useable pedestrian and cyclist facilities to maximise non-motorised transport modes.

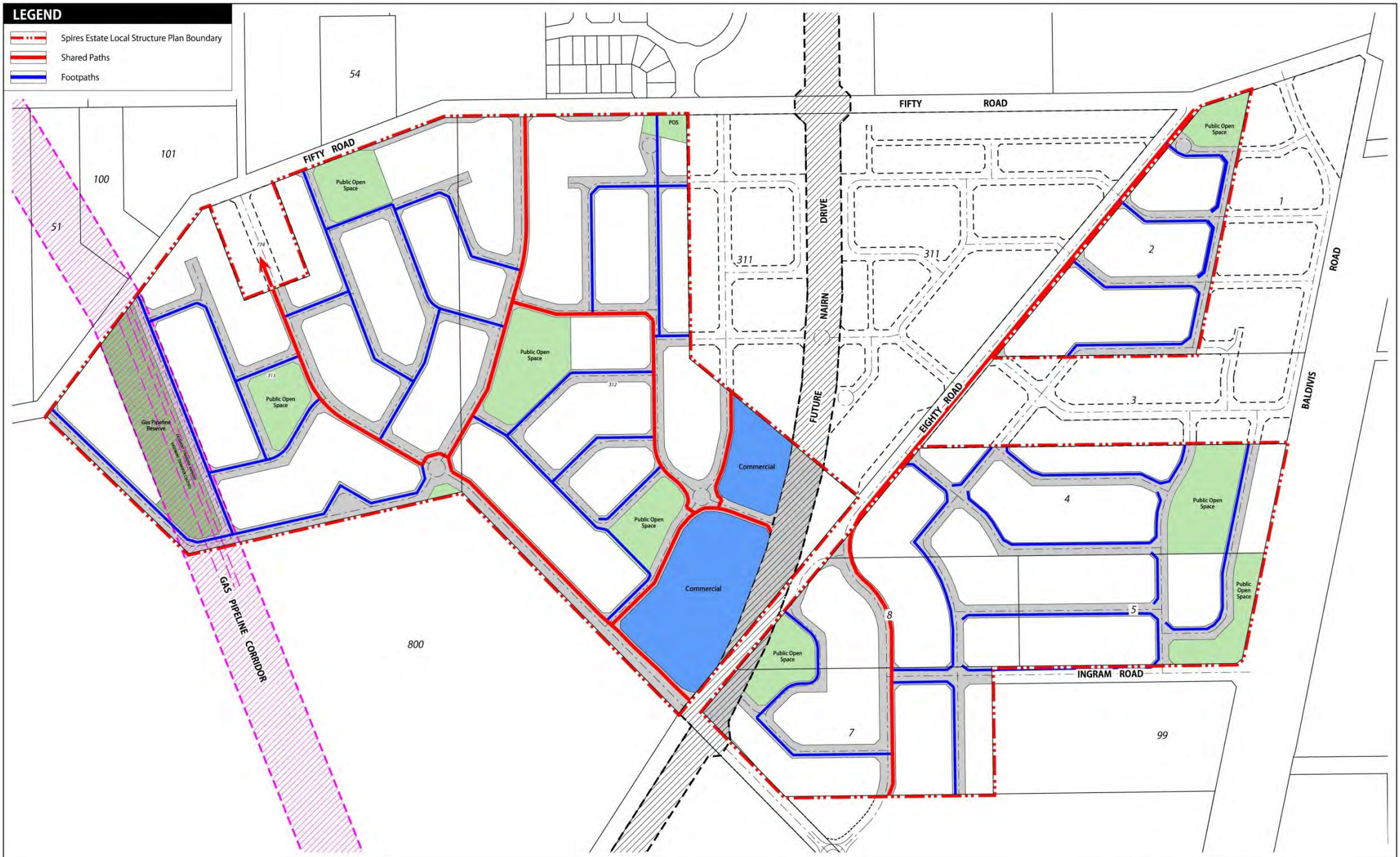
Pedestrian footpaths will be distributed throughout the Structure Plan area in conformance with the 'Indicative Path Network' Plan (refer **Plan 7**). The path network provides for a legible and accessible system of pedestrian access to focal points such as Public Open Space and the proposed Neighbourhood Centre. 'Shared Paths' (Dual Use Paths) are proposed within all *Neighbourhood Connector* roads and specific *Access Street C* roads, and standard footpaths are proposed within all other lower order roads.

All roads will have a footpath or shared path on at least one verge throughout the Structure Plan area.

5.7.4 *Public Transport*

The Public Transport Authority has indicated a preference to run a bus service north along future Nairn Drive to connect to Kerosene Lane to the west and potentially continue to Rockingham Station in the long term future.

Current public transport planning anticipates a future bus route through the Structure Plan area, and a potential bus stop within walking distance of the Neighbourhood Activity Centre. This is however dependent on staging of residential development, the road network and the availability of resources. Accordingly, both long term and short term bus routes are illustrated in **Plan 8.**



PLAN 7 - Indicative Path Network

Various Lots Fifty and Eighty Road, BALDIVIS

for: Spatial Property Group

NOTES :

- AREAS AND DIMENSIONS SUBJECT TO SURVEY
- CARRIAGEWAYS ARE DIAGRAMMATIC ONLY
- BASE DATA SUPPLIED BY LANDGATE / DEPT OF PLANNING

NORTH

Scale 1: 4000 @ A3

0 25 50 75 100 125 150 metres

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DATE:	16/02/2012	REVISED:	13/10/2014
GRID:	MGA 50	DATUM:	AHD
DRAWING NUMBER:	CARBD-5-002b	JOBCODE:	CARBDLSP
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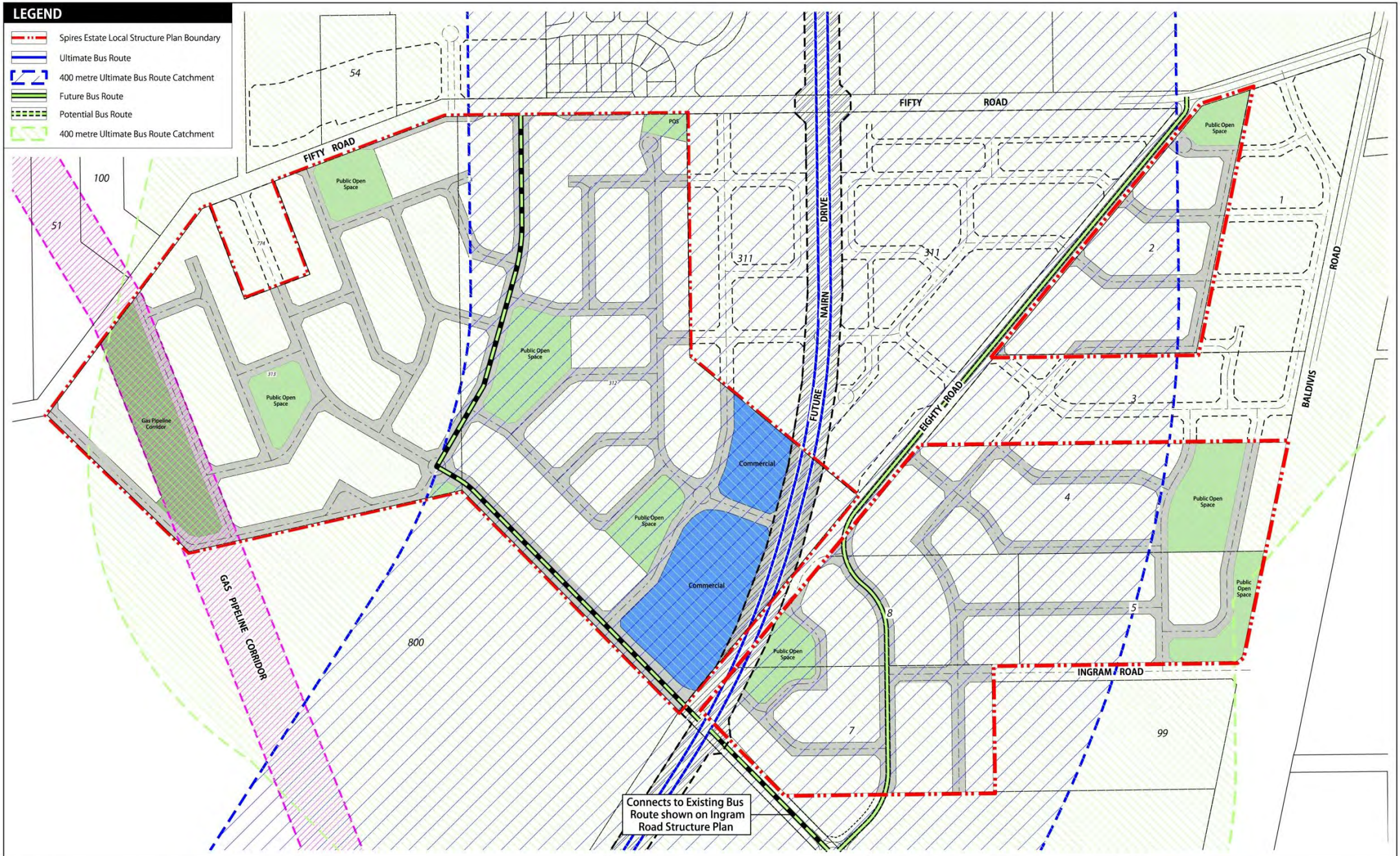

PLAN 8 - Bus Routes Plan

Various Lots Fifty and Eighty Road, BALDIVIS

for: Spatial Property Group

NOTES :

- AREAS AND DIMENSIONS SUBJECT TO SURVEY
- CARRIAGEWAYS ARE DIAGRAMMATIC ONLY
- BASE DATA SUPPLIED BY LANDGATE / DEPT OF PLANNING

NORTH

Scale 1: 4000 @ A3

0 25 50 75 100 125 150 metres

COMPILED: DPS		DRAWN BY:	RF
DATE:	22/6/2012	REVISED:	22/09/2014
GRID:	MGA 50	DATUM:	AHD
DRAWING NUMBER:	CARBD-5-003a	JOBCODE:	CARBDLSP
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5.8 Public Open Space

The provision of a minimum of 10% Public Open Space (POS) is provided in accordance with the WAPC's *Liveable Neighbourhoods*. POS is to be provided generally in accordance with **Plan 1** under Part One of the Structure Plan; with specific drainage detail and open space credits including relationship to Council Policy Provisions demonstrated in **Plan 9 – Landscape Strategy** and **Plan 10 – Public Open Space** below. All figures are rounded up for the purpose of Structure Plan calculations and will be reviewed in detail at the Subdivision Design phase.

5.8.1 *Overview*

The Structure Plan proposes a total of eleven areas of 'green space', of which nine are to be classified and credited as Public Open Space (POS). The POS areas are evenly distributed and will be designed so as to create amenity and walkable recreation opportunities for future residents within all subdivision stages. Specific POS areas will accommodate urban stormwater drainage, albeit of varying basin sizes; whilst other POS areas will retain native mature trees where practical based on further detailed survey, design and engineering.

The total POS 'green space' of 5.881ha proposed equates to ~12% of the gross subdivisible area. POS calculations provided under **Plan 10** demonstrate that 10% (4.986ha) of the Structure Plan area is provided as creditable Public Open space area in accordance with *Liveable Neighbourhoods* requirements. All POS areas will be developed and landscaped to a high standard by the proponent for the benefit of the future community.

In addition to this, the environmental objectives underpinning the location and configuration of open space within the Structure Plan include:

- to preserve areas of highest conservation value;
- to conserve examples of different natural areas on site and preserve biodiversity;
- to create sustainable conservation areas;
- to incorporate natural areas into new urban fabric;
- to interpret existing landscape and site memory in development areas;
- to incorporate the natural local landscape character within new public domain planting; and
- to develop community awareness and involvement.

Importantly, POS areas have been located and configured to ensure the conservation of several stands of mature Tuart trees throughout the Structure Plan area. Where possible Tuart trees have been identified for retention based on their ecological value, suitability for retention and fauna habitat potential.

Consistent with current practice, the POS system has been designed to accommodate stormwater drainage in the form of 'dry' shallow basins (swales). Drainage credits and calculations have been undertaken in accordance with Council Policy and *Liveable Neighbourhoods*.

5.8.2 *Design and Drainage Rationale*

In addition to the design rationale provided in **Plan 9 – Landscape Strategy**, the Public Open Space areas and location have been influenced by the following design attributes:

'PARK A'- This ~0.45ha 'Neighbourhood Active' POS is located in the western portion of the site will cater for residents within a 200m walkable catchment. The POS may offer a shelter and barbeque facilities and a turf kick-about area. There is no drainage within this park, or any significant trees to be retained.

'PARK B'- This ~0.5ha 'Neighbourhood Active' POS fronts Fifty Road and incorporates a drainage area, with passive recreational use and internal paths connecting to the street path network.

Residential lots directly abutting the eastern boundary of this open space will be elevated above the base of any drainage basin, noting that the 1:10yr ARI drainage component of ~0.117ha equates to 24% of the site.

This open space provides an appropriate size for a basketball court, tennis hit-up wall or skate bowl, and an area for turf kick-about.

'PARK C' – This POS at ~0.13ha will primarily serve a drainage function, and accordingly no open space credit is sought for this park.

'PARK D'- This ~0.89ha 'Neighbourhood Passive' is located centrally to the western portion of the Structure Plan area, and will cater for residents within a 200m walkable catchment. This POS provides no drainage function.

A number of mature Tuart trees are situated within this POS and every effort will be made by the developer to retain these trees at the request of the City; this subject to final detailed engineering and subdivision design, with particularly emphasis on adjacent road grades.

A number of recreational facilities are earmarked within this centrally located park including a shelter, barbeque and playground facilities.

'Park E' – This ~0.5ha 'Neighbourhood Active' POS is located to the south of the western portion of the Structure Plan area, provided adjacent to the *Commercial* zoned land. This POS will serve a strategic drainage function, with compensation for 1:10yr ARI events projected to occupy up to 46% of the site. Notwithstanding this, the remainder of the site provides ample space recreational facilities including playgrounds, shade structures and turf kick-about areas.

'PARK F'- This ~0.49ha 'Neighbourhood Passive' POS fronting the eastern side of Nairn Drive provides a strategic drainage function with compensation for 1:10yr ARI events projected to occupy up to 37% of the site. A number of mature Tuart trees are also located in this park and every effort will be made by the developer to retain these trees at the request of the City. Retention of the remnant vegetation is subject to final detailed engineering and subdivision design including grade of adjacent roads as well as serving the required drainage function.

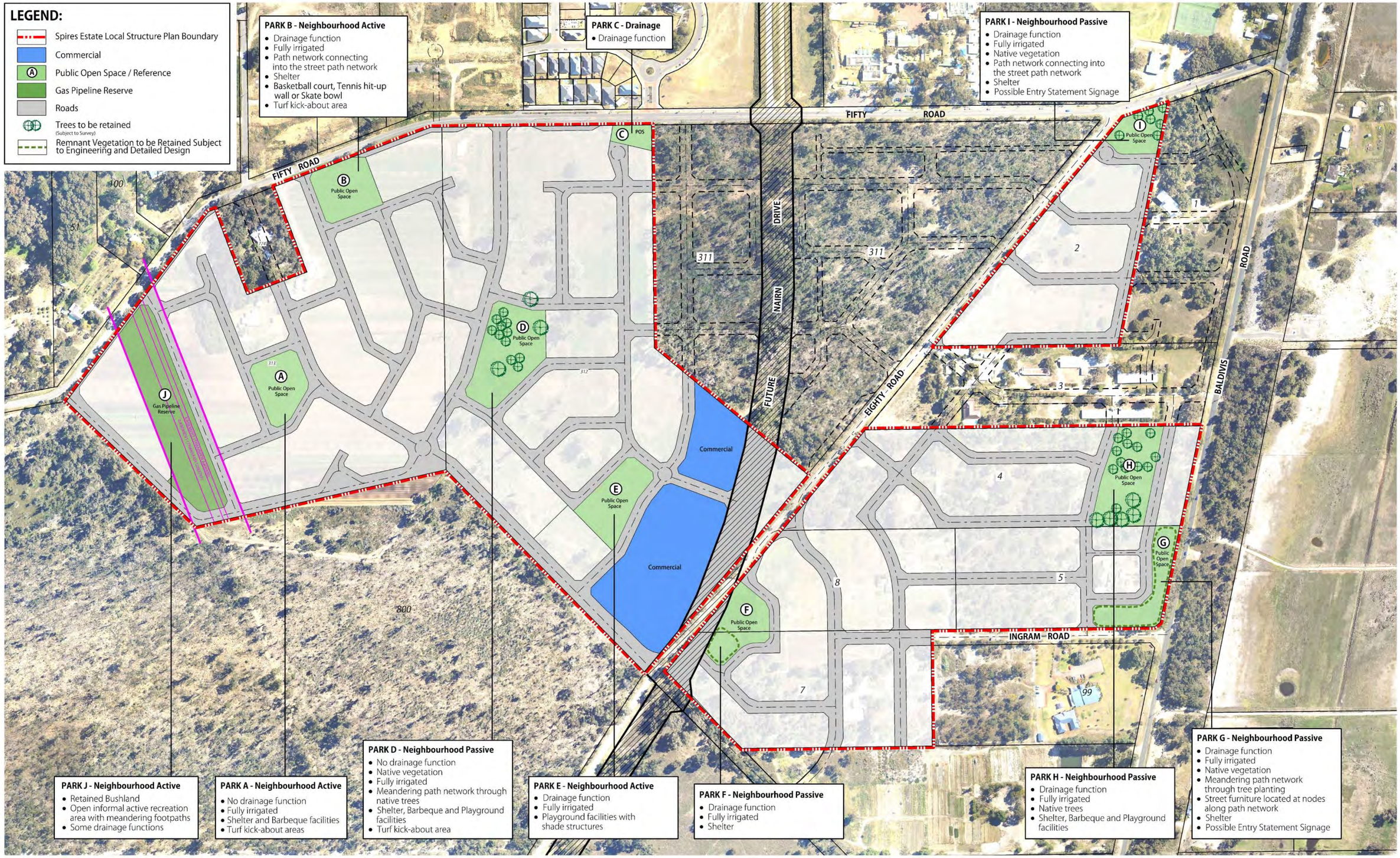
'PARK G'- This ~0.43ha 'Neighbourhood Passive' POS forms the eastern entrance into the Structure Plan area, on the north-western corner of the Ingram and Baldivis Roads intersection. Accordingly, this park will serve as an entry statement into the Structure Plan area and may accommodate future Estate signage by the developer.

Along with a minor drainage function, this linear configured park also serves to retain good quality remnant vegetation, including stands of mature Tuart trees fronting both Ingram and Baldivis Roads; this at the request of the City. Retention of the remnant vegetation is subject to final detailed engineering and subdivision design including adjacent road grades as well as serving the required drainage function.

'PARK H'- This large 0.85ha 'Neighbourhood Passive' POS will retain a large number of stands of mature Tuart trees; this again dependent on final detailed engineering and subdivision design, particularly the grades of roads adjacent.

This POS will serve a minor drainage function and will cater for residents within a 200m walkable catchment.

'PARK I'- This 0.32ha 'Neighbourhood Passive' POS is located at the northern extremity of the Structure Plan area, at the intersection of Eighty and Fifty Roads. This POS will ultimately form part of a larger POS area (~0.6ha) with the adjoining Lot 1. This POS will serve a strategic drainage function with up to 39% of the Spiers Estate Structure Plan portion of the site providing compensation for 1:10yr ARI events.



PLAN 9 - Landscape Strategy

Lots 312 & 313 Fifty Road, Lots 2, 4, 7, 8 Eighty Road, and Lot 5 Baldivis Road, Baldivis

for: Spatial Property Group

SPATIAL Property Group™

NORTH

NTS @ A3

0 50 100 150 200m

DATE:	22/06/2015	DRAFTEE:	RF
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DATUM:	AHD	PLAN NUMBER:	CARBD-5-004c

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LEGEND:

- Spires Estate Local Structure Plan Boundary
- Commercial
- Ⓐ Public Open Space / Reference
- Gas Pipeline Reserve
- Roads
- Trees to be retained (Subject to Survey)
- Remnant Vegetation to be Retained Subject to Engineering and Detailed Design

Spires Estate LSP - Public Open Space		
Structure Plan Area		**54.57**
Deductions	Drainage 1:1yr (Unrestricted)	0.79
	Commercial Zone	2.8
	Nairn Drive Reservation	1.01
	Gas Pipeline	0
	Road Widening	0.1
Total Deductions		4.7
Gross Subdivisable Area		49.87
POS Requirement @ 10%		***4.98***
Maximum Restricted Open Space (20%)		0.996
Maximum Unrestricted Open Space (80%)		3.98

SPIRES ESTATE LSP – POS TABLE (Amended)					
		Non Credit	Restricted	Unrestricted	Total Credit Open Space
POS Area (LSP Ref)	Land Area (ha)	1:1 Year Event	>1:1 – 1:5 Year	Above 1:5	Combined
All figures in hectares (ha)					
A	0.458			0.458	0.458
B	0.498	0.088	0.03	0.38	0.41
C	0.133				-
D	0.886			0.886	0.886
E	0.497	0.178	0.033	0.29	0.319
F	0.489	0.041	0.213	0.25	0.448
G	0.426	0.082	0.025	0.32	0.344
H	0.85	0.079	0.026	0.75	0.771
I	0.321	0.084	0.027	0.21	0.237
J	0.83	0.21	0.074	0.55	0.62
J (Gas Pipeline)	0.493		0.501		0.493
Total	**5.881**	**0.762**	**0.929**	**4.094**	**4.986**

LSP POS Requirement =	4.98
Creditable POS Provided =	4.986
Surplus =	0.006

PLAN 10 - Public Open Space

Lots 312 & 313 Fifty Road, Lots 2, 4, 7, 8 Eighty Road, and Lot 5 Baldivis Road, Baldivis

for: Spatial Property Group

SPATIAL Property Group™

NORTH

Scale 1:4000 @ A3

0 40 80 120 160 200m

DATE:	22/06/2015	DRAFTEE:	RF
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PROJECTION:	MGA 50	CHECK:	MS
DATUM:	AHD	PLAN NUMBER:	CARBD-5-005D

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Catering for residents within a 200m walkable catchment, 'Park I' will also serve to retain a number of stands of mature Tuart trees subject to final detailed engineering and subdivision design. The positioning of this POS provides opportunity as the northern 'entry statement' into the Structure Plan area.

'PARK J'- This ~1.32ha 'Neighbourhood Active' POS is situated over the Parmelia Gas Pipeline easement and associated setbacks (buffers).

The gas pipeline corridor itself contributes to only ~0.5ha of the total POS area with this portion treated as 'restricted' open space; and the balance of the pipeline buffer area designated as 'unrestricted' open space.

Facilities located within this open space area and associated landscaping will be restricted to that permitted by the gas pipeline proprietor; with anticipated bush retention in between turf and landscaping areas consistent with other development encompassing the pipeline corridor. It is recognised that drainage is permitted within the setback (buffer) area, with up to 35% of the 'unrestricted' POS area providing compensation for 1:10yr ARI events.

5.9 Urban Water Management

A Local Water Management Strategy (LWMS) has been prepared by Coterra Environment (**Appendix 5** refers).

A total water cycle management approach to water management across the Structure Plan area has been developed based on detailed site-specific investigations, industry best-practice and relevant state and City of Rockingham policies relating to water management.

The LWMS is in accordance with the *Better Urban Water Management Guidelines*, and addresses the following:

- Identification of the sites current hydrological regime and existing environment;
- Identification of proposed water supply (including irrigation requirements) and wastewater disposal;
- Identification of the constraints within the development area which may affect the design of the development with respect to urban stormwater drainage;
- Provides a description of the stormwater management strategy for minor and major events, including details on the proposed water sustainable urban design best management practices to be employed;
- Identification and description of mechanisms to protect the water regime, including water quality and water levels. This will include a discussion of the overarching design principles that will be employed to mitigate any impact from run-off and water issues, and ensure that the environment and the development will not be adversely impacted on;
- Identification of monitoring requirements and agreed performance targets for the urban stormwater and drainage treatment system; and
- Identification of contingency measures to be implemented in the event that pollution and nutrient removal, and stormwater detention are not achieving agreed performance targets.

The overall objective for water management is to replicate the hydrological regime that currently exists prior to development of the Structure Plan area.

The LWMS has been prepared with the intention of not only demonstrating that the Structure Plan is spatially able to accommodate the water management approaches proposed, it also intends to guide the future detailed designs for the site by providing clear, auditable criteria that will ensure that overall objectives are met.
An 'Urban Stormwater Drainage Catchment' Plan is provided in **Appendix 5**.

6 INFRASTRUCTURE CO-ORDINATION, SERVICING AND STAGING

An Engineering Service report has been prepared by Development Engineering Consultants (DEC) to support the Structure Plan (**Appendix 2** refers). The following section represents a summary of the report findings.

6.1 Road works

All roads will be constructed to City of Rockingham standards.

As part of subdivision works, Baldivis Road is required to be upgraded to an urban standard; in this case a single lane boulevard design consistent with the upgrading commensurate with subdivision development to the south. This will include reconstruction where required plus kerbing, sheeting, drainage and underground services.

Portions of Nairn Drive within the Structure Plan area will be constructed by the developer, although in the interim period, connection with Eighty Road is proposed subject to land issues being resolved with adjoining owners.

It is envisaged that Fifty and Eighty Roads will also be upgraded to urban standard during the development, including reconstruction (or supplementing), kerbing, sheeting and drainage, plus underground services as required for the development. Fifty Road is also proposed to be upgraded to a "Boulevard" design, which includes two single lane carriageways in accordance with the existing sections already upgraded.

Where roadways cross the pipeline easement, the profile of the road will be lifted to ensure that the required minimum cover over the pipeline is maintained to the specification/satisfaction of the gas pipeline operator/regulator and in accordance with the Pipeline Risk Management Plan.

6.2 Water

Reticulated water will be supplied to the Structure Plan area from the existing/new development abutting the land to the south, currently under construction. Water Corporation planning for this area is to link into and augment the existing supply by extending a new feeder main along Eighty Road from their Tamworth reservoir immediately south of the Structure Plan area. This feeder main is to link into the 300mm Main being extended along Baldivis Road, thus providing capacity for all developments between Baldivis Road and Eighty Road, and is to be installed in the near future.

At present there is reticulated water supply past the Structure Plan area in Fifty Road. An existing 250mm water Main abuts the northern verge of Eighty Road for the whole length of the Structure Plan frontage; this serving the existing developments of *Baldivis North* and *The Chase* from the Water Corporation's Tamworth reservoir immediately south of the Structure Plan area. A planned 300mm distribution Main, proposed along Baldivis Road, will be constructed as far as Ingram Road concurrent with development of the Structure Plan area. The 250mm Main also links along Fifty Road to Baldivis Road.

Water Corporation Planning requires a 600mm distribution Main along Baldivis Road to be extended to Fifty Road. Planning also requires a 500mm Main to be extended along Eighty Road between Tamworth Reservoir and Fifty Road, which will boost both the capacity and pressure in the area.

It is anticipated that both these sections of Main will need to be constructed as part of the Spiers development, although the timing of the various upgrades will depend on the timing and staging of this development relative to others. Case in point, if a cross connection was made between Baldivis Road and Eighty Road, the boost from that cross connection may increase the number of lots that can be immediately serviced.

6.3 Sewerage

The site falls within the catchments of three existing wastewater pumping stations (WWPS) being McDonald Road to the north, Baldivis Road to the north-east and Tamworth Boulevard to the south.

The 'Catchment Plan', together with the required fill levels is shown in ***Drawing S100*** in DEC Servicing Report (**Appendix 2** refers).

At present, the only portion of the catchment that is relatively unconstrained by capacity is the Tamworth Boulevard Pumping Station; this discharging south to the Rivergums Estate then west to the Point Peron Waste Water Treatment Plant (WWTP). The existing system has sufficient capacity for the designated Spiers catchment.

The Water Corporation has now achieved approval for linking of Mains to the East Rockingham WWTP, and consequently has agreed to development in the immediate area.

Connections can be made directly into existing sewers to the north, east and south catchments, and partially for the northern catchment as described below:

- Northern areas - McDonald Road and Baldivis WWPS's are severely limited by capacity. Currently the McDonald Road Station has been sized for an interim capacity of 15 litres per second (l/s), this equivalent to ~1500 lots, and Baldivis Road Pumping Station with suitable upgrade that can cater for a capacity of ~24 l/s (~2400 lots).
- Western areas – relating to the northern catchment, west of Eighty Road. This area is separated into two sub catchments, although they both connect ultimately to the McDonald Road WWPS.
    - The eastern sub catchment area connects to the existing 375mm sewer at the junctions of Fifty Road and Ingerfield Gardens. As part of the Spiers development, a 225mm diameter sewer is proposed to be extended from Fifty Road (Ingerfield Gardens) through the subdivision to Eighty Road to serve the proposed *Commercial* zoned land. There is a need for site fill on the southern portion of Lot 312 adjacent to Eighty Road to provide suitable cover for the sewer.
    - The western sub catchment area will need a 225mm extension from the McDonald Road WWPS along McDonald Road to Fifty Road. There is a need to fill the southern portion of this sub catchment to allow for the sewer to be constructed over the top of the gas pipeline and the low are along the southern boundary.

6.4 Power

Sufficient power supply exists within the area to service the Structure Plan area; 22Kv aerial lines are located in Baldivis Road, Fifty Road and Eighty Road.

Existing aerial powerlines will be relocated underground in line with current Western Australian Planning Commission approval guidelines at the cost of the developer. Transformer locations will be determined during the detailed subdivision design stage.

6.5 Telephone and Gas

Telephone and gas services are available to the site, and will be extended throughout the Structure Plan area during construction from Fifty and Baldivis Roads.

7 IMPLEMENTATION

7.1 Earthworks and Retaining Walls

The Structure Plan area requires filling in the southern and western areas to facilitate sewerage into the existing infrastructure. The fill levels vary, depending on the proximity of the site to the relevant pumping station, but in general the western portion of the site will be filled some 2.5 to 3.0m and retained on the boundary where necessary.

All lots will be finished level, with erection of retaining walls to suit. Retaining wall heights are proposed to be restricted to 1.5m in height on side boundaries, with a maximum height of 3m to rear boundaries; this ensuring maximum amenity to lots without excessive overshadowing. Earthworks are proposed to be designed on a 'cut to fill' balance as per levels illustrated in Appendix 7.

The City has prepared a preliminary design for future Nairn Drive which sets localised levels. Although this may have to be varied when the detailed design is undertaken, the preliminary design will need to be confirmed at Fifty Road and Eighty Road to coincide with existing road levels.

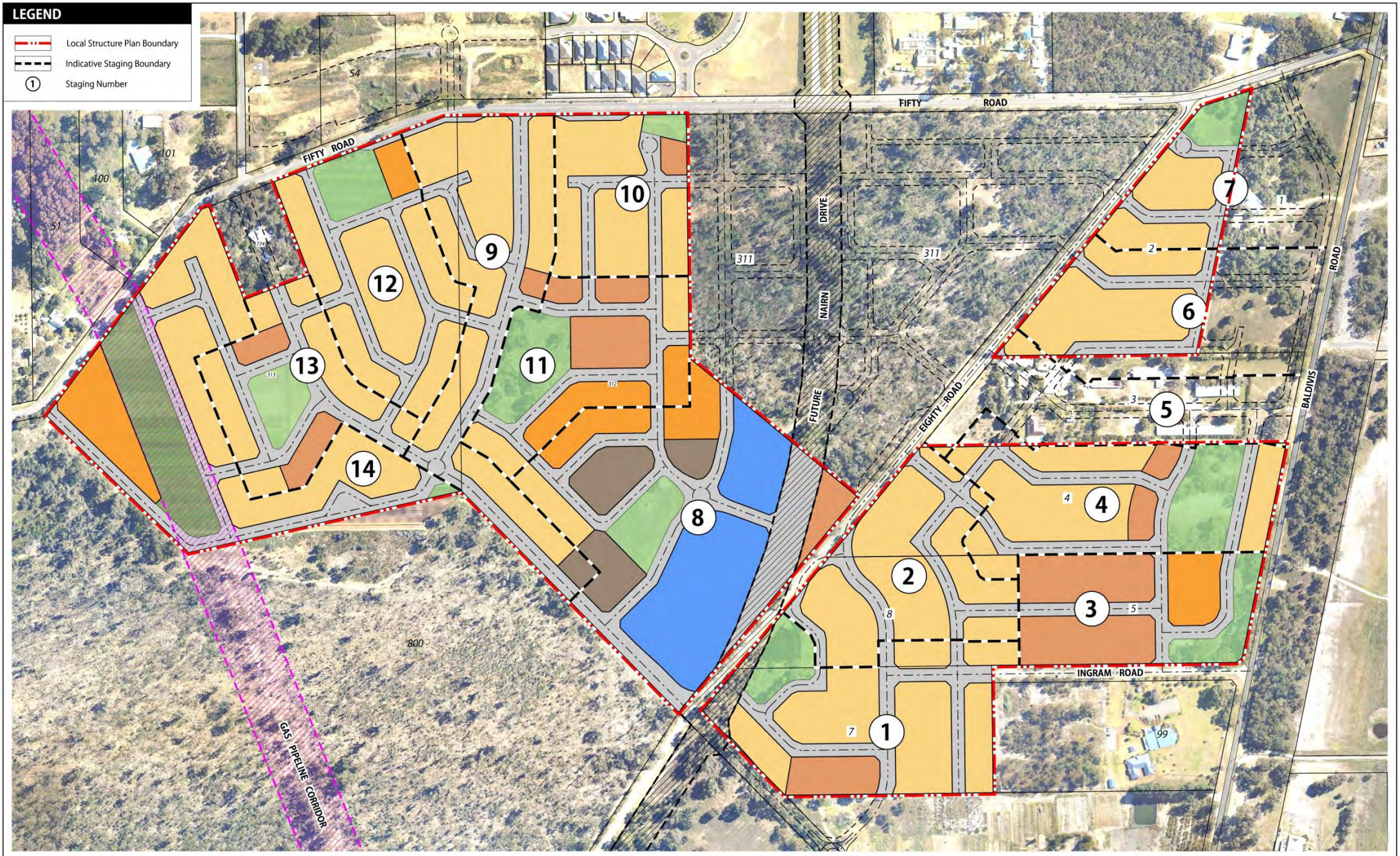
Where roads connect landholdings under separate ownership, it is likely that the boundary levels will need to be either matched to existing level or co-ordinated to ensure that a staged development approach can be accommodated.

7.2 Staging

Development of the Structure Plan area requires detailed subdivision design and subdivision approval from the Western Australian Planning Commission.

Development is envisaged to commence central-east in the Structure Plan area, this commensurate with the final staging within The Spiers Estate encompassed by LSP No. 1. Development will then extend north and then in an anti-clockwise direction in the western portion of the Structure Plan. An Indicative Staging Plan is provided under Plan 11.

Development within the Structure Plan area will be staged so as to avoid established buffers associated with the adjacent poultry farm and market garden operations; with development staggered until such time that these operations cease.



PLAN 11 - Indicative Staging Plan

Various Lots Fifty and Eighty Road, BALDIVIS

for: Spatial Property Group

SPATIAL Property Group™

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Scale 1: 4000 @ A3

0 25 50 75 100 125 150 metres

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Appendix **One** – Environmental Assessment

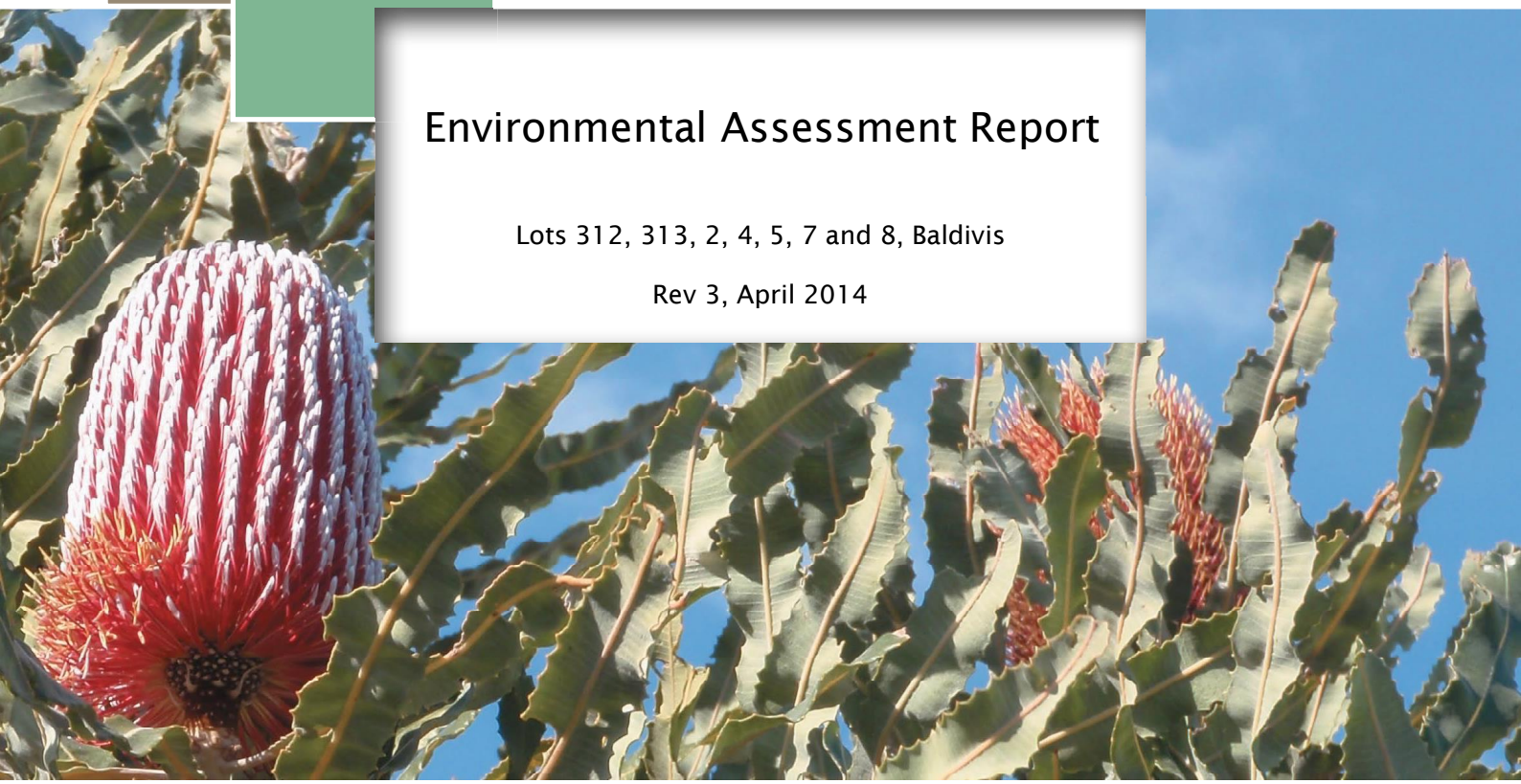
- Lot 5 Fauna Report
- Poultry Odour Assessment

COTERRA ENVIRONMENT

Environmental Assessment Report

Lots 312, 313, 2, 4, 5, 7 and 8, Baldivis

Rev 3, April 2014



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COTERRA
ENVIRONMENT

Environmental Assessment Report

Lots 312 and 313 Fifty Road, and Lots 2, 4, 5, 7 and 8 Eighty Road, Baldivis

Rev 3, April 2014

This report was prepared by:

Coterra Pty Ltd trading as COTERRA ENVIRONMENT
ABN: 92 143 411 456

Our Ref: SPABAL11
Author(s): L. Rogers and E. Bryce
Reviewer: K. Bennetts
Report Version: Rev 3
Date: April, 2014

This report was prepared for:

Spatial Property Group
Unit 1, 896 Canning Highway
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EXECUTIVE SUMMARY

Spatial Property Group, on behalf of the landowners (Carcione Group of Companies) are proposing to develop Lots 312 and 313 Fifty Road, and Lots 2, 4, 7 and 8 Eighty Road, Baldivis (Figure 1) for urban subdivision. The site is 52.3 hectares (ha) in size and is located between Fifty Road, Eighty Road and Baldivis Road, Baldivis in the City of Rockingham (CoR), approximately 40 kilometres (km) south of Perth (Figure 2). This report has also been prepared for Lot 5 Baldivis Road (Figure 2), which forms part of the Local Structure Plan (LSP), but is under separate ownership.

All of the Lots are currently zoned 'Urban' under the Metropolitan Region Scheme (MRS) (Figure 3) and 'Residential' under the City of Rockingham Town Planning Scheme No. 2 (TPS).

This report has been prepared to provide a detailed description of the existing environment, and outline proposed management measures to effectively mitigate any potential environmental impacts resulting from the implementation of the development.

The majority of the site has been parkland cleared, with pockets of remnant vegetation remaining in some areas. It is considered that urban development of the site is an acceptable land use given the current environmental condition and significance of the site, and in consideration of the proposed management strategies outlined in this report.

The condition of the remnant vegetation within the project area varies considerably from Good to Completely Degraded with the two largest lots, Lot 312 and 313, being 'Degraded' to 'Completely Degraded'. Lot 312 contains several stands of older *Eucalyptus gomphocephala* (Tuart). There were some areas of vegetation in good or better condition at Lots 2, 4 and 7.

These pockets of better quality vegetation and the larger Tuart trees on Lot 312 provide fauna habitat viability to some species, including conservation significant bird species.

As a result the LSP has been designed to retain and incorporate the areas of remnant vegetation where possible in Public Open Space (POS) across the development (Figure 4). In addition a range of management strategies have been proposed to effectively manage or mitigate any potential environmental impact caused as a result of the development. Proposed management actions are summarised on the table below.

Table A: Implementation Plan

Issue	Action	Frequency	Responsibility
Preconstruction Phase			
Vegetation protection	Clearly delineate POS areas and Bush Forever and associated setbacks.	Once	Licensed Surveyor (Developer)
	Prepare a Vegetation / POS Management Plan prior to subdivision.	Once	Developer (Status: completed and issued to CoR for assessment)
Acid Sulfate Soils	Undertake a Preliminary Site Assessment to assess the likely risk of encountering ASS and any proposed management measures.	Once	Developer (Status: ASS self-assessment form being prepared as per WAPC conditions)
Contamination	Undertake further investigations comprising a soil and groundwater Sampling and Analysis Plan (SAP) and subsequent Detailed Site Investigation (DSI) for DER approval.	Once	Developer (Status: Completed, voluntary audit undertaken)
Urban Water Management Plan (UWMP)	Following approval of the LWMS - Prepare a UWMP prior to subdivision for approval by DoW.	Once	Developer (Status: UWMP in preparation)
Construction Phase			
Fauna protection	Undertake clearing in the direction of existing bushland to allow fauna to escape.	Ongoing during construction phase.	Construction Contractor (Developer)
Construction Impacts	Ensure dust and sediment run-off is adequately managed. Ensure appropriate waste disposal of building materials.	Ongoing during construction phase.	Construction Contractor (Developer)
Post-construction Phase			
Vegetation protection	Inspect fencing (if applicable) and replace if required.	6 months	Developer until hand over to the City of Rockingham.
POS Management	Ensure ongoing maintenance of vegetation retained, and any revegetation areas / native landscaping prior to handover.	Ongoing until handover.	Developer until hand over to the City of Rockingham.

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APPENDICES

Appendix A: WAPC Approval Subject to Conditions – Freehold (Green Title) Subdivision – Lots 312, 313, 4, 7 and 8

Appendix B: Level 1 Flora and Vegetation Survey Report (Bennett Environmental, 2011)

Appendix C: Botanical Assessment Report for Lot 5 Baldivis Road (Bennett Environmental Consulting, 2011).

Appendix D: Level 1 Fauna Survey and Graceful Sun-Moth Survey (Bamford Consulting, 2011)

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1.0 INTRODUCTION

1.1 Project Description

Spatial Property Group, on behalf of the landowners (Carcione Group of Companies) are proposing to develop Lots 312 and 313 Fifty Road, and Lots 2, 4, 7 and 8 Eighty Road, Baldivis (Figure 1) for urban subdivision. The site is 52.3 hectares (ha) in size and is located between Fifty Road, Eighty Road and Baldivis Road, Baldivis in the City of Rockingham (CoR), approximately 40 kilometres (km) south of Perth (Figure 2).

This report has also been prepared for Lot 5 Baldivis Road (Figure 2), which forms part of the Local Structure Plan (LSP), but is under separate ownership of Lot 5. The management measures outlined in this report are intended to be applied in respect to prospective development of Lot 5, and reference to development under the LSP within this report is inclusive of Lot 5, unless stipulated otherwise.

All of the Lots are currently zoned 'Urban' under the Metropolitan Region Scheme (MRS) (Figure 3) and 'Residential' under the CoR Town Planning Scheme No. 2 (TPS).

The site has been identified in the North Baldivis District Structure Plan (DSP) as part of the future urban growth of the North Baldivis precinct.

The majority of the site has been parkland cleared, with pockets of remnant vegetation remaining in some areas across the site. It is considered that urban development of the site is an acceptable land use given the current environmental condition and significance of the site, and in consideration of the proposed management strategies outlined in this report.

1.2 Planning Context

The North Baldivis DSP was formulated by the City of Rockingham in recognition of the general designation of the North Baldivis locality as suitable to accommodate future residential development. As such, the City embarked on a comprehensive 'district level' structure planning exercise in the late 1990's over the potential urban cell east of Baldivis Road and spanning from Kerosene Lane in the north to the future Baldivis Town Centre to the south. This exercise culminated in the release of the Baldivis (North) District Structure Plan as formally adopted by Council in July 2000.

The District Structure Plan outlined the preferred broad land use and district road framework for the study area.

In accordance with the objectives of the DSP, the proponent has commissioned the formation of a Local Structure Plan (LSP) over the site, providing a greater level of detail in respect to the structure plan design for the landholdings.

The LSP design was completed by Development Planning Strategies, and is presented in Figure 4.

The subdivision plan for Lots 312, 313, 7, 8 and 4 of the subject area has been approved subject to conditions by the Western Australian Planning Commission (WAPC) (Application Number: 147921, approved 31 March 2014). The approval is

attached as Appendix A. The WAPC is prepared to endorse a deposited plan in accordance with the plan submitted once the imposed conditions have been fulfilled.

1.3 Scope of Report

The City of Rockingham TPS No.2 requires a LSP to be prepared and submitted for 'Residential Development Zones' prior to granting and/or recommending approval of any development within this zone.

This report has been prepared to address the following:

- Facilitate the approval of the LSP with the City of Rockingham.
- Provide a detailed description of the existing environment.
- Outline proposed management measures to effectively manage or mitigate any potential environmental impacts resulting from the implementation of the development.

1.4 Previous Environmental Assessments

Lot 313 Fifty Road (Figure 2) was part of Amendment No. 300 of the City of Rockingham's Town Planning Scheme No. 1, which was initiated to rezone the associated landholdings from 'Rural' to 'Development'. The rezoning application was assessed by the EPA in 2001 and determined that the proposal could be implemented subject to conditions. The formal approval and associated conditions are outlined in Ministerial Statement No. 580 (dated 19th December 2001).

Conditions relevant to the development of Lot 313 include:

- Condition 1: Drainage and Nutrient Management Plan (now addressed as a Local Water Management Strategy in accordance with the Department of Water's Better Urban Water Management Guidelines (DoW, 2008));
- Condition 2: Soil and Groundwater Investigation and Remediation Plan (addressed as a Preliminary Site Investigation – detailed in Section 4.9 below);
- Condition 4: Spray Drift Investigation and Management Plan; and,
- Condition 5: Vegetation Management Plan.

These conditions must also be addressed prior to development of Lot 313, in accordance with the provisions of this Lot under the City of Rockingham's TPS No.2.

2.0 KEY ENVIRONMENTAL POLICIES

2.1 Environmental Protection Act 1986

The *Environmental Protection Act 1986* ('the Act') is the pre-eminent environmental legislation in Western Australia. Development projects are regulated under Part IV of the Act.

Assessment opportunities under the Act occur at the rezoning stage (region scheme and/or town planning scheme) under Section 48A of the Act and the subdivision/ development stage under Section 38 of the Act.

The Act also has a number of Environmental Protection Policies and regulations which provide guidance on environmental management. Relevant documents are discussed below.

2.1.1 Environmental Protection (Peel Inlet – Harvey Estuary) Policy 1992

The site is located within the Swan Coastal Plain Catchment of the Peel Inlet - Harvey Estuary, which has a history of poor water quality. The objective of the *Environmental Protection (Peel Inlet – Harvey Estuary) Policy 1992* (Peel-Harvey EPP) is to reduce the input of nutrients, particularly phosphorus, into the Peel Inlet – Harvey Estuary through a number of means, which include appropriate land management by landowners in the policy area.

The Peel-Harvey EPP requires any future development within the policy area be designed to meet the water quality objectives. This may require the preparation of a nutrient budget or appropriate management plans for proposed land uses.

Existing drainage patterns, land use and nutrient export should be examined as the basis for evaluating the impacts of changing land use, and possible management techniques for nutrient control and engineering solutions for stormwater disposal derived from this evaluation.

2.2 Water Quality Improvement Plan for the Rivers and Estuary of the Peel - Harvey System – Phosphorus Management

The *Water Quality Improvement Plan for the Rivers and Estuary of the Peel – Harvey System – Phosphorus Management* (WQIP) was released by the EPA in November 2008 (EPA, 2008a). The objective of the WQIP is to limit the level of phosphorus reaching the Peel - Harvey waterways to 75 tonnes per year (currently 145t/a). There are thirteen actions stated in the WQIP. There are thirteen actions stated in the WQIP. Actions 1, 2, 5, 6 and 7 relate to agricultural land and hence are not relevant to this development. All requirements, and mechanisms by which this proposal can and will address the objectives of the WQIP are discussed in the Local Water Management Strategy (Coterra, 2011), prepared separately to this report.

2.3 State Planning Policy 2.1: Peel – Harvey Coastal Plain Catchment

State Planning Policy (SPP) 2.1 was prepared to ensure that land use changes within the Peel-Harvey Estuarine System likely to cause environmental damage are brought under planning control and prevented. The objectives of this policy are to:

- Improve the social, economic, ecological, aesthetic, and recreational potential of the Peel - Harvey coastal plain catchment.
- Ensure that changes to land use within the catchment to the Peel - Harvey estuarine system are controlled so as to avoid and minimise environmental damage.
- Balance environmental protection with the economic viability of the primary sector.
- Increase high water using vegetation cover within the Peel - Harvey coastal plain catchment.
- Reflect the environmental objectives in the *Environmental Protection (Peel Inlet -Harvey Estuary) Policy 1992*.
- Prevent land uses likely to result in excessive nutrient export into the drainage system.

The policy highlights that proposed changes to land zonings should take into account land capability and suitability with regards to the net effect that such changes are likely to have on the nutrient load discharging from that catchment into the Peel-Harvey system. Subdivision proposals should also make provision for a drainage system which maximises the consumption and retention of drainage on site. Industrial development where processes would create liquid effluent must include provision for connection to a reticulated sewerage system (WAPC, 2003).

2.4 City of Rockingham – Local Bushland Strategy

The *City of Rockingham* (CoR) *Planning Policy 7.2 – Local Bushland Strategy* aims to:

"provide Council with guidance in the assessment of proposals to rezone, subdivide and develop land in the City where remnant bushland is present".

The policy guides the assessment of the ecological value of remnant bushland to assist in determining the suitability of development over the land proposing to be developed. As such, in line with the policy directives, the bushland on site is assessed against the following factors:

- Presence of Rare species or threatened ecological communities
- Rarity of the vegetation complex present - (ie. is the present complex an example of one which has less than 10% remains in secure conservation reserves, either in a regional or locally representative context)
- Vegetation diversity
- Naturalness i.e. vegetation condition (level of degradation, structure retained)

- Connectivity as a wildlife corridor
- Significant because it is isolated and is the only remaining bushland in that area (particularly important in developed areas)
- Social value (e.g. educational resource, recreational area, locally admired for rural or visual amenity)
- Acts as a buffer between potentially conflicting land uses
- Impact from removal or modification on other parts of the environment
- Other significant attributes

2.5 EPA Guidance Statement No. 33 – Environmental Guidance for Land Development

Environmental Protection Authority (EPA) Guidance Statement No. 33 (EPA, 2008b) outlines the environmental protection process and provides the EPA's advice on a range of environmental factors in order to assist in the protection, conservation and enhancement of the environment during the land planning and development process.

3.0 LOCAL STRUCTURE PLAN

3.1 Description

The LSP has been developed to guide the subdivision and development of 52.3 ha of undeveloped land under ownership of the Carcione Group of Companies within the North Baldivis precinct. The LSP design is detailed in Figure 4.

Lot 5 Baldivis Road, while under separate ownership, also forms part of the LSP for this project (Figure 4).

The LSP proposes predominantly residential development in accordance with the 'Urban' zoning in the MRS. The LSP design is shown in Figure 4 and can be divided into the following land uses:

- Residential
- Commercial
- Movement network
- Gas pipeline reserve
- Public Open Space (POS)

3.2 Environmental Aspects of LSP Design

This Environmental Assessment Report is primarily concerned with management and maintenance of the natural areas to be retained within the LSP site, and the minimisation of potential environmental impacts. The process for the preparation of this report involved the input into design of the LSP to designate natural areas across the site suitable for retention based on their environmental value and as a mechanism to mitigate any potential environmental impacts resulting from the implementation of the development.

The LSP design has responded to as many of the environmental opportunities presented as practicable in a residential area. These are discussed in detail below.

3.2.1 Public Open Space

There are a number of environmental objectives which underpin the LSP design; these are to:

- Preserve areas of conservation value.
- Conserve examples of different natural areas on site and preserve biodiversity.
- Create sustainable conservation areas.
- Incorporate natural areas into new urban fabric.
- Interpret existing landscape and site memory in development areas.

- Incorporate the natural local landscape character within new public domain planting.
- Develop community awareness and involvement.

Where engineering and design requirements allow, areas of the best quality remnant native vegetation will be retained in POS areas across the site.

Land attributes and functional values which have been accounted for in the process of identifying POS areas in the LSP include the following:

- Conservation values.
- Recreation opportunities.
- Fauna habitat values.
- Significant tree values.

Areas of POS in the LSP have been developed to provide the necessary active recreation opportunities for the future residents of the area whilst also preserving as many ecological values as practicable on 'Urban' zoned land. The area allocated to POS in the LSP is 5.99 ha (including the gas pipeline corridor area of 1.36 ha) of 54.54 ha total LSP area (or 11.0% of net subdivisible area).

3.3 Areas of Retained Vegetation

POS areas proposed to include retained vegetation include (Figure 4):

- POS D – mature Tuart trees to be retained within the landscape design
- POS I – mature Marri and Jarrah trees to be retained within the landscape design
- POS H – tree species comprising Marri, Tuart and River Red Gum (*Eucalyptus camaldulensis*) to be selectively retained within the landscape design.

Tree retention will be supplemented with additional landscape planting to create useable and environmental sensitive green spaces in accordance with the objectives of the City of Rockingham as outlined within the Draft Greening Plan 2012-2017 (CoR, 2013). Planting will incorporate locally indigenous plants where suitable to assist to increase the ecological value of the site.

Detailed landscape design plans will be submitted to council for approval prior to implementation, in accordance with the Vegetation Management Plan. These plans will provide details of the specific trees being retained.

4.0 EXISTING ENVIRONMENT

4.1 Context and Setting

4.1.1 Historical Land Use

Lot 313 has historically been used as a Market Garden Operations on this site are planning to be concluded in 2014. Lot 312 has been parkland cleared, and was likely used for stock grazing historically. Lots 4, 7 and 8 are have been used as rural residential lifestyle properties, with some small scale hobby farming apparent. Lot 5 Baldivis Road is currently utilised as a scrapyard.

4.1.2 Surrounding Land Use

Bush Forever site No. 356 is located adjacent to the western and southern boundary of Lot 313, and adjacent to the western boundary of Lot 312. Future residential land, (representing the initial phase of a larger development by Carcione Group), is located to the south of Lot 7, with future urban proposed for the Lots north of Fifty Road, and east of Baldivis Road. Baldivis Primary School is located to the north of the site.

A poultry farm which is currently in operation is located between Lot 2 and Lot 4 Baldivis Road (Lot 3). The farm conducts only hatchery operations.

The Parmelia high pressure natural gas pipeline runs through Lot 313 in a general north west to south east direction along the western portion of the site (Figure 4).

The property is less than one kilometre from the new Perth to Bunbury Highway and approximately seven kilometres from the Transperth Perth to Mandurah rail line.

4.2 Topography, Landforms and Soils

4.2.1 Topography

The site is generally flat, with a gentle rise toward the north. The site elevation ranges from approximately 3 metres (m) Australian Height Datum (AHD) to 15 m AHD near the northern end of the site (Figure 5).

4.2.2 Landforms and Soils

The Department of Minerals and Energy (2000) mapping provided in Figure 5 indicates that the project site contains three natural soil types of the Spearwood and Tamala soil systems consisting of:

- Sand (S8): which is described as - very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted, of eolian origin as relatively thin veneer over C2 (clay), M4 (silt) and Mc2;
- Sand (S7): which is described as - pale yellowish brown, medium to coarse-grained, sub-angular to well-rounded quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin; and,

- Limestone (LS1): which is described as pale yellowish brown, fine to coarse-grained, sub-angular to well rounded, quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin.

4.2.3 Acid Sulfate Soils

According to Acid Sulfate Soil (ASS) risk mapping sourced from the CSIRO *Australian Soil Resource Information System* (ASRIS) database, the site is identified as having a '*no known occurrence of AASS and PASS occurring*'. This is consistent with the Perth Groundwater Atlas (DoW, 2004) which maps the site as 'Low to Nil risk of acid or potentially acid sulphate soils >3m below the ground surface'. However, the Department of Environment and Conservation (DEC) ASS Risk Map indicates that the majority of the site has a Moderate to Low ASS risk (Figure 6) (DEC, 2010a).

The site is surrounded by areas of high ASS risk associated with Lake Coogee (Conservation management category wetland) to the west and a Resource Enhancement category wetland to the north (based on DPaW geomorphic wetland database mapping). The closest high risk ASS area, the Opwin Swamp Dampland, is located approximately 100 m to the north-west of Lot 313 (DEC, 2010a). Subsequent high risk ASS areas located near the site include: the Tamworth Hill Swamp sumpland (located approximately 780 m south south-west), Cooloongup Lake (approximately 1 km to the west) and Folly Pool (located approximately 920 m to the east).

DEC (now DER for matters relating to ASS) guidance advises that consideration of ASS issues should be undertaken within a 500 m radius of all high risk ASS mapped features, wetlands and/or surface water bodies (DEC, 2009).

4.3 Hydrology

4.3.1 Groundwater

Regional groundwater mapping obtained from the Department of Water (DoW) Perth Groundwater Atlas, indicates that groundwater occurs at a depth of approximately 2 mAHD across the site. Therefore the separation distance to groundwater from the natural surface level would vary between 1m AHD and 13m AHD within the LSP area. Regional groundwater information indicates that groundwater flow is generally in a westerly direction (DoW, 2004).

4.3.2 Wetlands

There are no mapped wetlands within the site as identified in the DPaW geomorphic wetlands database (Figure 7). In addition, there are no wetlands on the site listed under the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992*. The site is not impacted by buffer or setback requirements from any wetlands located nearby.

A small seasonal wetland was identified in the fauna survey as occurring within Lot 312. This wetland is not mapped by the DPaW as being of conservation significance, though it may contain habitat for some wetland associated flora and fauna species on a seasonal basis. The wetland was dry during the site visit conducted in February 2011.

4.3.3 Peel-Harvey Estuary Catchment

The site is located within the Swan Coastal Plain Catchment of the Peel-Harvey Estuary, which has a history of poor water quality. The objective of the *Environmental Protection (Peel Inlet – Harvey Estuary) Policy 1992* is to reduce the input of phosphorous into the Peel-Harvey Estuary through a number of means, which includes appropriate land management by landowners in the policy area. A change in land use from predominantly agricultural to urban development, with a reticulated sewer system, will reduce the potential for nutrient export to the receiving environment, which is in accordance with the general objectives of the policy.

4.4 Vegetation and Flora

The vegetation extent across the site differs between lots, and varies from completely cleared market gardens, to pockets of remnant vegetation in good condition. Overall the site is mostly degraded and parkland cleared, with historical farming and grazing impacting on the ecological viability of the remaining vegetation.

The site was originally situated within two mapped vegetation complexes, described below (Heddle et al., 1980):

- Karrakatta Complex (Central and South), described as predominantly an open forest of *Eucalyptus gomphocephala – Eucalyptus marginata – Corymbia calophylla* and woodland of *Eucalyptus marginata – Banksia* spp (Heddle et al., 1980) (Figure 8).
- Cottesloe Complex (Central and South), described as a mosaic of woodland of *Eucalyptus gomphocephala* and open forest of *Eucalyptus gomphocephala – Eucalyptus marginata – Coryumbia calophylla*: closed heath on the limestone outcrops (Heddle et al., 1980) (Figure 8).

The reservation status of this vegetation type within the Swan Coastal Plain (SCP) at both a regional and local level is presented below. As can be seen from Table 1, the Cottesloe Complex meets the State government target of at least 10% of the original extent proposed for protection (Bush Forever protection area of the Perth metropolitan region), however this figure is at 8% for the Karrakatta complex. In addition, both complexes are locally well represented with a high percentage of the original extent remaining within the City of Rockingham.

Table 1: Regional and Local Conservation Status of Karrakatta Complex – Central and South and Cottesloe Complex – Central and South.

	Description	*Karrakatta Complex*		*Cottesloe Complex*	
		Area	**Percentage of Original Area**	**Area**	**Percentage of Original Area**
Local Representation (City of Rockingham)	Original extent	4,276 ha	-	2,017 ha	-
	Remaining area	1,552 ha	36 %	1,011 ha	50 %
Regional Representation (Perth Metro Area of Swan Coastal Plain)	Original extent	34,532 ha	-	34,439 ha	-
	Remaining area	6,275 ha	18%	12,362 ha	36%
	Area proposed for protection (Bush Forever)	2,590 ha	8%	6,085 ha	18%

Source: Del Marco et al., 2004.

4.4.1 Vegetation Assessment

A Level 1 Flora and Vegetation Survey (report attached as Appendix B) with additional spring surveying was undertaken by botanical consultant Bennett Environmental Consulting Pty Ltd on the 6th October 2011 for all landholding apart from Lot 5, which supplements the initial Level 1 Flora survey undertaken in January and April, 2011, over all Lots (Level 1 Survey report for Lot 5 is attached as Appendix C). The survey assessed the vegetation type and condition, presence of any rare or significant vegetation and flora for each Lot across the site. The individual vegetation units are identified in Figure 9, with vegetation condition provided in Figure 10.

The following is a summary of the vegetation and flora survey findings across each of the individual Lots:

- Lot 8 was completely cleared of all vegetation;
- Lot 313 was a market garden with two small areas of remnant vegetation;
- Lot 312 had excellent sized trees but with the understorey replaced by weeds dominated by **Ehrharta calycina* and **Lupinus cosentinii*;
- Lot 2 included several cultivated trees including **Olea europaea* (Olive) and **Melia azedarach* (Cape lilac) together with several *Eucalyptus marginata* subsp. *marginata* (Jarrah) and a *Corymbia calophylla* (Marri);
- Lot 4 included some remnant vegetation in good condition;
- Lot 7 recorded an area of remnant vegetation; and,
- Lot 5 contains some vegetation in the western portion of the site.

The condition of the project area varied considerably from good to completely degraded with the two largest lots, Lot 312 and 313 being degraded to completely

degraded. Lot 312 contains several stands of older *Eucalyptus gomphocephala*. There were some areas of vegetation in good or better condition at Lots 2, 4 and 7, with Lot 5 only containing vegetation in 'Degraded' to 'Completely Degraded' condition. The spring survey did not record any vegetation of significance, or the presence of any rare or priority flora.

The complete flora and vegetation survey report is attached as Appendix B, with the survey report for Lot 5 attached as Appendix C.

4.4.2 Significant Flora and Vegetation Communities

No significant flora or Threatened Ecological Communities were identified as part of the Flora and Vegetation survey.

4.4.3 Bush Forever

There are no Bush Forever Sites located within the landholdings, however Bush Forever Site No. 356 abuts the western boundary of Lots 313 and 312 (WAPC, 2000). Bush Forever Site No. 356 begins at its most eastern point adjacent to Lots 313 and 312, and expands westward to include Lakes Cooloongup and Walyungup, and surrounding bushland (Figure 8).

4.5 Fauna and Habitat

A Level 1 Fauna survey completed in accordance with the EPA's Guidance Statement No. 56 – *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004) was completed across the project area in February 2011 (Appendix D). Following observation of potential habitat, a Graceful Sun-Moth survey was also undertaken in accordance with the DEC's Survey Guidelines for the Graceful Sun-Moth (*Synemon gratiosa*) and site habitat assessments (DEC, 2010b) (Appendix D).

The fauna survey established 3 different habitats within each of the Lots across the site, including:

- Lots 2 and 312 were largely cleared, with some mature trees retained. The trees within Lot 312 were considered to have higher habitat value given their age and subsequent likelihood of suitable nesting hollows being available to a range of fauna species (see Appendix D for raw data on 'Mature' trees);
- Lots 4 and 7 were partially cleared, but with pockets of "remnant open woodland over shrubland" across the Lots. These may provide some linkage value to surrounding bushland areas. A number of trees within these two Lots are considered to have high habitat value given their age and subsequent likelihood of suitable nesting hollows being available to a range of fauna species (see Appendix D for raw data on 'Mature' trees); and,
- A small seasonal wetland was also found to exist within Lot 312.

Based on the available habitats present within the site, the species observed during the survey, and the results of the desktop search on the fauna species known to occur in this region, the report concluded the following in respect to development of the site:

- The presence of numerous large, potentially hollow-bearing trees may provide nest hollows for conservation significant fauna such as Carnaby's Black Cockatoo.
- Remnant vegetation may provide habitat for a range of fauna species; in some cases acting as habitat corridors, allowing them to move through the landscape.
- Following the completion of a Graceful Sun-Moth survey programme in March 2011 (see Appendix D) it is considered that this species does not occur in the study area.

The proponent referred the project to the federal Department of Sustainability, Environment, Water, Populations and Communities (SEWPaC) (now the Department of the Environment) for approval under the EPBC Act, based on the potential impacts to federally listed species, with particular focus on the Carnaby's Black Cockatoo.

An approval (Not a Controlled Action) was issued by SEWPaC under the EPBC Act for development over the LSP area in January 2012. The approval letter is attached as Appendix E.

It should be noted that Lot 5 was not included in the fauna assessment undertaken in February. Based on the botanical assessment of the landholding, Lot 5 is not considered to contain significantly viable fauna habitat. Some of the existing trees may contain habitat for the protected Black Cockatoo species.

4.6 Cultural Heritage

A search of the Department of Aboriginal Affairs (DAA) (formerly the Department of Indigenous Affairs) Heritage Sites database determined that there are no sites of Aboriginal significance which have been recorded on the landholdings, however one site is located near the proposed Nairn Road Alignment in an adjacent Lot located on the corner of Fifty Road and Eighty Road. No other registered sites are located within or nearby the site (DIA, 2011).

All contractors working on the development will be made aware of their responsibilities under the *Aboriginal Heritage Act 1972* with regard to finding potential archaeological sites. In the event a site is discovered, all work in the area will cease and the DAA will be contacted.

5.0 IMPACTS AND MANAGEMENT

In consideration of the existing environment as outlined above, and the requirements on the approved TPS Amendment for Lot 313, as detailed in Ministerial Statement No. 580 (outlined in Section 1.4 above), and under the TPS provisions for Lot 313, the following management measures are proposed. These measures are designed to mitigate and manage any potential environmental impacts resulting from development of the site, in accordance with Local, State and Federal agency objectives.

5.1 Vegetation and Flora

The condition of vegetation within the project area varied considerably from Good to Completely Degraded, based on the Keighery vegetation condition scale. There were some pockets of vegetation that were considered to be in better condition and contained higher ecological value primarily due to the age of some of the remnant trees across the site.

Therefore it is considered pertinent to retain these areas of vegetation across the site in Good condition or better, where engineering and design requirements allow. The vegetated areas proposed for retention in the LSP are identified in Figure 4.

The larger significant trees, particularly the larger Tuarts within Lot 312 were identified for retention based on their ecological value, suitability for retention in an urban development and fauna habitat potential during the flora and vegetation survey and fauna survey (Appendix B). These are retained within POS D (Figure 4).

Each of the trees identified in this survey have been mapped across the site (Figure 1 - Appendix D). These trees were considered the highest priority for retention and have been retained where possible within POS as outlined in the final LSP design shown as Figure 4.

In consideration of the attributes outlined above for allocation of POS, the development area accounts for the retention of a number of mature trees that also have significant value as potential fauna habitat (Marris, Tuarts and Jarrahs are significant habitat trees for protected cockatoo species). Tree retention will be supplemented with additional landscape planting to create useable and environmental sensitive green spaces in accordance with the objectives of the City of Rockingham as outlined within the Draft Greening Plan 2012-2017 (CoR, 2013). Planting will incorporate locally indigenous plants where suitable to assist to increase the ecological value of the site.

To ensure the future viability of retained vegetated and revegetated areas the following management strategies are proposed:

- Delineation of POS areas containing retained vegetation and revegetation zones with a road separation.
- Hard edges such as roads will separate the development edge and the boundary of the Bush Forever site, as outlined in the LSP design attached as Figure 4. This will minimise edge effects from the development impacting on the Bush Forever site.

- Clear demarcation of vegetated areas and individual trees proposed for retention within the LSP, prior to site works to ensure that these areas are not accidentally impacted.

- Preparation of a Vegetation / POS Management Plan which will provide details regarding revegetation species and establishment, weed control, access control (during construction and post-construction), dieback control and management, fire management and interface management. The Vegetation / POS Management Plan has been prepared in accordance with Ministerial Statement No. 580 to address interface management with Bush Forever site No. 356 and other management measures as outlined in the Ministerial Statement. This management plan is also a requirement of the conditional subdivision approval (WAPC ref: 147921). It has been submitted and is currently under review by City of Rockingham and WAPC.

5.2 Fauna and Habitat

The site contains fauna habitat of varied viability, consisting of mostly cleared areas, with patches of vegetation in good condition that provide some level of habitat and connection to nearby bushland in Lots 2, 4, 5, 7 and 312. Remnant mature trees scattered across the site, predominantly in Lot 312 offers habitat to bird species, including but not limited to the federally protected Black Cockatoo species.

The proponent referred the project to SEWPaC (now the Department of the Environment) for approval under the EPBC Act, based on the potential impacts to federally listed species, with particular focus on the Carnaby's Black Cockatoo.

An approval (Not a Controlled Action) was issued by SEWPaC under the EPBC Act for development over the LSP area in January. The approval letter is attached as Appendix E.

The larger significant trees, particularly the larger Tuarts within Lot 312, were mapped across the site and retained where possible within POS as outlined in the final LSP design (Figure 4). The Tuart tree locations along with areas of highest fauna habitat viability were considered in respect to the allocation of POS. Marri and Jarrah trees were also retained in areas of POS largely based on their value as potential habitat for fauna including, but not limited to, protected Black Cockatoo species.

To ensure the future viability of retained fauna habitat areas and to minimise impacts to fauna resulting from any clearing activities, the following management strategies are proposed:

- During construction, the extent of authorised clearing will be clearly defined and demarcated to avoid accidental clearing.

- Loud noises (e.g. air horns) will be made just prior to commencement of clearing.

- Clearing works will occur in the direction of a conservation area where possible, to allow animals time to escape.

- If any injured or distressed fauna are encountered during site works the Site Supervisor will be instructed to immediately call the DPaW Wildcare Hotline (08)

9474 9055, to allow for the closest appropriate DPaW registered wildlife rehabilitator to attend the site.

- Long-term fencing for conservation areas will be relatively permeable to most species of fauna (reptiles, small mammals) with a 30 cm gap between ground level and the first rail/wire.
- Where possible, local native species will be planted along road verges and median strips in and near conservation areas and strategic ecological linkages to enhance the value of the linkage to fauna.

5.3 Drainage and Nutrient Retention

A Local Water Management Strategy (LWMS) was prepared by Coterra Environment, separate to this report, as a requirement of submission of a Structure Plan. The LWMS was prepared in accordance with the Better Urban Water Management Guidelines (DoW, 2008) and addresses the following:

- Identification of the sites current hydrological regime and existing environment.
- Identification of the proposed water supply (including irrigation requirements) and wastewater disposal.
- Identification of the constraints within the development area which may affect the design of the development with respect to urban stormwater drainage,
- Provide a description of the stormwater management strategy for minor and major events, including details on the proposed water sustainable urban design best management practises to be employed.
- Identification and description of mechanisms to protect the water regime, including water quality and water levels. This will include a discussion of the overarching engineering principles that will be employed to mitigate any impact from run-off and water issues, and ensure that the environment and the development will not be adversely impacted upon.
- Identification of monitoring requirements and derivation of agreed performance targets for the urban stormwater and drainage treatment system.
- Identification of contingency measures to be implemented in the event that pollution and nutrient removal, and stormwater detention are not achieving agreed performance targets.
- Urban Water Management Plan's will be required to be prepared and approved prior to subdivision approval in accordance with the *Better Urban Water Management Guidelines* (2008) and the conditional subdivision approval (WAPC ref: 147921).

The LWMS was approved by the Department of Water in May 2013. An Urban Water Management Plan (UWMP) is now undergoing preparation for the subdivision stage of the project.

5.4 Acid Sulfate Soils

Previous DER mapping indicates the site contains areas mapped as having both a 'Moderate to Low' risk and a 'Low to No' risk of Acid Sulfate Soils (ASS). However a high risk area is located less than 500 m from the boundary of the site, triggering a requirement for a more detailed ASS risk assessment in accordance with the DER's requirements.

A condition regarding ASS has been placed on the subdivision approval of the site (WAPC Application Number: 147921, approved 31 March 2014). It states:

> *23. An acid sulphate soils self-assessment form and, if required as a result of the self-assessment, an acid sulphate soils report and acid sulphate soils management plan shall be submitted to and approved by the Department of Environment Regulation before any subdivision works or development are commenced. Where an acid sulphate soils management plan is required to be submitted, all subdivision works shall be carried out in accordance with the approved management plan. (DER)*

In this regard, an acid sulphate soils self-assessment form is currently being completed to assess the requirement for further investigation. Consequently, a if a Preliminary Site Assessment isidentified as being required, this will then be undertaken to assess the presence and extent of ASS within the subject area and within 500 m of the high risk zone prior to subdivision. Depending upon the results of the preliminary assessment, an Acid Sulfate Soil Assessment and Dewatering Management Plan will be prepared if required. This plan would need to be approved for implementation by the DER prior to any ground disturbing works being undertaken.

5.5 Potential Contamination

Based on the historical land uses of the site, the proposed redevelopment of the area has triggered a WAPC condition with regards to potential contamination on site. This condition states:

> *24. Prior to commencement of subdivision works, investigation for soil and groundwater contamination is to be carried out to determine if remediation is required. If required, remediation, including validation of remediation, of any contamination identified shall be completed prior to the issuing of titles to the satisfaction of the Western Australian Planning Commission on advice from the Department of Environment Regulation, to ensure that the lots created are suitable for the proposed use. Investigations and remediation are to be carried out in compliance with the Contaminated Sites Act 2003 and current Department of Environment Regulation Contaminated Sites Guidelines. (DER)*

The first stage of this work, being a Preliminary Site Investigation consistent with the DEC (2001–2011) *Contaminated Site Management Series,* has been completed and approved by an Auditor.

The PSI determined that further investigations comprising a soil and groundwater Sampling and Analysis Plan (SAP) and subsequent Detailed Site Investigation (DSI) were required to assess the nature, extent and magnitude of contamination (if

present) at the locations identified as having potential contamination concerns. Remedial works were undertaken in accordance with the DER's requirements within the subject area. GHD (a DER accredited contaminated sites Auditor) undertook a review and voluntary audit of the subject area.

5.6 Surrounding Land Use and Buffer Requirements

As identified in Section 4.1, a poultry farm is located on Lot 3 Baldivis Road, which is adjacent to the site (Figure 2).

The EPA's Guidance Statement No. 3 – *Separation Distances between Industrial and Sensitive Land Uses* (2005) recommends separation distances from industrial based land uses (including poultry farms) to sensitive based land uses such as residential. The Guidance Statement identifies a generic separation distance of 300m to 1000m from poultry farms to residential development. However the Guidance Statement recommends on-site investigations to determine the actual required buffer to prevent noise and odour impacts to residential development.

An odour assessment was completed by 'The Odour Unit' (2010) to assess any potential odour impacts from the Poultry Farm to proposed development, adjacent to and nearby the poultry operation. The odour assessment established site specific setbacks from the poultry farm based on on-site data and modelling of impacts from prevailing wind directions and likely worst case odour levels resulting from the operation. The proposed site specific setbacks are illustrated in Figure 9.1 of Appendix F. As can be seen from Figure 9.1 (Appendix F), the required buffer to the Poultry Farm extends into Lots 2 and 4 Eighty Road. Therefore development will be staged so as not take place within these site specific established buffer areas while the poultry farm is still in operation.

The odour study report is attached as Appendix F.

The Parmelia high pressure natural gas pipeline runs through Lot 313 in a general north west to south east direction along the western portion of the site (Figure 4).

Land uses on the pipeline easement, and within proximity to the easement are guided by both the EPA's conditions on the approval for Lot 313 under Town Planning Scheme Amendment No. 300, and in the Western Australian Planning Commission's Planning Bulletin No. 87 – *High Pressure Gas Transmission Pipelines in the Perth Metropolitan Region*.

In consideration of these requirements, the proponent will implement a 3 metre wide by 150mm thick concrete cover with marker tape, which will be placed over the pipeline below the surface. This allows the reduction of the residential setback to the 'boundary of the pipeline corridor' in accordance with Planning Bulletin No. 87.

5.7 Construction Impacts

Construction activities need to be managed to minimise the impact to nearby bushland, surrounding residents and the retained vegetation on-site. Impacts can include:

- Nuisance dust generation during bulk earthworks.

- Disturbance of Acid Sulfate Soils during earthworks and/or installation of services.
- Silt and sediment run-off to waterways from uncontrolled run-off during site works.
- Inadvertent damage to trees and other vegetation earmarked for retention.
- Inappropriate disposal of waste building material and poor housekeeping on building sites leading to wind-blown litter.

All of these potential impacts are manageable through appropriate engineering design and/or good site management practices. Specific management of impacts to retained vegetation and the adjacent Bush Forever reserve will be detailed in the Vegetation / POS Management Plan, which will be prepared prior to subdivision.

6.0 IMPLEMENTATION STRATEGY

The following Table presents a provisional schedule of all programmed activities for the Preconstruction, Construction and Post-construction phases of the project relevant to this stage in the planning process. More detailed management measures will be provided as part of the preparation of relevant management plans which will be prepared and signed off by the Local Authority prior to subdivision approval.

Table 2: Implementation Plan

Issue	Action	Frequency	Responsibility
Preconstruction Phase			
Vegetation protection	Clearly delineate POS areas and Bush Forever and associated set back.	Once	Licensed Surveyor (Developer)
	Prepare a Vegetation / POS Management Plan prior to subdivision.	Once	Developer (Status: VMP prepared and issued to CoR for assessment)
Acid Sulfate Soils	Undertake a Preliminary Site Assessment to assess the likely risk of encountering ASS and any proposed management measures.	Once	Developer (Status: ASS self-assessment form being completed as per WAPC conditions)
Contamination	Undertake further investigations comprising a soil and groundwater Sampling and Analysis Plan (SAP) and subsequent Detailed Site Investigation (DSI) for DER approval.	Once	Developer (Status: Completed, voluntary audit undertaken)
Urban Water Management Plan (UWMP)	Following approval of the LWMS - Prepare a UWMP prior to subdivision for approval by DoW.	Once	Developer (Status: UWMP in preparation)
Construction Phase			
Fauna protection	Undertake clearing in the direction of existing bushland to allow fauna to escape.	Ongoing during construction phase.	Construction Contractor (Developer)
Construction Impacts	Ensure dust and sediment run-off is adequately managed. Ensure appropriate waste disposal of building materials.	Ongoing during construction phase.	Construction Contractor (Developer)
Post-construction Phase			
Vegetation protection	Inspect fencing (if applicable) and replace if required.	6 months	Developer until hand over to the City of Rockingham.
POS Management	Ensure ongoing maintenance of vegetation retained, and any revegetation areas / native landscaping prior to handover.	Ongoing until handover.	Developer until hand over to the City of Rockingham.

7.0 REFERENCES

Australian Government. (2010). CSIRO Australian Soil Resource Information System (ASRIS) Database. www.anra.gov.au

City of Rockingham (undated). Local Planning Policy 7.2 – *Local Bushland Strategy*. City of Rockingham, WA.

Del Marco. A, Taylor. R, Clarke. K, Savage. K, Cullity. J, and Miles. C. (2004). *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region*. Perth Biodiversity Project. Western Australian Local Government Association. Perth. WA.

Department of Environment and Conservation (DEC) (2001-2010). Contaminated Sites Management Series. DEC, Perth.

DEC (2010a). *Acid Sulphate Soil Risk Map, Swan Coastal Plain.* Department of Environment and Conservation, Perth.

DEC (2010b). *Survey Guidelines for the Graceful sun-moth (Synemon gratiosa) & site habitat assessments.* Department of Environment and Conservation, Perth, WA.

Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) (2011) Environment Protection and Biodiversity Conservation Act 1999, Overview [Online] http://www.environment.gov.au/epbc/about/index.html (Accessed 02/07/2011).

Department of Minerals and Energy (2000). Rockingham sheet (Gozzard JR 1983 Rockingham Sheet part of Sheets 2033 III and 2033 II. Environmental Geology Series. Geological Survey of Western Australia, Perth, Western Australia.)

Department of Water (DoW) (2004). *Perth Groundwater Atlas online.* Department of Water, Perth. www.water.wa.gov.au

DoW (2008). Urban Water Management Plans. Guidelines for preparing plans and complying with subdivision conditions.

Environmental Protection Authority (EPA) (1992). Environmental Protection (*Peel Inlet – Harvey Estuary*) Policy. EPA, Perth.

EPA (2004). *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia.* EPA Guidance Statement No. 56. EPA, Perth.

EPA (2005) - *Guidance Statement for the separation distances between industrial and sensitive land uses*. Final Guidance No. 3. Environmental Protection Authority, Perth.

EPA (2008a) Water Quality Improvement Plan for the Rivers and Estuary of the Peel – Harvey System – Phosphorus Management. EPA and Australian Government, Perth.

EPA (2008b) *Environmental Guidance for Planning and Development*. Final Guidance No. 33. Environmental Protection Authority, Perth.

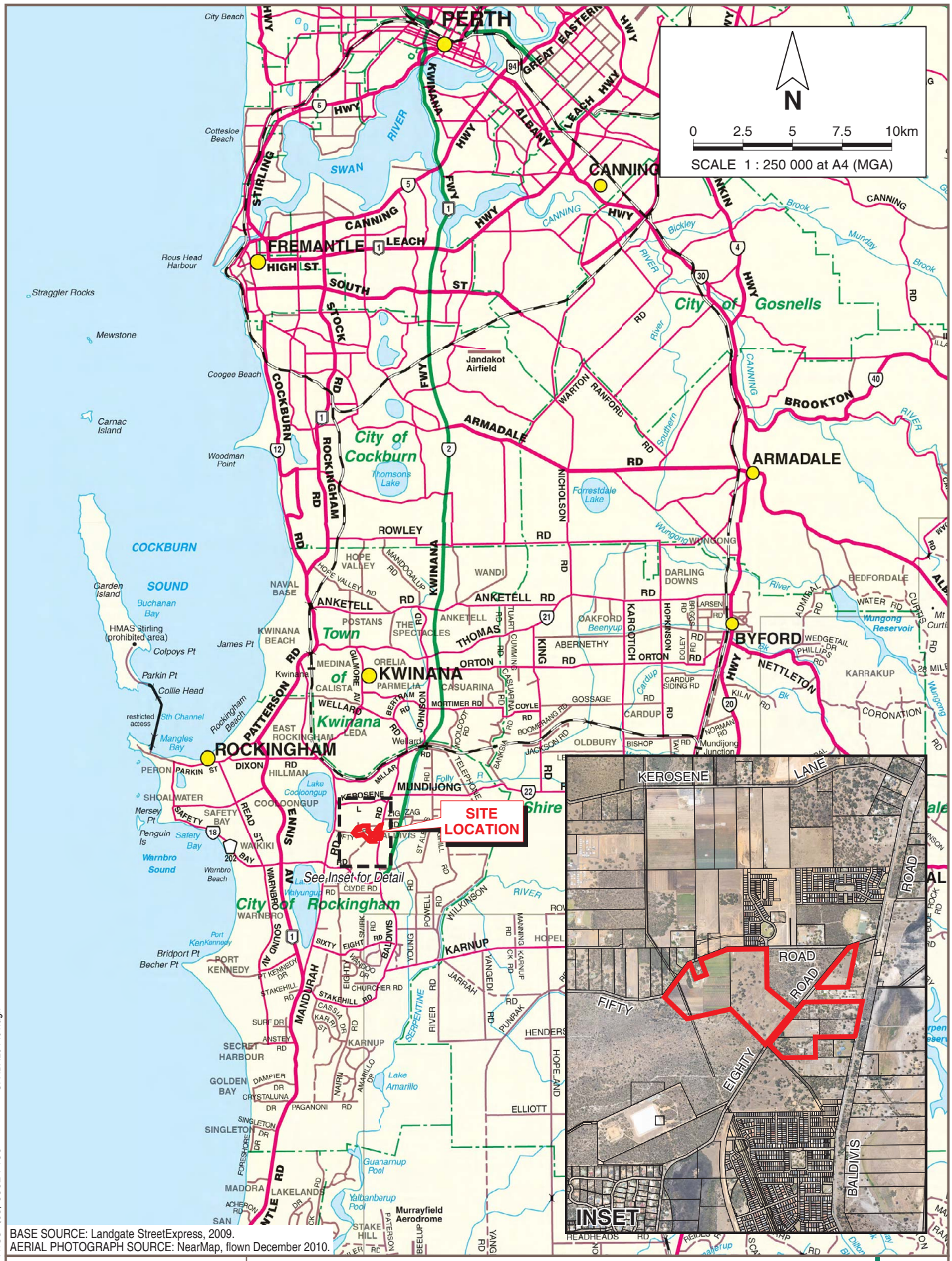
Heddle, E.M. Loneragan, O.W, Havel, J.J (1980) Vegetation Complexes of the Darling System Western Australia, In. Atlas of Natural Resources, Darling System, Western

Australia. Department of Conservation and Environment, Perth.RPS (2008). *Lot 221 Nambeelup – Urban Water Management Strategy*, for Clough Nambeelup Pty Ltd and Westprime Asset Pty Ltd.

Western Australian Planning Commission (WAPC) (2000). *Bush Forever*. WAPC, Perth, WA.

WAPC (2003) State Planning Policy 2.1: The Peel-Harvey Coastal Plain Catchment. State of Western Australia, Perth.

FIGURES



BASE SOURCE: Landgate StreetExpress, 2009.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown December 2010.

COTERRA ENVIRONMENT

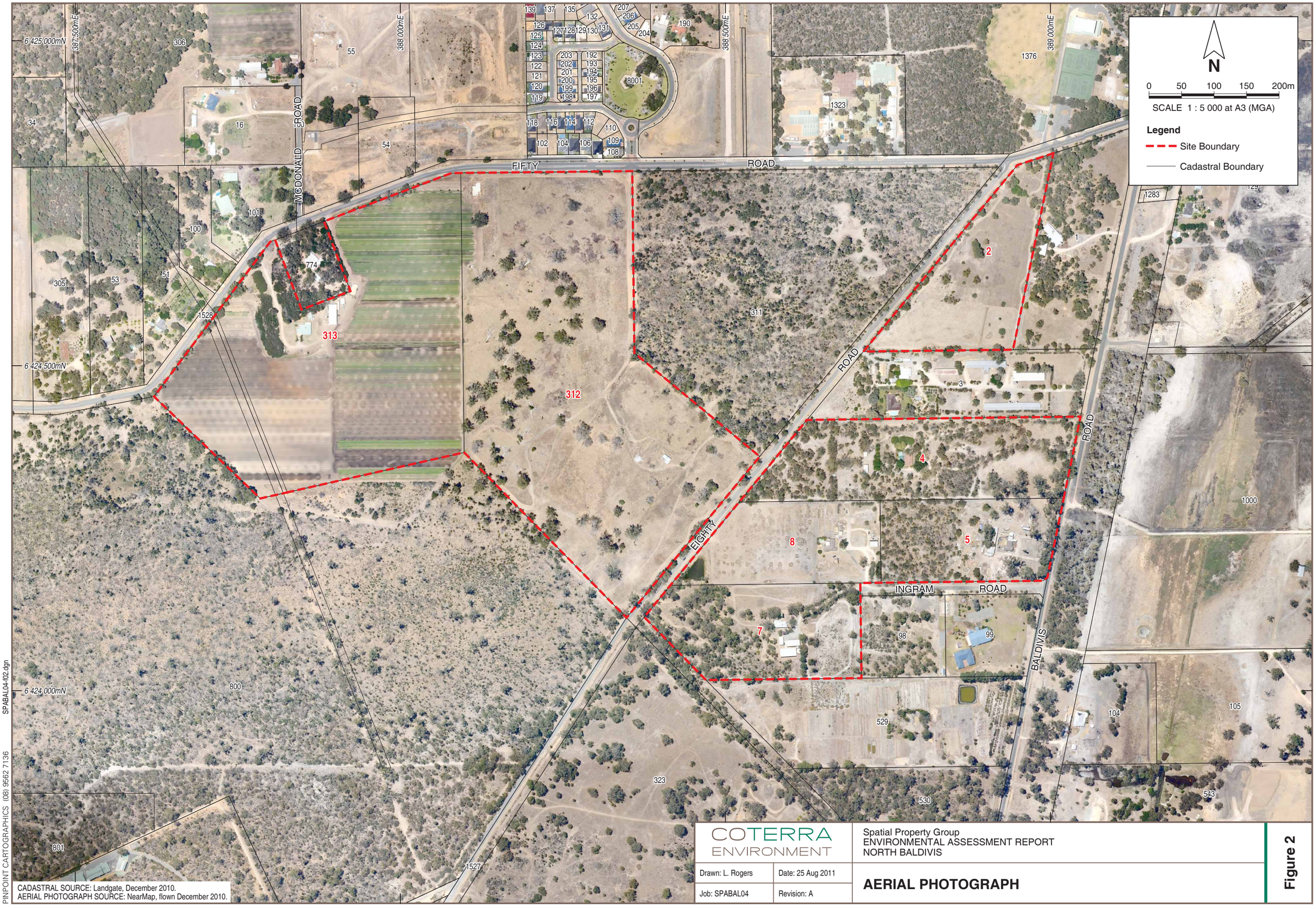
Spatial Property Group
ENVIRONMENTAL ASSESSMENT REPORT
NORTH BALDIVIS

Drawn: L. Rogers	Date: 25 Aug 2011
Job: SPABAL04	Revision: A

SITE LOCATION

Figure 1

PINPOINT CARTOGRAPHICS (08) 9562 7136 SPABAL04-f01.dgn



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PINPOINT CARTOGRAPHICS (08) 9562 7136

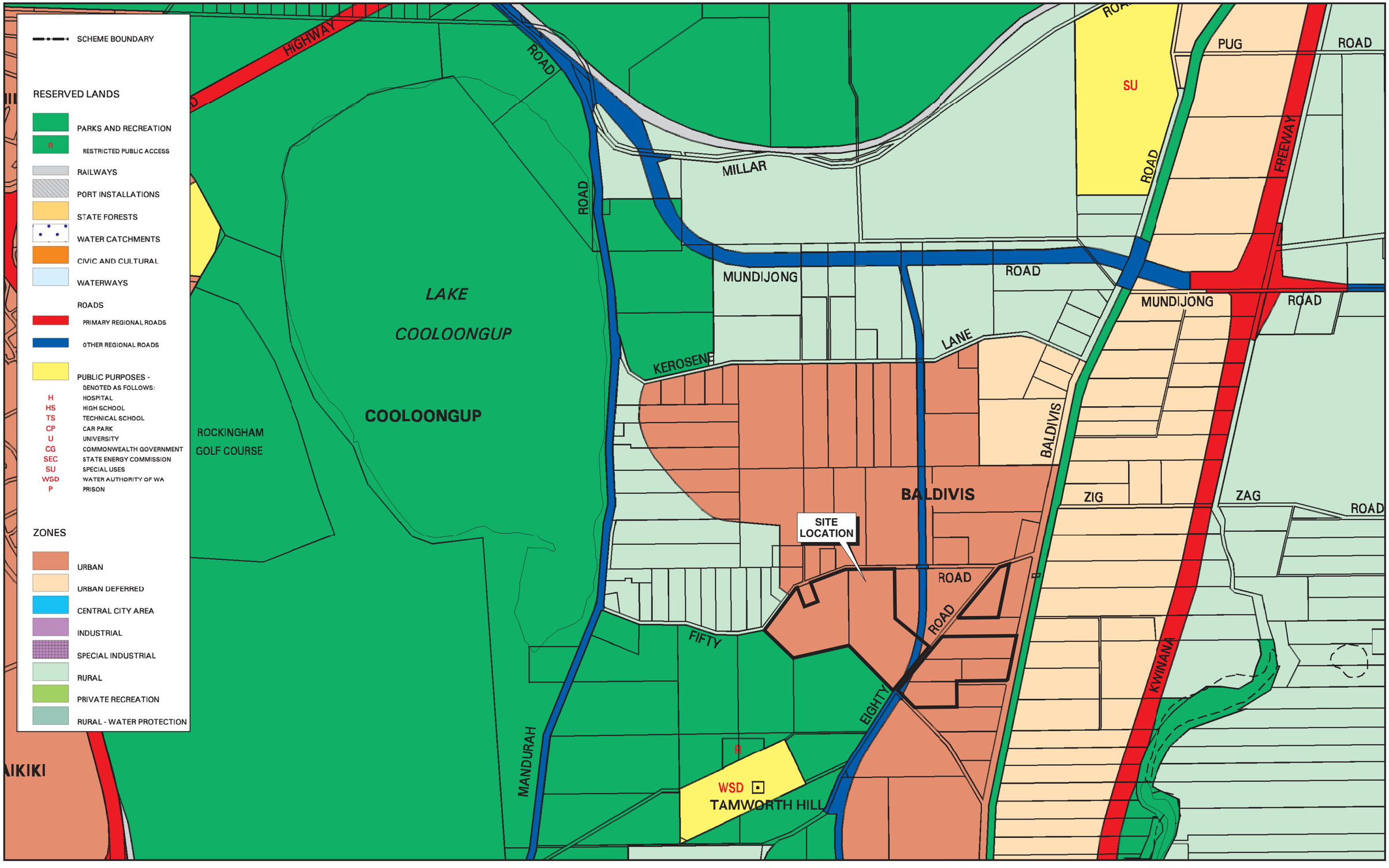
COTERRA ENVIRONMENT

Drawn: L. Rogers	Date: 25 Aug 2011
Job: SPABAL04	Revision: A

Spatial Property Group
ENVIRONMENTAL ASSESSMENT REPORT
NORTH BALDIVIS

AERIAL PHOTOGRAPH

Figure 2



N

0 200 400 600 800 1000m

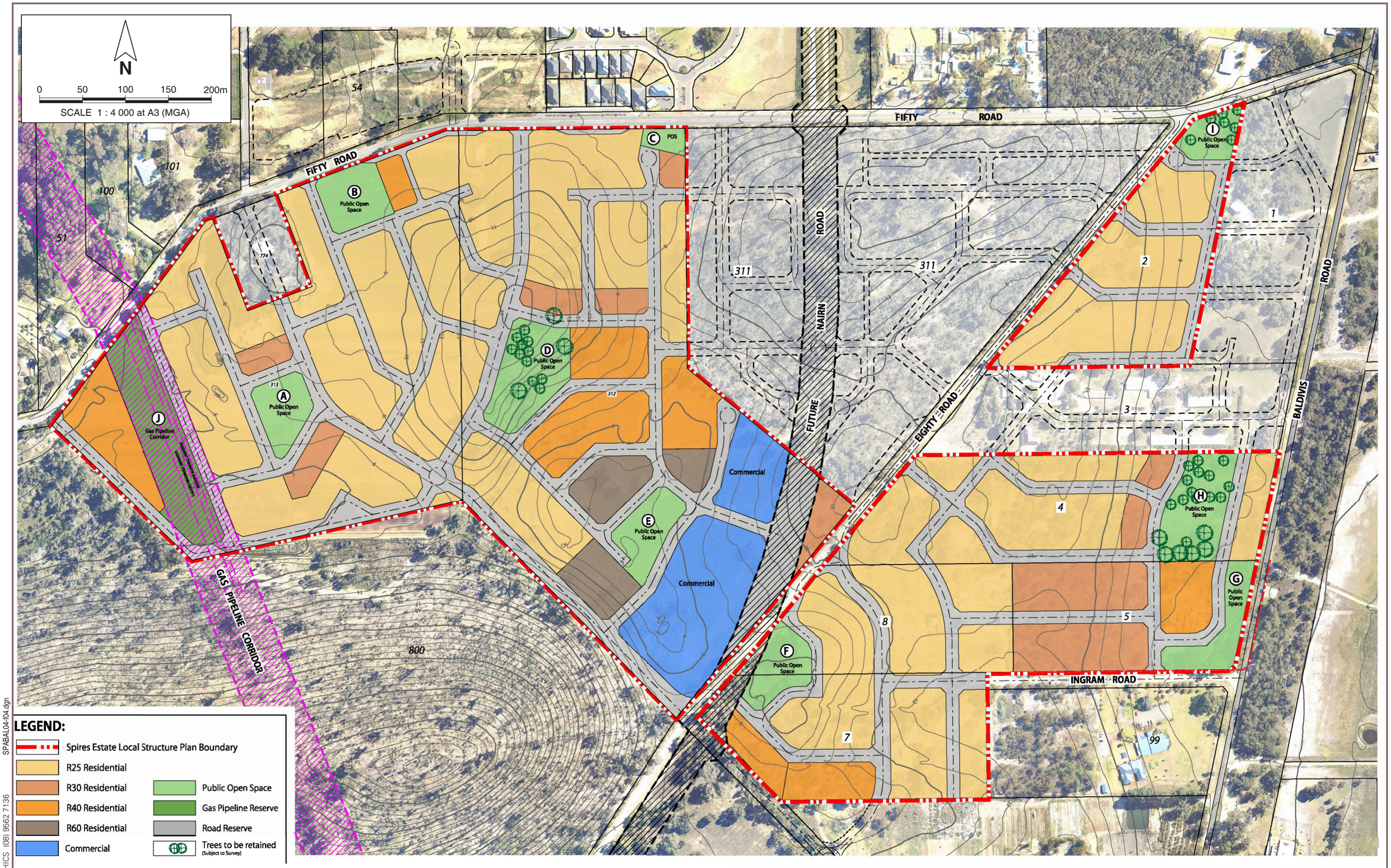
SCALE 1 : 20 000 at A3 (MGA)

SOURCE: DPI, December 2010.

SPABAL04-003.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

COTERRA ENVIRONMENT		Spatial Property Group ENVIRONMENTAL ASSESSMENT REPORT NORTH BALDIVIS	Figure 3
Drawn: L. Rogers	Date: 25 Aug 2011	**METROPOLITAN REGION SCHEME**	
Job: SPABAL04	Revision: A		



SPABAL04-f04.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

dpp Development Planning Strategies

SOURCE: Development Planning Strategies, Dwg No. CARBD-2-001c, 12-04-13.

COTERRA ENVIRONMENT

Spatial Property Group
ENVIRONMENTAL ASSESSMENT REPORT
NORTH BALDIVIS

Drawn: L. Rogers	Date: 2 Apr 2014
Job: SPABAL04	Revision: A

LOCAL STRUCTURE PLAN

Figure 4

N

0 50 100 150 200m

SCALE 1 : 5 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Topographic Contour

Environmental Geology

- **Cps** PEATY CLAY - dark grey and black, soft, variable organic content, some quartz sand in places, of lacustrine origin
- **Ls1** LIMESTONE - pale yellowish brown, fine to coarse-grained, sub-angular to well rounded, quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin
- **M4** SILT - very pale brown silt, soft when moist, firm when dry, low clay content, of alluvial origin
- **S7** SAND - pale yellowish brown, medium to coarse-grained, sub-angular to well-rounded quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin
- **S8** SAND - very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted, of eolian origin as relatively thin veneer over C2, M4 and Mc2

CADASTRAL SOURCE: Landgate, December 2010.
CONTOUR SOURCE: Landgate, March 2011.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown December 2010.
GEOLOGY SOURCE: Geological Survey of WA, 1 : 50 000 Environmental Geology.

COTERRA ENVIRONMENT

Spatial Property Group
ENVIRONMENTAL ASSESSMENT REPORT
NORTH BALDIVIS

Drawn: L. Rogers | Date: 25 Aug 2011
Job: SPABAL04 | Revision: A

TOPOGRAPHY, SOILS AND LANDFORMS

Figure 5

SPABAL04-f05.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

N

0 50 100 150 200m

SCALE 1 : 5 000 at A3 (MGA)

Legend

Site Boundary

Cadastral Boundary

Acid Sulfate Soils

No Known Risk

Moderate to Low Risk

High to Moderate Risk

ACID SULFATE SOILS SOURCE: DPI, 2007.
CADASTRAL SOURCE: Landgate, December 2010.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown December 2010.

COTERRA ENVIRONMENT	Spatial Property Group ENVIRONMENTAL ASSESSMENT REPORT NORTH BALDIVIS
Drawn: L. Rogers / Date: 25 Aug 2011	**ACID SULFATE SOILS**
Job: SPABAL04 / Revision: A	**Figure 6**

PINPOINT CARTOGRAPHICS (08) 9562 7136 SPABAL04-f06.dgn

N

0 50 100 150 200m

SCALE 1 : 5 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Topographic Contour
- Groundwater Contour (mAHD)

Geomorphic Wetlands

- Conservation Category Wetland
- Multiple Use Wetland
- 6400 Wetland UFI Number

FIFTY ROAD

MCDONALD ROAD

EIGHTY ROAD

INGRAM ROAD

BALDIVIS ROAD

6 425 000mN

6 424 500mN

6 424 000mN

387 500mE

388 000mE

388 500mE

389 000mE

6400

6622

15591

313

312

2

4

WETLANDS SOURCE: DEC, June 2010.
CONTOUR SOURCE: Landgate, March 2011.
CADASTRAL SOURCE: Landgate, December 2010.
GROUNDWATER CONTOURS SOURCE: DoW, May 2003.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown December 2010.

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Spatial Property Group
ENVIRONMENTAL ASSESSMENT REPORT
NORTH BALDIVIS

Drawn: L. Rogers | Date: 25 Aug 2011
Job: SPABAL04 | Revision: A

GROUNDWATER AND WETLAND MAPPING

Figure 7

SPABAL04-f07.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

N

0 50 100 150 200m

SCALE 1 : 5 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Vegetation Complex Boundary
- Bush Forever Site
- 356 Bush Forever Site Number

Cottesloe Complex Central and South

Karrakatta Complex Central and South

Serpentine River Complex

FIFTY ROAD

MCDONALD ROAD

ROAD

EIGHTY ROAD

INGRAM ROAD

BALDIVIS ROAD

6 425 000mN

6 424 500mN

6 424 000mN

387 500mE

388 000mE

388 500mE

389 000mE

BUSH FOREVER SOURCE: DPI, December 2010.
CADASTRAL SOURCE: Landgate, December 2010.
VEGETATION COMPLEXES SOURCE: Heddle et al. 1980.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown December 2010.

SPABAL04-f08.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

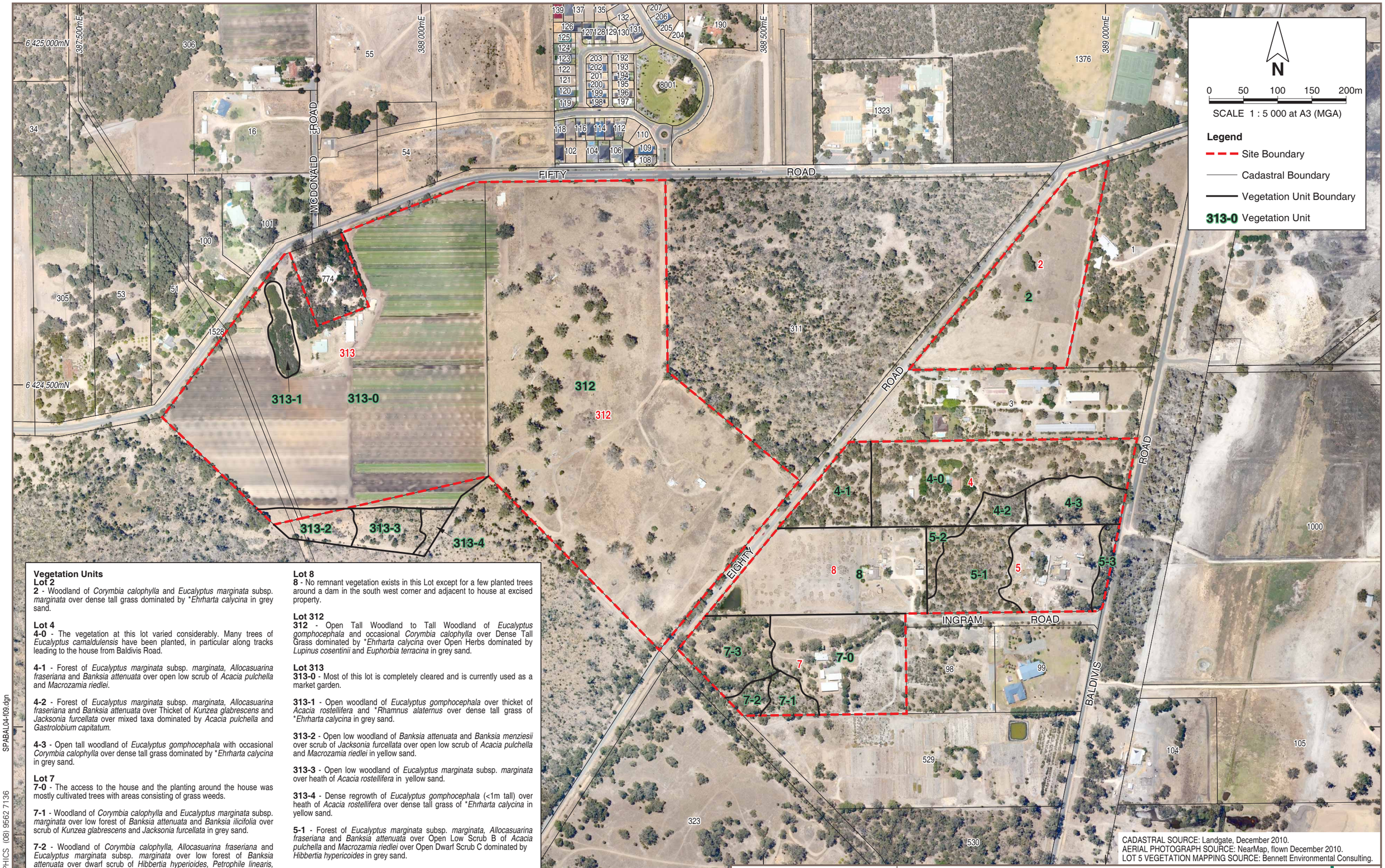
COTERRA ENVIRONMENT

Spatial Property Group
ENVIRONMENTAL ASSESSMENT REPORT
NORTH BALDIVIS

Drawn: L. Rogers | Date: 25 Aug 2011
Job: SPABAL04 | Revision: A

REGIONAL VEGETATION COMPLEXES AND BUSH FOREVER SITES

Figure 8



Vegetation Units

Lot 2

2 - Woodland of *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* over dense tall grass dominated by **Ehrharta calycina* in grey sand.

Lot 4

4-0 - The vegetation at this lot varied considerably. Many trees of *Eucalyptus camaldulensis* have been planted, in particular along tracks leading to the house from Baldivis Road.

4-1 - Forest of *Eucalyptus marginata* subsp. *marginata, Allocasuarina fraseriana* and *Banksia attenuata* over open low scrub of *Acacia pulchella* and *Macrozamia riedlei*.

4-2 - Forest of *Eucalyptus marginata* subsp. *marginata, Allocasuarina fraseriana* and *Banksia attenuata* over Thicket of *Kunzea glabrescens* and *Jacksonia furcellata* over mixed taxa dominated by *Acacia pulchella* and *Gastrolobium capitatum*.

4-3 - Open tall woodland of *Eucalyptus gomphocephala* with occasional *Corymbia calophylla* over dense tall grass dominated by **Ehrharta calycina* in grey sand.

Lot 7

7-0 - The access to the house and the planting around the house was mostly cultivated trees with areas consisting of grass weeds.

7-1 - Woodland of *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* over low forest of *Banksia attenuata* and *Banksia ilicifolia* over scrub of *Kunzea glabrescens* and *Jacksonia furcellata* in grey sand.

7-2 - Woodland of *Corymbia calophylla, Allocasuarina fraseriana* and *Eucalyptus marginata* subsp. *marginata* over low forest of *Banksia attenuata* over dwarf scrub of *Hibbertia hypericoides, Petrophile linearis, Calytrix flavescens, Daviesia triflora* and *Gompholobium tomentosum* in grey sand.

7-3 - Woodland of *Corymbia calophylla* and *Eucalyptus gomphocephala* over dense tall grass dominated by **Ehrharta calycina* in grey sand.

Lot 8

8 - No remnant vegetation exists in this Lot except for a few planted trees around a dam in the south west corner and adjacent to house at excised property.

Lot 312

312 - Open Tall Woodland to Tall Woodland of *Eucalyptus gomphocephala* and occasional *Corymbia calophylla* over Dense Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by *Lupinus cosentinii* and *Euphorbia terracina* in grey sand.

Lot 313

313-0 - Most of this lot is completely cleared and is currently used as a market garden.

313-1 - Open woodland of *Eucalyptus gomphocephala* over thicket of *Acacia rostellifera* and **Rhamnus alaternus* over dense tall grass of **Ehrharta calycina* in grey sand.

313-2 - Open low woodland of *Banksia attenuata* and *Banksia menziesii* over scrub of *Jacksonia furcellata* over open low scrub of *Acacia pulchella* and *Macrozamia riedlei* in yellow sand.

313-3 - Open low woodland of *Eucalyptus marginata* subsp. *marginata* over heath of *Acacia rostellifera* in yellow sand.

313-4 - Dense regrowth of *Eucalyptus gomphocephala* (<1m tall) over heath of *Acacia rostellifera* over dense tall grass of **Ehrharta calycina* in yellow sand.

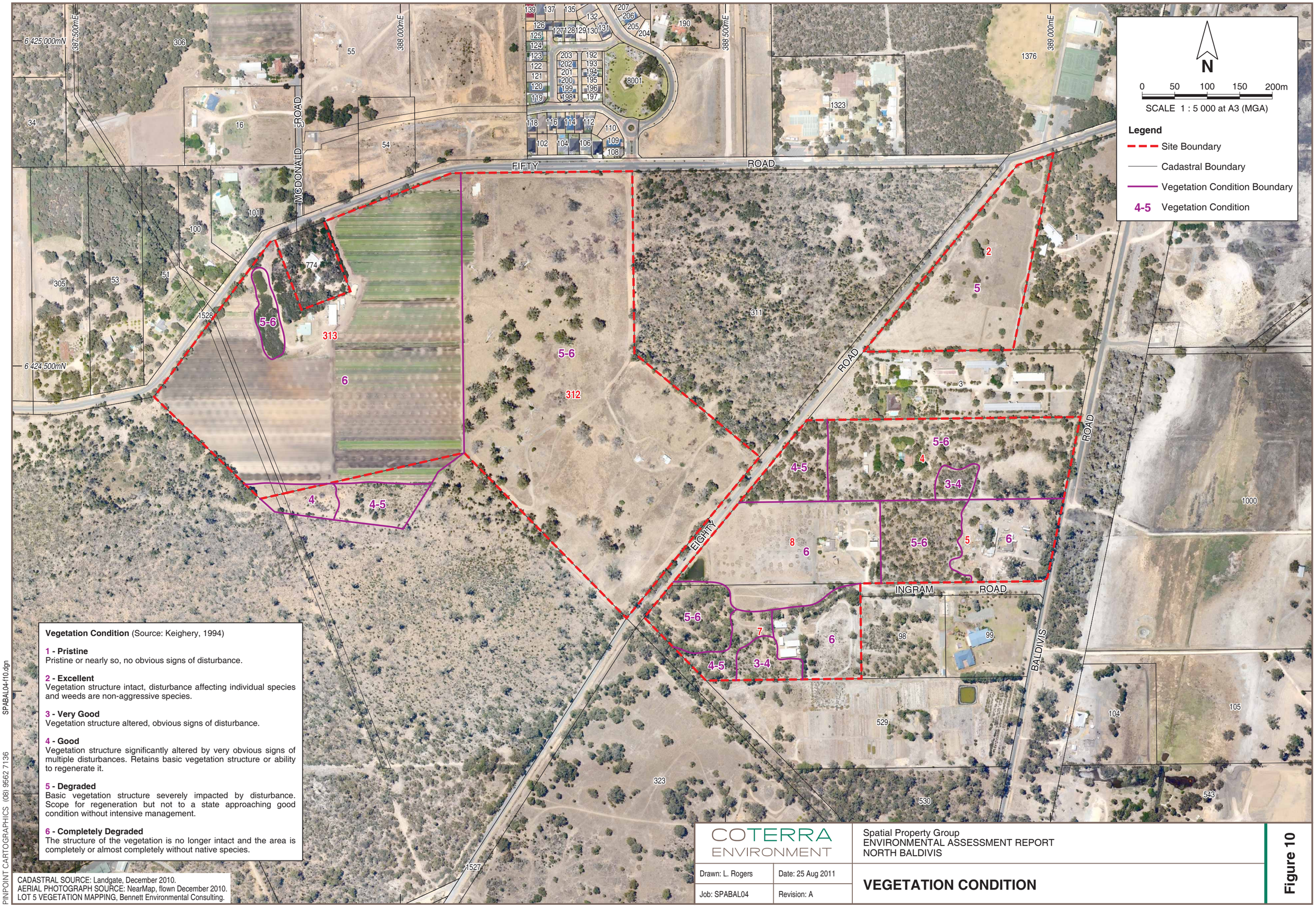
5-1 - Forest of *Eucalyptus marginata* subsp. *marginata, Allocasuarina fraseriana* and *Banksia attenuata* over Open Low Scrub B of *Acacia pulchella* and *Macrozamia riedlei* over Open Dwarf Scrub C dominated by *Hibbertia hypericoides* in grey sand.

5-2 - Forest of *Eucalyptus marginata* subsp. *marginata, Allocasuarina fraseriana* and *Banksia attenuata* over Open Scrub of *Kunzea glabrescens* and *Jacksonia furcellata* over Open Dwarf Scrub C of mixed taxa dominated by *Acacia pulchella* and *Gastrolobium capitatum* over Tall Grass dominated by **Ehrharta calycina* in grey sand.

5-3 - Open Tall Woodland of *Eucalyptus gomphocephala* over weeds and bare ground in grey sand.

COTERRA ENVIRONMENT		Spatial Property Group ENVIRONMENTAL ASSESSMENT REPORT NORTH BALDIVIS	Figure 9
Drawn: L. Rogers	Date: 25 Aug 2011	**VEGETATION UNITS**	
Job: SPABAL04	Revision: A		

SPABAL04-f09.dgn
PINPOINT CARTOGRAPHICS (08) 9562 7136



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COTERRA ENVIRONMENT

Spatial Property Group
ENVIRONMENTAL ASSESSMENT REPORT
NORTH BALDIVIS

Drawn: L. Rogers	Date: 25 Aug 2011
Job: SPABAL04	Revision: A

VEGETATION CONDITION

Figure 10

APPENDIX A – WAPC APPROVAL SUBJECT TO CONDITIONS – FREEHOLD (GREEN TITLE) SUBDIVISION – LOTS 312, 313, 4, 7 AND 8

CARBDSUB

Western Australian Planning Commission

RECEIVED
31 MAR 2014
BY:

Your Ref :
Enquiries : Anika Chhabra (Ph 65519258)

Development Planning Strategies
P O Box 6697
EAST PERTH WA 6892

Approval Subject To Condition(s)
Freehold (Green Title) Subdivision

Application No : 147921

Planning and Development Act 2005

Applicant	:	Development Planning Strategies P O Box 6697 EAST PERTH WA 6892
Owner	:	Piperpoint Pty Ltd, Mainday Holdings Pty Ltd & Arrowest Pty Ltd 289 Stock Road O'CONNOR WA 6163
Application Receipt	:	8 May 2013

Lot Number	:	312, 313, 7, 8 & 4
Diagram / Plan	:	Diagram 47818, 29589, 47817 DP 202704
Location	:	-
C/T Volume/Folio	:	2201/100,38/2a, 1955/395, 1324/476, 1411/708
Street Address	:	Fifty & Eighty Roads, Baldivis
Local Government	:	City of Rockingham

The Western Australian Planning Commission has considered the application referred to and is prepared to endorse a deposited plan in accordance with the plan date-stamped 08 May 2013 once the condition(s) set out have been fulfilled.

This decision is valid for four years from the date of this advice, which includes the lodgement of the deposited plan within this period.

The deposited plan for this approval and all required written advice confirming that the requirement(s) outlined in the condition(s) have been fulfilled must be submitted by 26 March 2018 or this approval no longer will remain valid.

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Reconsideration - 28 days

Under section 151(1) of the *Planning and Development Act 2005*, the applicant/owner may, within 28 days from the date of this decision, make a written request to the WAPC to reconsider any condition(s) imposed in its decision. One of the matters to which the WAPC will have regard in reconsideration of its decision is whether there is compelling evidence by way of additional information or justification from the applicant/owner to warrant a reconsideration of the decision. A request for reconsideration is to be submitted to the WAPC on a Form 3A with appropriate fees. An application for reconsideration may be submitted to the WAPC prior to submission of an application for review. Form 3A and a schedule of fees are available on the WAPC website: http://www.planning.wa.gov.au

Right to apply for a review - 28 days

Should the applicant/owner be aggrieved by this decision, there is a right to apply for a review under Part 14 of the *Planning and Development Act 2005*. The application for review must be submitted in accordance with part 2 of the *State Administrative Tribunal Rules 2004* and should be lodged within 28 days of the date of this decision to: the State Administrative Tribunal, 12 St Georges Terrace, Perth, WA 6000. It is recommended that you contact the tribunal for further details: telephone 9219 3111 or go to its website: http://www.sat.justice.wa.gov.au

Deposited plan

The deposited plan is to be submitted to the Western Australian Land Information Authority (Landgate) for certification. Once certified, Landgate will forward it to the WAPC. In addition, the applicant/owner is responsible for submission of a Form 1C with appropriate fees to the WAPC requesting endorsement of the deposited plan. A copy of the deposited plan with confirmation of submission to Landgate is to be submitted with all required written advice confirming compliance with any condition(s) from the nominated agency/authority or local government. Form 1C and a schedule of fees are available on the WAPC website: http://www.planning.wa.gov.au

Condition(s)

The WAPC is prepared to endorse a deposited plan in accordance with the plan submitted once the condition(s) set out have been fulfilled.

The condition(s) of this approval are to be fulfilled to the satisfaction of the WAPC.

The condition(s) must be fulfilled before submission of a copy of the deposited plan for endorsement.

The agency/authority or local government noted in brackets at the end of the condition(s) identify the body responsible for providing written advice confirming that the WAPC's requirement(s) outlined in the condition(s) have been fulfilled. The written advice of the agency/authority or local government is to be obtained by the applicant/owner. When the written advice of each identified agency/authority or local government has been obtained, it should be submitted to the WAPC with a Form 1C and appropriate fees and a copy of the deposited plan.

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If there is no agency/authority or local government noted in brackets at the end of the condition(s), a written request for confirmation that the requirement(s) outlined in the condition(s) have been fulfilled should be submitted to the WAPC, prior to lodgement of the deposited plan for endorsement.

Prior to the commencement of any subdivision works or the implementation of any condition(s) in any other way, the applicant/owner is to liaise with the nominated agency/authority or local government on the requirement(s) it considers necessary to fulfil the condition(s).

The applicant/owner is to make reasonable enquiry to the nominated agency/authority or local government to obtain confirmation that the requirement(s) of the condition(s) have been fulfilled. This may include the provision of supplementary information. In the event that the nominated agency/authority or local government will not provide its written confirmation following reasonable enquiry, the applicant/owner then may approach the WAPC for confirmation that the condition(s) have been fulfilled.

In approaching the WAPC, the applicant/owner is to provide all necessary information, including proof of reasonable enquiry to the nominated agency/authority or local government.

The condition(s) of this approval, with accompanying advice, are:

CONDITIONS:

Plan of Subdivision

1. Proposed Lots 36 and 37, Lots 56 to 69 (inclusive), Lots 79 to 81 (inclusive), Lots 241 to 244 (inclusive), Lots 246 and 247 and Lots 259 and 260 are excluded from the approved plan of subdivision as shown on the plan dated 8 May 2013 (attached) until such time as the temporary bush fire risk presented by the adjacent 100 metres of land within adjoining Lot 311 and Lot 5 is removed, per the endorsed '*Fire Management Plan Spires Estate Local Structure Plan*' prepared by Strategen. (Local Government)

2. Proposed lots within 300 metres of the existing operating market garden on Lot 311 are excluded from the approved plan of subdivision as shown on the plan dated 8 May 2013 (attached) until such time as Condition 4 of Ministerial Statement No.580 for the preparation and implementation of a Spray Drift Investigation and Management Plan has been satisfied, in accordance with its tenor. (Local Government)

3. Proposed Lots 82 to 94 (inclusive) are excluded from the approved plan of subdivision as shown on the plan dated 8 May 2013 (attached) until such time as Condition 5 of Ministerial Statement No.580 for the preparation of a Vegetation Management Plan has been satisfied, in accordance with its tenor. (Local Government)

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4. The road reserve widths shall be amended as follows:

   a) Neighbourhood Connector A, adjacent to Bush Forever Site No.356, is to be widened to 24.4 metres;
   b) Neighbourhood Connector B, adjacent to Bush Forever Site No.356, is to be widened to 19.4 metres; and
   c) The Access Street C road adjacent to Public Open Space No.3 and proposed Lot 82 is to be widened to 15.4 metres,

   consistent with the Spires Estate Local Structure Plan. (Local Government)

Administrative

5. The landowner/applicant contributing towards development infrastructure provisions pursuant to the City of Rockingham Local Planning Scheme No. 2. (Local Government)

Amenity

6. A spray drift buffer is to be provided between the market garden and adjacent residential lots by way of the landowner/applicant installing a specially designed 1.8 metre high fence and a protected and maintained vegetation buffer of one line of evergreen trees or bushes (a minimum height of 1.5 metres) in accordance with the plan dated 8 May 2013 (attached) to the satisfaction of the Western Australian Planning Commission. (Local Government)

7. The landowner/applicant shall provide a written undertaking to the satisfaction of the Western Australian Planning Commission to ensure that prospective purchasers of lots proposed within 300 metres of an operating market garden are notified on contracts of sale of the existence of the market garden operations and the potential to be affected by odours, noise, dust and spray drift that this land use may cause. (Local Government)

8. A notification, pursuant to Section 165 of the *Planning and Development Act 2005* is to be placed on the certificates of title of the proposed lots advising of the existence of a hazard or other factor. Notice of this notification is to be included on the diagram or plan of survey (deposited plan). The notification is to state as follows:

   "This lot is located within 300 metres of operating market garden/s and has the potential to be affected by odours, noise, spray drift and dust that are associated with the continued operation of a market garden".

   (Western Australian Planning Commission)

9. Prior to the commencement of subdivision works, a noise management plan is to be prepared and approved to ensure noise amelioration measures apply to those lots affected by the impact of transport noise associated with Nairn Drive. (Local Government)

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10. The landowner/applicant shall make arrangements to ensure that prospective purchasers of lots subject of noise amelioration measures as outlined in the noise management plan required under Condition 9 are made aware of those requirements, and for those requirements to apply at development stage. (Local Government)

11. A notification, pursuant to Section 70A of the *Transfer of Land Act 1893* is to be placed on the certificates of title of the proposed lots identified in the noise management plan required under Condition 9. Notice of this notification is to be included on the diagram or plan of survey (deposited plan). The notification is to state as follows:

    'The lot is situated in the vicinity of a transport corridor and is currently affected, or may in the future be affected by transport noise.' (Local Government)

Buildings and Use

12. Uniform fencing being constructed along the boundaries of all of the proposed lots abutting public open space and Nairn Drive. (Local Government)

13. Other than buildings, outbuildings and/or structures shown on the approved plan for retention, all buildings, outbuildings and/or structures present on the site at the time of subdivision approval being demolished and materials removed from the lots. (Local Government)

Drainage and Site Works

14. Engineering drawings and specifications are to be submitted, approved, and works undertaken in accordance with the approved engineering drawings, specifications and approved plan of subdivision, for grading and/or stabilisation of the site to ensure that:

    a) lots can accommodate their intended use; and
    b) finished ground levels at the boundaries of the lots the subject of this approval match or otherwise coordinate with the existing and/or proposed finished ground levels of the land abutting.

    (Local Government)

15. Prior to the commencement of subdivisional works, an Urban Water Management Plan is to be prepared and approved, in consultation with the Department of Water, consistent with the approved Local Water Management Strategy for the adopted Spires Estate Local Structure Plan. (Local Government)

16. Engineering drawings and specifications are to be submitted and approved, and works undertaken in accordance with the approved engineering drawings and specifications and approved plan of subdivision, for the filling and/or draining of the land, including ensuring that stormwater is contained on-site, or appropriately treated and connected to the local drainage system. Engineering drawings and specifications are to be in accordance with the approved Urban Water Management Plan for the site. (Local Government)

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17. Prior to the commencement of subdivisional works, the landowner/applicant is to provide a pre-works geotechnical report certifying that the land is physically capable of development or advising how the land is to be remediated and compacted to ensure it is capable of development; and in the event that remediation works are required, the landowner/applicant is to provide a post geotechnical report certifying that all subdivisional works have been carried out in accordance with the pre-works geotechnical report. (Local Government)

18. Drainage easements and reserves as may be required by the local government for drainage infrastructure being shown on the diagram or plan of survey (deposited plan) as such, granted free of cost, and vested in that local government under Sections 152 and 167 of the *Planning and Development Act 2005.* (Local Government)

19. Arrangements being made to the satisfaction of the Western Australian Planning Commission for the filling and/or capping of any bores and/or wells, or the identification of any bore and/or well to be retained on the land. (Local Government)

Environmental

20. Measures being taken to ensure the identification and protection of any vegetation on the site worthy of retention that is not impacted by subdivisional works, prior to commencement of subdivisional works. (Local Government)

21. Measures being taken to ensure no vegetation within Bush Forever Site No.356 is removed or disturbed during subdivisional works, including any secondary impacts from works to provide service infrastructure and drainage to implement the approved plan of subdivision. (Local Government)

22. A fence restricting vehicle and pedestrian access to Bush Forever Site No.356 is to be constructed on the boundary of the subdivision area and Bush Forever Site No.356 in accordance with the plan dated 8 May 2013 (attached) and in consultation with Department of Parks and Wildlife. (Local Government)

23. An acid sulphate soils self-assessment form and, if required as a result of the self-assessment, an acid sulphate soils report and an acid sulphate soils management plan shall be submitted to and approved by the Department of Environment Regulation before any subdivision works or development are commenced. Where an acid sulphate soils management plan is required to be submitted, all subdivision works shall be carried out in accordance with the approved management plan. (Department of Environment Regulation)

24. Prior to commencement of subdivision works, investigation for soil and groundwater contamination is to be carried out to determine if remediation is required. If required, remediation, including validation of remediation, of any contamination identified shall be completed prior to the issuing of titles to the satisfaction of the Western Australian Planning Commission on advice from the Department of Environment Regulation, to ensure that the lots created are suitable for the proposed use.

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Investigations and remediation are to be carried out in compliance with the *Contaminated Sites Act 2003* and current Department of Environment Regulation Contaminated Sites Guidelines. (Department of Environment Regulation)

Fire and Emergency

25. The landowner/applicant is to prepare, have approved by the City of Rockingham, and implement a detailed plan demonstrating the location and capacity of fire emergency infrastructure to the satisfaction of the Western Australian Planning Commission. (Local Government)

26. The landowner/applicant's obligations as referenced in the endorsed '*Fire Management Plan Spires Estate Local Structure Plan*' prepared by Strategen are to be implemented during subdivisional works to the satisfaction of the Western Australian Planning Commission. (Local Government)

27. A notification, pursuant to section 70A of the *Transfer of Land Act 1893* is to be placed on the certificates of title of proposed lots with a Bushfire Attack Level (BAL) rating of 12.5 or greater, as per *Australian Standard 3959 – Building of dwellings in bushfire-prone areas* and the endorsed '*Fire Management Plan Spires Estate Local Structure Plan*' prepared by Strategen. Notice of this notification is to be included on the diagram or plan of survey (deposited plan). The notification is to state as follows:

'*The lot is subject to a fire management plan.*' (Local Government)

Lot Design

28. Detailed Area Plan being prepared and approved for lots shown on the plan dated 8 May 2013 (attached) that address the matters referenced in the Spires Estate Local Structure Plan to the satisfaction of the Western Australian Planning Commission. (Local Government)

29. The landowner/applicant shall make arrangements to ensure that prospective purchasers of lots subject of a Detailed Area Plan are advised in writing that Detailed Area Plan provisions apply. (Local Government)

Reserves

30. The proposed reserves shown on the approved plan of subdivision being shown on the diagram or plan of survey (deposited plan) as reserves for Recreation and vested in the Crown under Section 152 of the *Planning and Development Act 2005,* such land to be ceded free of cost and without any payment of compensation by the Crown. (Local Government)

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31. Arrangements being made for the proposed public open space to be developed by the landowner/applicant to a minimum standard and maintained for two summers through the implementation of an approved landscape plan providing for the development and maintenance of the proposed public open space in accordance with the requirements of Liveable Neighbourhoods and to the specifications of the local government. (Local Government)

Servicing

32. Arrangements being made with the Water Corporation so that provision of a suitable water supply service will be available to the lots shown on the approved plan of subdivision. (Water Corporation)

33. Arrangements being made with the Water Corporation so that provision of a sewerage service will be available to the lots shown on the approved plan of subdivision. (Water Corporation)

34. Arrangements being made to the satisfaction of the Western Australian Planning Commission and to the specification of Western Power for the provision of an underground electricity supply to the lots shown on the approved plan of subdivision. (Western Power)

35. The transfer of land as a Crown reserve free of cost to Western Power for the provision of electricity supply infrastructure. (Western Power)

Transport, Roads and Access

36. Engineering drawings and specifications are to be submitted, approved, and subdivisional works undertaken in accordance with the approved plan of subdivision, engineering drawings and specifications, to ensure that those lots not fronting an existing road are provided with frontage to a constructed road(s) connected by a constructed road(s) to the local road system and such road(s) are constructed and drained at the landowner/applicant's cost.

    As an alternative, and subject to the agreement of the Local Government the Western Australian Planning Commission (WAPC) is prepared to accept the landowner/applicant paying to the local government the cost of such road works as estimated by the local government and the local government providing formal assurance to the WAPC confirming that the works will be completed within a reasonable period as agreed by the WAPC. (Local Government)

37. Engineering drawings and specifications are to be submitted and approved, and subdivisional works undertaken in accordance with the approved plan of subdivision, engineering drawings and specifications to ensure that:

    a) street lighting is installed on all new subdivisional roads to the standards of the relevant licensed service provider; and
    b) roads that have been designed to connect with existing or proposed roads abutting the subject land are coordinated so the road reserve location and width connect seamlessly; and

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c) temporary turning areas are provided to those subdivisional roads that are subject to future extension; and
d) embayment parking is provided abutting the proposed public open space

to the satisfaction of the Western Australian Planning Commission. (Local Government)

38. Engineering drawings and specifications are to be submitted, approved, and subdivisional works undertaken in accordance with the approved plan of subdivision, engineering drawings and specifications, for the provision of shared paths through and connecting to the application area in accordance with the approved Spires Estate Local Structure Plan. The approved shared paths are to be constructed by the landowner/ applicant. (Local Government)

39. The landowner/applicant shall be responsible for all costs involved with the redesign and construction of the signalised intersection of Nairn Drive/Eighty Road and Amazon Drive, including any future land requirements to ensure that this intersection operates safely and efficiently. (Local Government)

40. Engineering drawings and specifications are to be submitted and approved, and satisfactory arrangements being made for subdivisional works to be undertaken in accordance with the approved plan of subdivision and engineering drawings and specifications, for the construction of full earthworks, one carriageway, shared path(s), drainage facilities and grade separated pedestrian crossing(s) required for the portion of Nairn Drive within the application area. (Local Government)

41. Satisfactory arrangements being made with the local government for the partial upgrading of Fifty Road and Eighty Road in the locations as shown on the plan dated 8 May 2013 (attached) to the satisfaction of the local government. (Local Government)

42. The Nairn Drive road reserve being set out on a separate diagram or plan of survey (deposited plan) and transferred free of cost to the local government for road purposes and without any payment of compensation. (Local Government)

43. All local streets within the subdivision being truncated in accordance with the Western Australian Planning Commission's Liveable Neighbourhoods policy. (Local Government)

44. Pursuant to section 150 of the *Planning and Development Act 2005* and Division 3 of the *Planning and Development Regulations 2009* a covenant preventing vehicular access onto Fifty Road and Nairn Drive being lodged on the certificates of title of the proposed lots at the full expense of the landowner/applicant. The covenant is to prevent access, to the benefit of the City of Rockingham, in accordance with the plan dated 8 May 2013 (attached) and the covenant is to specify:

"No vehicular access is permitted from Fifty Road/Nairn Drive." (Local Government)

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ADVICE:

1. In regard to Condition 1, upon removal of the temporary bush fire risk by way of development of the adjacent 100 metres of land within adjoining Lot 311 and Lot 5, Condition 1 will become redundant and the excluded lots shown on the attached plan dated 8 May 2013 will form part of this approval.

2. Conditions 2 and 3 reference Conditions 4 and 5 of the Environmental Protection Authority's Ministerial Statement No. 580 (respectively), which require:

"***4. Spray Drift Investigation and Management Plan***

4.1 Prior to the approval of subdivision or development, the subdivider or developer shall prepare and implement a Spray Drift Investigation and Management Plan to the requirements of the local government, on advice of the Department of Health, the Department of Agriculture and the Department of Environment Protection.

4.2 This Plan shall

- *Require undertaking investigations of spray drift from all rural or semi-rural activities occurring within the proximity of the Amendment area, to clearly define impacts on the health and amenity of future residents; and*
- *In the event that the investigations find that unacceptable health or amenity impacts are likely to affect the residents with the Amendment area, provide management strategies to ensure that impacts on the health and amenity of future residents are acceptable.*"

and

"***5. Vegetation Management Plan***

5.1 Prior to subdivision approval, the subdivider shall prepare a Vegetation Management Plan that protects the regionally significant vegetation abutting the Amendment area, particularly Bush Forever Site No.356, from direct and indirect impacts associated with the development, through the provision of a hard edge along the amendment boundary and the implementation of appropriate construction and access management strategies.

5.2 The Vegetation Management Plan shall be prepared to the satisfaction of the local government and on advice of the Department of Conservation and Land Management and the Department of Environmental Protection."

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Upon demonstration by the proponent that the requirements of Conditions 4 and 5 have been fulfilled and that evidence to that effect has been provided (respectively), Conditions 4 and 5 (respectively) will become redundant and the respective areas shown the attached plan dated 8 May 2013 will form part of this approval.

3. In regard to Condition 6 the planting and design of the special fencing should be in accordance with the Western Australian Planning Commission's *Planning Bulletin 63 Policy for Dealing with Potential Conflicts Between Residential Subdivision and Market Gardens in East Wanneroo*.

4. In regard to Conditions 6 to 8 (inclusive), the landowner/applicant is advised that if evidence is provided that the market garden has ceased operating after conditional approval is granted then Conditions 6 to 8 (inclusive) will no longer need to be satisfied.

5. In regard to Condition 13, a demolition licence may be required to be obtained from the local government prior to the commencement of demolition works.

6. Condition 15 has been imposed in accordance with *Better Urban Water Management Guidelines (WAPC 2008)*. Further guidance on the contents of urban water management plans is provided in *'Urban Water Management Plans: Guidelines for preparing and complying with subdivision conditions' (Department of Water 2008)*.

7. Condition 23 makes reference to an 'acid sulphate soils self-assessment form'. This form can be downloaded from the Western Australian Planning Commission's website at: www.planning.wa.gov.au

   The 'acid sulphate soils self-assessment form' makes reference to the Department of Environment Regulation's 'Identification and Investigation of Acid Sulphate Soils' guideline. This guideline can be obtained from the Department of Environment Regulation's website at: www.der.wa.gov.au

8. With regard to Condition 24 and in accordance with regulation 31(1)(c) of the *Contaminated Sites Regulations 2006*, a Mandatory Auditor's Report, prepared by an accredited contaminated sites auditor, will need to be submitted to the Department of Environment Regulation as evidence of compliance with Condition 24. A current list of accredited auditors is available from www.der.wa.gov.au.

9. The landowner/applicant is advised that the Department of Environment and Regulation has prepared dust control guidelines for development sites, which, outline the procedures for the preparation of dust management plans. The dust management plans are generally approved, and their implementation overseen, by Local Government. Further information on the guidelines can be obtained from the Department of Environment and Regulation's website: www.der.wa.gov.au under air quality publications.

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10. In regard to Condition 31, the development is to include full earthworks, basic reticulation, grassing of key areas, and pathways that form part of the overall pedestrian and/or cycle network.

11. In regard to Conditions 32 and 33, the landowner/applicant shall make arrangements with the Water Corporation for the provision of the necessary services. On receipt of a request from the landowner/applicant, a Land Development Agreement under Section 67 of the *Water Agencies (Powers) Act 1984* will be prepared by the Water Corporation to document the specific requirements for the proposed subdivision.

12. In regard to Condition 34, Western Power provides only one underground point of electricity supply per freehold lot.

13. The landowner/applicant and the local government are advised to refer to the Institute of Public Works Engineering Australia Local Government Guidelines for Subdivisional Development (current edition). The guidelines set out the minimum best practice requirements recommended for subdivision construction and granting clearance of engineering conditions imposed.

14. In regard to Conditions 36 to 38 (inclusive), the landowner/applicant is advised that the road reserves, including the constructed carriageways, laneways, truncations, footpaths/dual use paths and car embayments, are to be generally consistent with the approved plan of subdivision.

15. In regard to Condition 39, the City of Rockingham's approval of construction drawings is required before any subdivision works are undertaken within the Nairn Drive road reservation area. A Traffic Management Plan while working within the road reservation is required to be submitted with the construction drawings to the City.

16. The landowner/applicant is advised that the intersections of Access Street D and Neighbourhood Connector B with the existing Eighty Road shall be constructed as T-intersections (see attached plan dated 8 May 2013). Eighty Road is to remain a Neighbourhood Connector B road providing north-south access until such time as Nairn Drove is constructed to connect with Fifty Road.

Please liaise direct with the City in the above regard.

Tim Hillyard
Secretary
Western Australian Planning Commission
26 March 2014

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ATTACHMENT 1: CONDITIONS 1 - 3

	Condition 1
	Condition 2
	Condition 3

FIFTY ROAD

EIGHTY ROAD

INGRAM ROAD

BALDIVIS ROAD

Future Nairn Road

Road Widening 82m²

AMAZON DRIVE

SISTENE STREET

SAHARA DRIVE

MIRAGE STREET

EVEREST WAY

COPENHAGEN STREET

VENETIAN WAY

774

313

311

312

800

3

4

5

ORIGINAL LANDHOLDING DIAGRAM

FIFTY ROAD

774

DP202704 313 14.910Ha

DP202704 312 88.8737Ha

311

2

1

3

D29589 4 1.7577Ha

D47817 6 3.4178Ha

5

99

D47817 7 4.3181Ha

BALDIVIS ROAD

800

9007

Proposed Subdivision 27.575Ha

(Not to Scale)

RESIDENTIAL LOT SUMMARY:

Size	No. Lots	% Total Lots
201m² - 300m²	3	1.19%
301m² - 400m²	21	8.30%
401m² - 500m²	123	48.62%
501m² - 600m²	91	35.97%
601m² - 700m²	13	5.14%
701m² +	2	0.79%
Total Residential Lots	253	
Total Superlots	7	
Total Balance Lots	4	
Total Lots	264	

Minimum Lot Size 396m²
Maximum Lot Size 944m²
Average Lot Size 480m²
Total Lot Area 12.2364Ha

LANDUSE SUMMARY:

Residential Lots	12.217ha
Superlots	5.070ha
Balance Lots	19.964ha
Public Open Space	2.062Ha
Road Reserve	7.768Ha
Total Subdivision Area	47.043ha

LEGEND:

Area subject to subdivision application
Public Open Space
Road Widening
Shared Paths
Footpaths
Existing Building to be removed
Existing Building to be retained

ENDORSEMENT OF REGISTERED TOWN PLANNER

SIGNATURE: _____ DATE: _____

DEPARTMENT OF PLANNING
DATE - 8 MAY 2013
FILE 147921

PROPOSED SUBDIVISION

Lot 4 Baldivis Road, Lots 7 & 8 Ingram Road & Lots 311 & 312 Fifty Road, BALDIVIS

for: Spatial Property Group

NOTES:

SPATIAL Property Group

Scale 1:2000 @ A3
0 20 40 60 80 100 metres

COMPILED: DPS_LEVIS | DRAWN BY: JNP
DATE: 15/4/2013 | REVISION: 08/05/2013
GRID: MGA 50 | DATUM: AHD
DRAWING NUMBER: CA80-3-0016 | JOB CODE: CA80-03
FILE NO. M:\CA80\80-03\DRAWINGS\SUBDIVISION PLANS\CA80-3-0001.dgn

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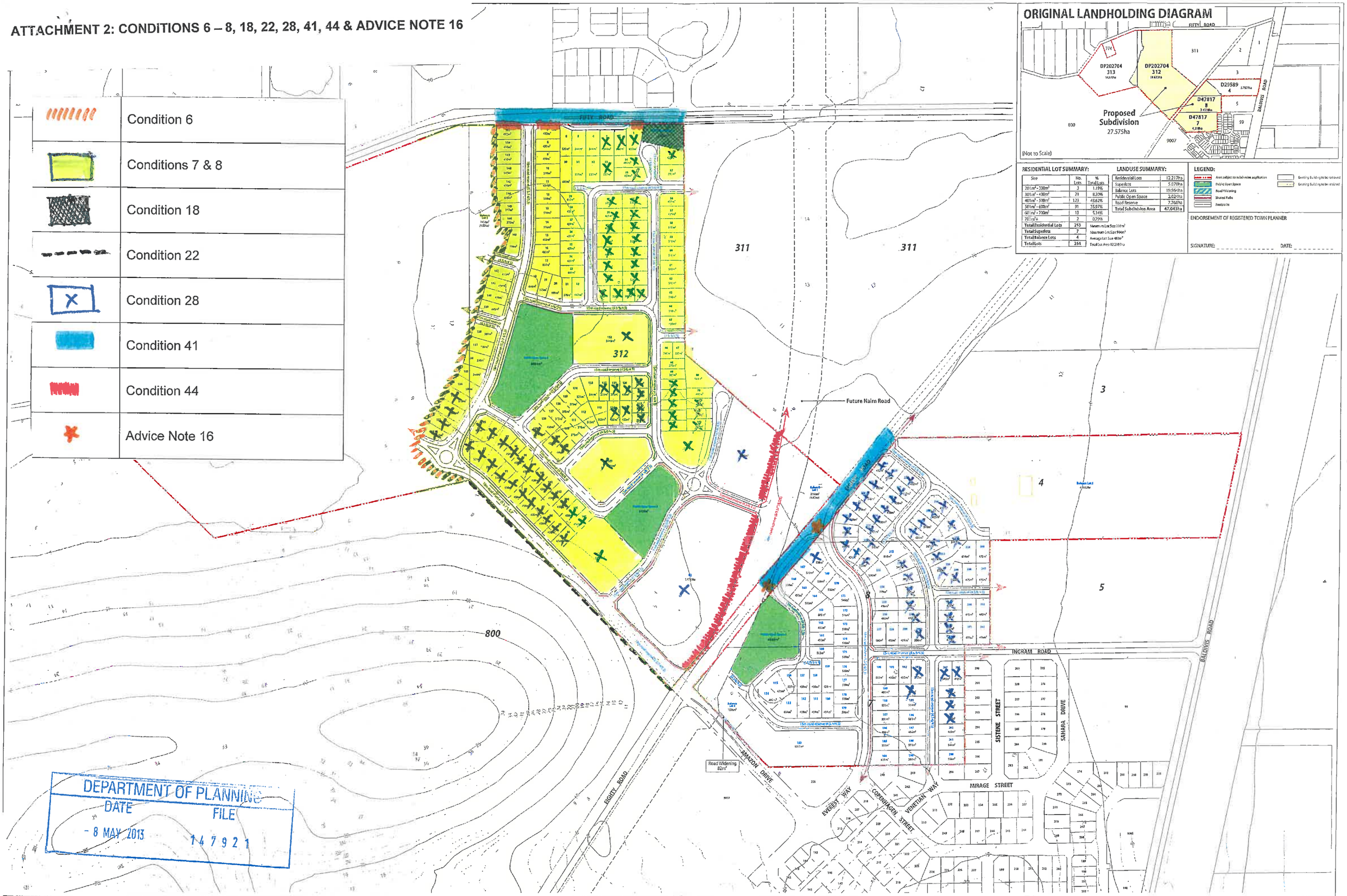
ATTACHMENT 2: CONDITIONS 6 – 8, 18, 22, 28, 41, 44 & ADVICE NOTE 16



PROPOSED SUBDIVISION

Lot 4 Baldivis Road, Lots 7 & 8 Ingram Road & Lots 311 & 312 Fifty Road, BALDIVIS

for: Spatial Property Group

SPATIAL Property Group

Scale 1: 2000 @ A1

dpp Development Planning Strategies

APPENDIX B – LEVEL 1 FLORA AND VEGETATION SURVEY REPORT (BENNETT ENVIRONMENTAL CONSULTING, 2011)

Botanical Assessment of Selected Sites Along Baldivis Road and Fifty Road

Prepared for:
COTERRA ENVIRONMENT
19/336 Churchill Avenue,
SUBIACO WA 6008

Prepared by:
Bennett Environmental Consulting Pty Ltd

Sollya heterophylla

PO Box 341
KALAMUNDA 6926

February 2011
Updated November 2011

STATEMENT OF LIMITATIONS

Scope of Services

This report ("the report") has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Eleanor Bennett ("the Author"). In some circumstances a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services.

Reliance on Data

In preparing the report, the Author has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise stated in the report, the Author has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. The Author will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to the Author.

Environmental Conclusions

In accordance with the scope of services, the Author has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

The conclusions are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. Also it should be recognised that site conditions, can change with time.

Within the limitations imposed by the scope of services, the field assessment and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and no other party. The Author assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of the Author or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

Other Limitations

The Author will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report. The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in the report nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

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SUMMARY

Bennett Environmental Consulting Pty Ltd undertook a level 1 vegetation survey (Environmental Protection Authority, 2004) and an assessment of exceptional individual trees at Lots 2, 4, 7, 8, 312 and 313 between Baldivis Road and Fifty Road, Baldivis on 24th January and an additional area to the south of Lot 313 on 8th February 2011.

Lot 2

Woodland of *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* over Dense Tall Grass dominated by **Ehrharta calycina.*
Vegetation condition – Degraded.
Included several cultivated trees including **Olea europaea* (Olive) and **Melia azedarach* (Cape Lilac).

Lot 4

Forest of *Eucalyptus marginata* subsp. *marginata, Allocasuarina fraseriana* and *Banksia attenuata* over Open Low Scrub B of *Acacia pulchella* var. *glaberrima* and *Macrozamia riedlei* over Dwarf Scrub C dominated by *Hibbertia hypericoides* over Dense Tall Grass dominated by **Ehrharta calycina*; and
Forest of *Eucalyptus marginata* subsp. *marginata, Allocasuarina fraseriana* and *Banksia attenuata* over Thicket of *Kunzea glabrescens* and *Jacksonia furcellata* over Dwarf Scrub C of mixed taxa dominated by *Acacia pulchella* and *Gastrolobium capitatum* over Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by *Phlebocarya ciliata* over Open Low Sedges dominated by *Lepidosperma squamatum*.
Vegetation condition varied from good to completely degraded.

Lot 7

Woodland of *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* over Low Forest A of *Banksia attenuata* and *Banksia ilicifolia* over Scrub of *Kunzea glabrescens* and *Jacksonia furcellata* over Dwarf Scrub C dominated by *Acacia pulchella, Acacia stenoptera, Xanthorrhoea brunonis* and *Gastrolobium capitatum* over Very Open Herbs of *Lomandra hermaphrodita* and *Lomandra caespitosa* over Dense Tall Grass dominated by **Ehrharta calycina*; and
Woodland of *Corymbia calophylla, Allocasuarina fraseriana* and *Eucalyptus marginata* subsp. *marginata* over Low Forest A of *Banksia attenuata* over Dwarf Scrub D of *Hibbertia hypericoides, Petrophile linearis, Calytrix flavescens, Daviesia triflora* and *Gompholobium tomentosum* over Dense Tall Grass dominated by **Ehrharta calycina*.
Vegetation condition varied from good to completely degraded.

Lot 312

Open Tall Woodland to Tall Woodland of *Eucalyptus gomphocephala* and occasional *Corymbia calophylla* over Dense Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by **Lupinus cosentinii* and **Euphorbia terracina.*
Vegetation condition – degraded to completely degraded.

Lot 313

Two small areas of remnant vegetation only as Lot developed as market garden.
Open Woodland of *Eucalyptus gomphocephala* over Thicket of *Acacia rostellifera* and **Rhamnus alaternus* over Dense Tall Grass of **Ehrharta calycina;* and
Open Low Woodland B of *Banksia attenuata* and *Banksia menziesii* over Scrub of *Jacksonia furcellata* over Open Low Scrub B of *Acacia pulchella* and *Macrozamia riedlei* over Dense Tall Grass of **Ehrharta calycina* over Open herbs of *Corynotheca micrantha* and *Conostylis aculeata* subsp. *preissii*; and

Open Low Woodland A of *Eucalyptus marginata* subsp. *marginata* over Heath B of *Acacia rostellifera* over Dense Tall Grass of **Ehrharta calycina* over Open Herbs of *Lomandra suaveolens* and *Conostylis aculeata* subsp. *preissii;* and
Dense regrowth of *Eucalyptus gomphocephala* (<1m tall) over Heath B of *Acacia rostellifera* over Dense Tall Grass of **Ehrharta calycina*.
Vegetation condition varied between good to degraded in remnant bushland.

It is recommended that a group of Marris and Tuarts on Lot 312 which adjoins the Rockingham Lakes Regional Park and a group or Jarrahs on Lot 2 be retained. Two areas of remnant vegetation recorded in Lot 4 and Lot 7 which were in good condition are also recommended for conservation.

It was recommended that a spring survey be undertaken of the remnant vegetation at Lots 2, 4, 7, 312 and 313 but not Lot 8 to record all taxa present at the site.

A spring survey has now been completed and included in this revised report.

1 INTRODUCTION

1.1 Background

Coterra Environment commissioned Bennett Environmental Consulting Pty Ltd to undertake a vegetation overview and listing of exceptional individual trees at Lots 2, 4, 7, 8, 312 and 313 as outlined in Figure 1. The area of Lot 8 to be surveyed is cleared and Lot 313 is cultivated as a market garden. A follow up spring survey is intended for the Lots.

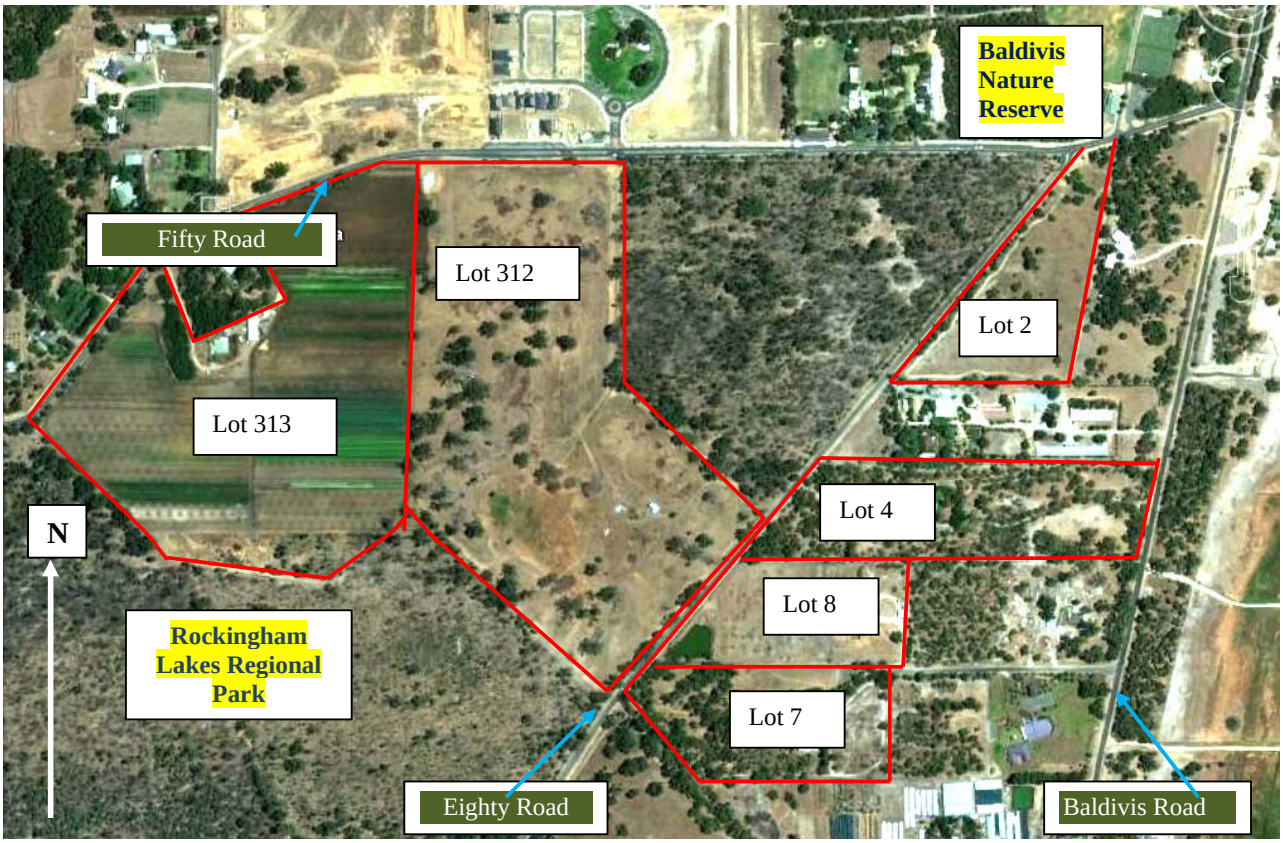


Figure 1. Location of the site to be surveyed - outlined in red (extracted from Google Maps).

1.2 Scope of Works

The requirements for this project were to:

- Undertake a Level 1 vegetation survey (Environmental Protection Authority, 2004);
- Search for and record all significant species at the site; and
- In spring 2011 to assess quadrats in the remnant vegetation nominated during the January survey.

2 BACKGROUND INFORMATION

2.1 Geology and Landform

The survey lots are included in the Spearwood Dunes, which consist of a core of limestone overlain by yellow sand. Differential wind erosion has produced two different landscapes but the site is within the Karrakatta unit, which is described as having deep yellow brown sands (Churchward and McArthur, 1980).

2.2 Vegetation

The Interim Biogeographical Regionalisation for Australia (IBRA) (Thackway and Cresswell, 1995) recognizes 85 bioregions. The IBRA is used as the common unit to compare biological and biophysical attributes. Bioregions represent a landscape-based approach to classifying the land surface and each region is defined by a set of major environmental influences, which shape the occurrence of flora and fauna and their interaction with the physical environment. Baldivis occurs in the Swan Coastal Plain, which has been subdivided into the northern section and the southern section. The study area is located in the southern section, abbreviated SWA2 (Mitchell, Williams and Desmond, 2002).

The survey lots are mapped as a Medium Woodland of *Eucalyptus gomphocephala* and *Eucalyptus marginata* (abbreviated e2,4Mi). Shepherd *et al.* (2002) have determined the pre-European and current extent of the vegetation associations described by Beard. In addition they have assessed the percentage of each vegetation association remaining, the amount in IUCN reserves and the percentage in other reserves. The pre-European area of e2,3Mi is estimated to be 79,001ha, the current extent 18,398ha which represents 23.2% remaining vegetated of which 38% is included in conservation.

Heddle *et al.* (1980) described the vegetation complexes of the Darling System at a scale of 1: 250 000. There was found to be a distinct pattern of plant distribution linked to landforms, soils and climate. The most obvious trend was associated with increasing aridity from west to east on the Darling Plateau. The vegetation changes observed were a decrease in height and percentage cover of the tallest stratum and a distinct change in floristics. Baldivis occurs between two vegetation complexes. These are:

- Karrakatta Complex – Central and South. The vegetation is predominantly an Open Forest of *Eucalytus gomphocephala – Eucalyptus marginata* subsp. *marginata – Corymbia calophylla* and Woodland of *Eucalyptus marginata* subsp. *marginata* and *Banksia* species.
- Cottesloe Conmplex – Central and South. The vegetation is a mosaic consisitng of a Woodland of *Eucalyptus gomphocephala*; an Open Forest of *Eucalyptus gomphocephala – Eucalyptus marginata* subsp. *marginata – Corymbia calopphylla;* and a Closed Heath on the liemstone outcrops..

Bush Forever (Government of Western Australia, 2000) states that 18% of the original area of the Karakatta Complex Central and South and 36% of the Cottesloe Complex Central and South remain vegetated within the Swan Coastal Plain. The area proposed for protection (Government of Western Australia, 2000) is 8% and 18% for Karakatta Complex Central and South and Cottesloe Complex Central and South respectively.

2.3 Threatened Ecological Communities

An ecological community is a naturally occurring biological assemblage that occurs in a particular type of habitat. A Threatened Ecological Community is one which falls into one of the following categories, presumed totally destroyed, critically endangered, endangered or vulnerable (Department Environment and Conservation, 2011b).

A possible ecological community which does not meet the above is added to the Priority Ecological Community List. Priorities 1, 2, and 3 are adequately known but are not currently believed to be threatened. Those that have recently been removed from the threatened list are listed as Priority 4. Conservation dependent ecological communities are placed in Priority 5.

2.4 Significant Flora

Prior to undertaking the field work a search was undertaken of the Department of Conservation and Environment Threatened Flora Database using NatureMap (Department of Environment and Conservation, 2011c) for a 40km radius from 32°18’36”S and 115°48’56”E No Threatened or Priority Flora were recorded during this search.

Table 1. Code and description of Threatened and Priority Flora (Department Environment and Conservation, 2011a)

Code	Declared Rare and Priority Flora Categories
T	T (Declared Rare Flora) -Extant Taxa. Taxa, which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection.
X	DRF (Declared Rare Flora) -Presumed Extinct Taxa. Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently.
1	Priority One -Poorly Known Taxa. Taxa, which are known from one or a few (generally <5) populations, which are under threat.
2	Priority Two -Poorly Known Taxa. Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat.
3	Priority Three -Poorly Known Taxa. Taxa, which are known from several populations, at least some of which are not believed to be under immediate threat.
4	Priority Four -Rare Taxa. Taxa which are considered to have been adequately surveyed and which whilst being rare, are not currently threatened by any identifiable factors.

Table 1 presents the definitions of the Threatened and the four Priority Flora ratings under the Wildlife Conservation Act (1950) as extracted from Department of Environment and Conservation (2011a). Table 2 presents the definitions of the threatened species under the Environmental Protection and Biodiversity Conservation Act, 1999 (Department of Sustainability, Environment, Water, Populations and Communities, 2011).

Table 2. Categories of Threatened Flora Species (Department of Sustainability, Environment, Water, Populations and Communities, 2011)

Code	Declared Rare and Priority Flora Categories
Ex	Extinct Taxa which at a particular time if, at that time, there is no reasonable doubt that the last member of this species has died.
ExW	Extinct in the Wild Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	Critically Endangered Taxa which at any particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	Endangered Taxa, which is not critically endangered, and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	Vulnerable Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	Conservation Dependent Taxa which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

3. METHODS

Transects were walked through the remnant bushland listing the vegetation units in the area and the dominant taxa. As this was being undertaken the bushland was searched for Declared Rare and Priority Flora. In January a Level 1 vegetation survey was required so no quadrats were recorded. In spring nine temporary, 10m x 10m quadrats were set up using a compass

and oriented due N,S,E,W. These were placed in the areas suggested from the January survey for a spring survey. The data obtained from these is provided in Appendix A.

The vegetation at the site is described using the vegetation classification of Muir (1977) as described in Table 3.

Table 3 Vegetation Classification (from Muir, 1977)

LIFE FORM / HEIGHT CLASS	Canopy Cover			
	DENSE 70 % - 100%	**MID DENSE 30% - 70%**	**SPARSE 10% - 30%**	**VERY SPARSE 2% - 10%**
Trees > 30 m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
Trees 15 – 30 m	Dense Forest	Forest	Woodland	Open Woodland
Trees 5 – 15 m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
Trees < 5 m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
Mallee (tree form)	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Mallee (shrub form)	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs > 2 m	Dense Thicket	Thicket	Scrub	Open Scrub
Shrubs 1.5 – 2 m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
Shrubs 1 - 1.5 m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
Shrubs 0.5 – 1 m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
Shrubs 0 - 0.5 m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
Mat plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
Hummock grass	Dense Hummock Grass	Mid-Dense Hummock Grass	Hummock Grass	Open Hummock Grass
Bunch grass > 0.5 m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
Bunch grass < 0.5 m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
Herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
Sedges > 0.5 m	Dense Tall sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
Sedges < 0.5 m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
Ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
Mosses, liverworts	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

4. RESULTS

Field work was undertaken on 24th January 2011 and quadrats were established on 6th October 2011. Lot 2 has Baldivis Nature Reserve to the north, Lots 312 and 313 have the Rockingham Lakes Regional Park on the southern side. All the other lots are surrounded by privately owned land including a hatchery between Lot 2 and Lot 4 and a scrap yard to the east of Lot 8.

4.1 Vegetation Overview

The vegetation for each of the Lots as described from the January survey are provided below.

Lot 2

Woodland of *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* over Dense Tall Grass dominated by **Ehrharta calycina* in grey sand.
This Lot included many cultivated trees eg Olives and South African Lilacs but occasional shrubs of *Jacksonia furcellata* were recorded.
Vegetation Condition 5.

Lot 4

The vegetation at this lot varied considerably. Many trees of *Eucalyptus camaldulensis* have been planted, in particular along tracks leading to the house from Baldivis Road. These are readily distinguished by the pale bark.

On western edge on Eighty Road (4-1) – Forest of *Eucalyptus marginata* subsp. *marginata, Allocasuarina fraseriana* and *Banksia attenuata* over Open Low Scrub B of *Acacia pulchella* var. *glaberrima* and *Macrozamia riedlei* over Dwarf Scrub C

dominated by *Hibbertia hypericoides* over Dense Tall Grass dominated by **Ehrharta calycina* in grey sand.
Occasional twiners of *Hardenbergia comptoniana* were also recorded.
Vegetation Condition 4-5 due to dense tree cover – up to 40%.

Near centre of block (4-2) – Forest of *Eucalyptus marginata* subsp. *marginata, Allocasuarina fraseriana* and *Banksia attenuata* over Thicket of *Kunzea glabrescens* and *Jacksonia furcellata* over Dwarf Scrub C of mixed taxa dominated by *Acacia pulchella* subsp. *pulchella* and *Gastrolobium capitatum* over Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by *Phlebocarya ciliata* over Open Low Sedges dominated by *Lepidosperma squamatum* in grey sand.
Plants of *Lomandra suaveolens, Lomandra caespitosa* and *Lomandra sericea* were recorded from 4-2.
Vegetation Condition 3-4.
This area requires a spring survey to be undertaken.

On eastern edge at Baldivis Road (4-3) - Open Tall Woodland of *Eucalyptus gomphocephala* with occasional *Corymbia calophylla* over Dense Tall grass dominated by **Ehrharta calycina* in grey sand.
Vegetation Condition 5 -6.

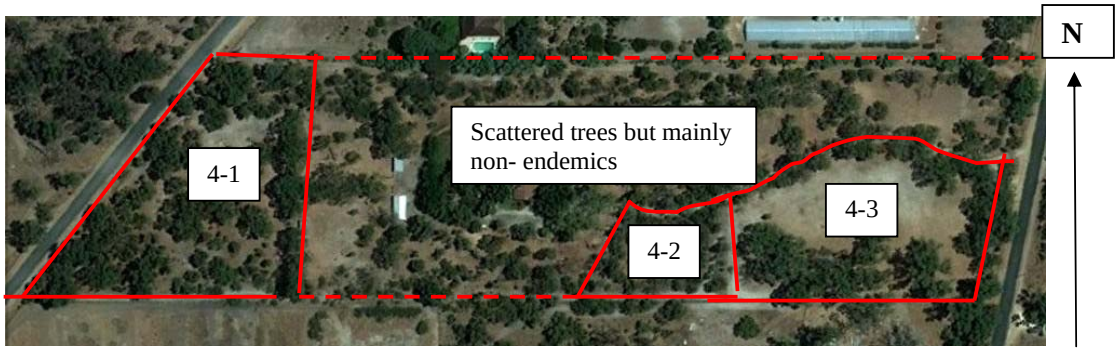


Figure 2. Vegetation at Lot 4.

Lot 7

The access to the house and the planting around the house was mostly cultivated trees. There were also open areas consisting of grass weeds.

Area to west of house (7-1) - Woodland of *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* over Low Forest A of *Banksia attenuata* and *Banksia ilicifolia* over Scrub of *Kunzea glabrescens* and *Jacksonia furcellata* over Dwarf Scrub C dominated by *Acacia pulchella, Acacia stenoptera, Xanthorrhoea brunonis* and *Gastrolobium capitatum* over Very Open Herbs of *Lomandra hermaphrodita* and *Lomandra caespitosa* over Dense Tall Grass dominated by **Ehrharta calycina* in grey sand.
Vegetation Condition 4-5.

Area to west of above (7-2) – Woodland of *Corymbia calophylla, Allocasuarina fraseriana* and *Eucalyptus marginata* subsp. *marginata* over Low Forest A of *Banksia attenuata* over Dwarf Scrub D of *Hibbertia hypericoides, Petrophile linearis, Calytrix flavescens, Daviesia triflora* and *Gompholobium tomentosum* over Dense Tall Grass dominated by **Ehrharta calycina* in grey sand.
Vegetation Condition 4-5.

Area close to Eighty Road adjacent to Lot 8 (7-3) - Woodland of *Corymbia calophylla* and *Eucalyptus gomphocephala* over Dense Tall Grass dominated by **Ehrharta calycina* in grey sand.
Vegetation Condition 5-6.

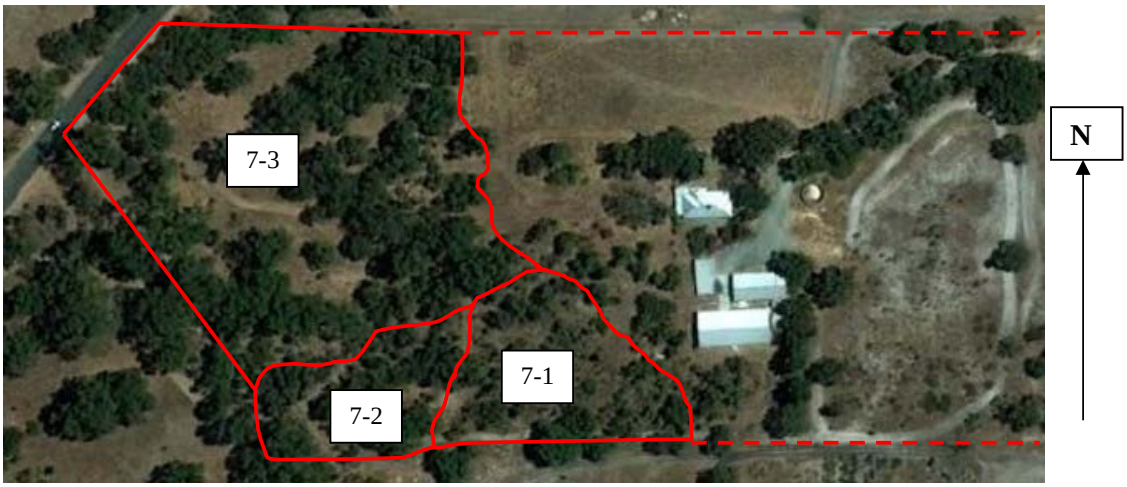


Figure 3. Vegetation at Lot 7.

Lot 8

No remnant vegetation at the lot except for a few planted trees around a dam in the south west corner.

Lot 312

Open Tall Woodland to Tall Woodland of *Eucalyptus gomphocephala* and occasional *Corymbia calophylla* over Dense Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by *Lupinus cosentinii* and *Euphorbia terracina* in grey sand.
Vegetation Condition 5-6.

Lot 313

Most of this lot is under market gardens except for two small areas of remnant vegetation.

Area adjacent to house (313-1) : Open Woodland of *Eucalyptus gomphocephala* over Thicket of *Acacia rostellifera* and **Rhamnus alaternus* over Dense Tall Grass of **Ehrharta calycina* in grey sand.
Vegetation Condition 5-6.

South western area (313-2): Open Low Woodland B of *Banksia attenuata* and *Banksia menziesii* over Scrub of *Jacksonia furcellata* over Open Low Scrub B of *Acacia pulchella* and *Macrozamia riedlei* over Dense Tall Grass of **Ehrharta calycina* over Open herbs of *Corynotheca micrantha* and *Conostylis aculeata* subsp. *preissii* in yellow sand.
Vegetation condition 4.

South eastern area (313-3): Open Low Woodland A of *Eucalyptus marginata* subsp. *marginata* over Heath B of *Acacia rostellifera* over Dense Tall Grass of **Ehrharta calycina* over Open Herbs of *Lomandra suaveolens* and *Conostylis aculeata* subsp. *preissii* in yellow sand.
Vegetation condition 4-5.

Eastern edge (313-4): Dense regrowth of *Eucalyptus gomphocephala* (<1m tall) over Heath B of *Acacia rostellifera* over Dense Tall Grass of **Ehrharta calycina* in yellow sand.
Vegetation condition 5.

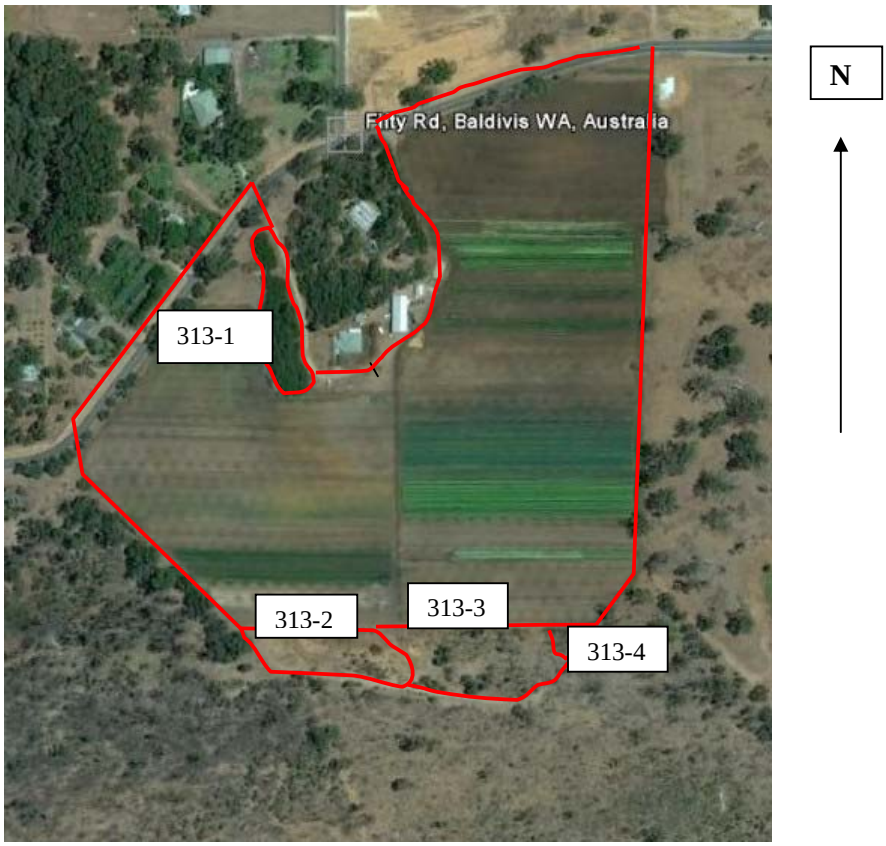


Figure 4. Remnant vegetation at Lot 313.

The Floristic Community Types (Gibson *et al.*, 1994) of the vegetation recorded at the Lots is inferred to be:

- FCT24 – Northern Spearwood Shrublands and Woodlands – includes trees of *Eucalyptus gomphocephala* at Lot 4, Lot 7 and Lot 312;
- FCT22 – *Banksia ilicifolia* – small area at Lot 7; and
- FCT21c – Low lying *Banksia attenuata* Woodlands or Shrublands - small areas at Lot 4, Lot 7 and Lot 313.

None of the above FCT's are listed as Threatened Ecological Communities by the Department of Environment and Conservation (2011b).

4.2 Spring Survey

Quadrats were established in the following Lots and vegetation as described above. Lot 4 vegetation units 4-1 and 4-2; Lot 7 vegetation units 7-1 and 7-2; Lot 312; Lot 313 vegetation units 313-1, 313-2, 313-3and 313-4. The data collected from these quadrats is provided in Appendix A.

Lot 4

Quadrat 4-1 was placed in an area with good tree cover. Typically the understory had been replaced by weeds, there were a lot of *Banksia attenuata* and *Eucalyptus marginata* subsp. *marginata* deaths.

Quadrat 4-2 had several dead Banksia attenuata trees and there was a large build up of litter. Along the track edge there were many weeds including **Euphorbia terracina*, **Bromus diandrus* and **Ehrharta calycina.* Generally the diversity of the understory was good.

Lot 7

Quadrat 7-1 has a small area of remnant bushland in good condition, mostly it is good to degraded but it does have reasonable diversity in the understory.

Quadrat 7-2 is in good to degraded condition but has a reasonable diversity. The block to the south of this vegetation unit is now cleared in preparation for subdivision.

Lot 312
Although not a Lot recommended for a spring survey it is the largest of the Lots at the site. It was decided to place a quadrat in one of the better remnants to illustrate how degraded is Lot 312. There were several seedling *Eucalyptus* species observed.

Lot 313
Quadrat 313-1 was as described in January. It was noted that weeds were not as common under the dense *Acacia rostellifera* areas as they were in the open especially along the edge of the track.

Quadrat 313-2 is only a small area but it does act as a buffer for the vegetated block behind.

Quadrat 313-3 was burnt about 3-5 years resulting in some dense patches of *Acacia rostellifera.*

Quadrat 313-4 was also burnt about 3-5 years previously. Several *Eucalyptus marginata* subsp. *marginata* and *Eucalyptus gomphocephala* seedlings were now germinating.

Lot 2
When the survey was undertaken mowing of the whole of Lot 2 was occurring in preparation for summer. No quadrat was established.

4.3 Vegetation Condition

Bushland has been historically subject to ongoing degradation and is especially susceptible to disturbances arising as a result of indirect impacts from surrounding developments and human activity. Degradation is caused by a wide range of factors, including isolation, edge effects, weed invasion, plant diseases, changes in fire frequency, landscape fragmentation, increased predation on native fauna by feral animals, decrease in species richness and general modification of ecological function. These issues can affect the biodiversity rating and ecological viability of areas of remnant vegetation and should be assessed in line with conservation values.

Vegetation condition was rated according to the vegetation condition scale used in Keighery (1994). The vegetation condition at the survey site was mainly good to completely degraded with a small area on the southern side that was in very good condition. Although there were groups of trees with good cover the understorey had been completely replaced with weeds. These areas were degraded (condition 5). Where there were no trees and the weeds were dominant the vegetation condition was completely degraded (condition 6). The vegetation condition of the site is mapped in Figure 5.

Table 4. Explanation of Vegetation Condition Rating (Keighery, 1994)

Rating	Description	Explanation
1	Pristine	Pristine or nearly so, no obvious signs of disturbance.
2	Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
3	Very Good	Vegetation structure altered, obvious signs of disturbance.
4	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it.
5	Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management.
6	Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.

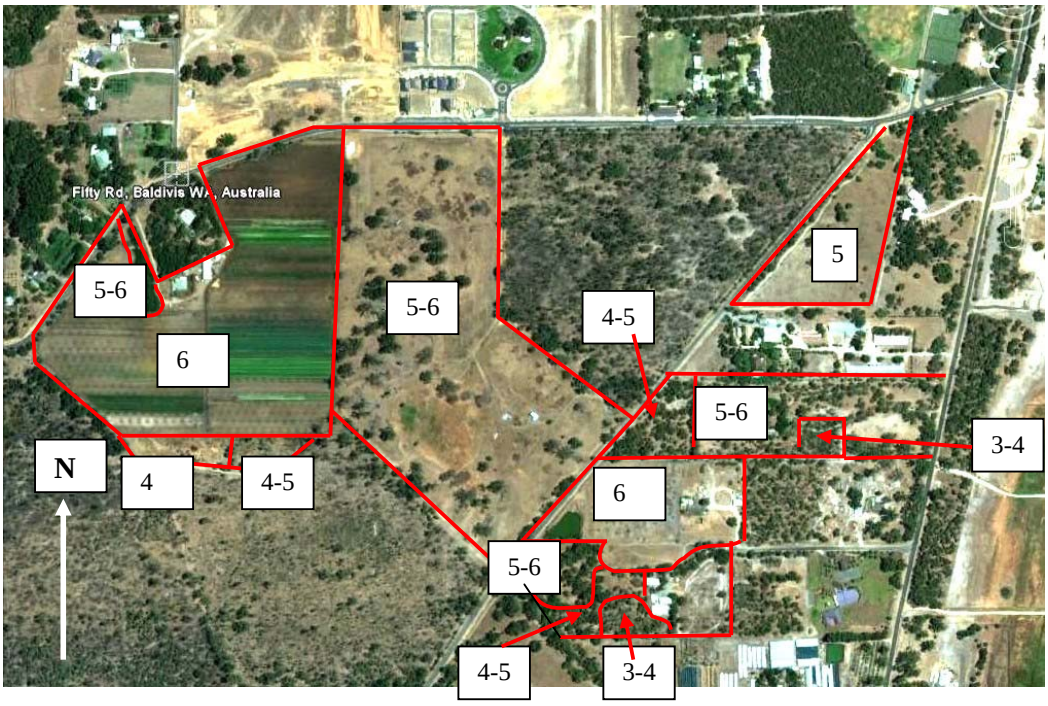


Figure 5. Vegetation condition at the Lots surveyed

4.3 Significant Taxa

No Declared Rare or Priority Flora were recorded from the site.

4.4 Taller Trees at the Site

There were several tall *Eucalyptus gomphocephala* (up to 35m) recorded from Lot 312. Tuarts are inclined to shed branches and are not suitable for inclusion in a typical metropolitan urban development. As such consideration should be given to leaving a block of several trees, a mixture of *Eucalyptus gomphocephala* and *Corymbia calophylla* as public open space. In Lot 312 an area of Tuarts at 388188E – 388124E and 6424507N - 6424423N, and another group of Marri and Tuarts adjacent to the Rockingham Lakes Regional Park (388176E and 6424549N) should be considered for retention as public open space.

There was also a group of *Eucalyptus marginata* subsp. *marginata* at the north east corner of Lot 2 that should also considered for retention as open space. These trees were about 12m tall, not a considerable height for Jarrahs.

Where possible it is recommended within any planned development that as many trees as possible be retained.

5. DISCUSSION

A level 1 vegetation survey (Environmental Protection Authority, 2004) was undertaken at Lots 2, 4, 7, 8, 312 and 313 between Baldivis Road and Fifty Road.

- Lot 8 was completely cleared of all vegetation;
- Lot 313 was a market garden with two small areas of remnant vegetation;
- Lot 312 had excellent sized trees but with the understorey replaced by weeds dominated by **Ehrharta calycina* and **Lupinus cosentinii;*
- Lot 2 included several cultivated trees including **Olea europaea* (Olive) and **Melia azedarach* (Cape lilac) together with several *Eucalyptus marginata* subsp. *marginata* (Jarrah) and a *Corymbia calophylla* (Marri) which are worthy of conservation;
- Lot 4 included some remnant vegetation in good condition; and

- Lot 7 recorded an area of remnant vegetation.

Lot 4 recorded three vegetation units two of which had remnant vegetation in reasonable condition and were resurveyed in spring to record all taxa. These units were:

- Forest of *Eucalyptus marginata* subsp. *marginata, Allocasuarina fraseriana* and *Banksia attenuata* over Open Low Scrub B of *Acacia pulchella* and *Macrozamia riedlei* over Dwarf Scrub C dominated by *Hibbertia hypericoides* over Dense Tall Grass dominated by **Ehrharta calycina* in grey sand; and
- Forest of *Eucalyptus marginata* subsp. *marginata, Allocasuarina fraseriana* and *Banksia attenuata* over Thicket of *Kunzea glabrescens* and *Jacksonia furcellata* over Dwarf Scrub C of mixed taxa dominated by *Acacia pulchella* var. *glaberrima* and *Gastrolobium capitatum* over Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by *Phlebocarya ciliata* over Open Low Sedges dominated by *Lepidosperma squamatum* in grey sand.

This lot has remnant vegetation worthy of conservation but the area is so small that unless a larger area is retained, with development it would lose its good condition.

Lot 7 recorded three vegetation units two of which had remnant vegetation in reasonable condition and were resurveyed in spring to record all taxa. These units were:

- Woodland of *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* over Low Forest A of *Banksia attenuata* and *Banksia ilicifolia* over Scrub of *Kunzea glabrescens* and *Jacksonia furcellata* over Dwarf Scrub C dominated by *Acacia pulchella* var. *glaberrima, Acacia stenoptera, Xanthorrhoea brunonis* and *Gastrolobium capitatum* over Dense Tall Grass dominated by **Ehrharta calycina* over Very Open Herbs of *Lomandra hermaphrodita* and *Lomandra caespitosa* in grey sand; and
- Woodland of *Corymbia calophylla, Allocasuarina fraseriana* and *Eucalyptus marginata* subsp. *marginata* over Low Forest A of *Banksia attenuata* over Dwarf Scrub D of *Hibbertia hypericoides, Petrophile linearis, Calytrix flavescens, Daviesia triflora* and *Gompholobium tomentosum* over Dense Tall Grass dominated by **Ehrharta calycina* in grey sand.

This lot has vegetation in reasonable condition but with the block to the south now being developed and there being weeds invading on that edge it is likely that the vegetation will become further degraded.

Lot 313 recorded four vegetation units all of which were resurveyed in spring. These units were:

- Open Woodland of *Eucalyptus gomphocephala* over Thicket of *Acacia rostellifera* and **Rhamnus alaternus* over Dense Tall Grass of **Ehrharta calycina* in yellow sand*;*
- Open Low Woodland B of *Banksia attenuata* and *Banksia menziesii* over Scrub of *Jacksonia furcellata* over Open Low Scrub B of *Acacia pulchella* and *Macrozamia riedlei* over Dense Tall Grass of **Ehrharta calycina* over Open herbs of *Corynotheca micrantha* and *Conostylis aculeata* subsp. *preissii* in yellow sand;
- Open Low Woodland A of *Eucalyptus marginata* subsp. *marginata* over Heath B of *Acacia rostellifera* over Dense Tall Grass of **Ehrharta calycina* over Open Herbs of *Lomandra suaveolens* and *Conostylis aculeata* subsp. *preissii* in yellow sand*;* and
- Dense regrowth of *Eucalyptus gomphocephala* (<1m tall) over Heath B of *Acacia rostellifera* over Dense Tall Grass of **Ehrharta calycina* in yellow sand.

All except the first of these vegetation units adjoin the regional park and as such could act as a buffer to that vegetation.

Lot 312 retained many *Eucalyptus gomphocephala* (Tuart) and *Corymbia calophylla* (Marri) trees which were of a reasonable height. Although not suggested a quadrat was placed in this Lot. Several trees of Tuart and Marri up to 35m in height and in better condition or with nesting hollows occurred adjacent to the Rockingham Lakes Regional Park It is recommended that these be retained as public open space and it is preferable that groups of trees be retained rather than individual trees. Tees with the dimensions of many Tuarts and Marris are not recommended for urban development.

At the Level 1 survey it was recommended that an area at both Lot 4 and Lot 7 be retained for conservation. At October survey these areas were found to be small and included many dead and dying trees. This has resulted in a high litter build up which could be a fire hazard. A cool burn of the vegetation units selected may rejuvenate the bushland which could enhance their vegetation condition. If open space is required to be retained, then Lot 4 would be the better one for remnant vegetation, but Lot 312 if developed with mown grass or similar would provide a more open recreational area.

The condition of the whole area varied considerably from good to completely degraded with the two largest lots, Lot 312 and 313 being degraded to completely degraded but Lot 312 did include several stands of tall *Eucalyptus gomphocephala*. At the January survey there were area where the vegetation was in good or better condition at Lots 2, 4 and 7, but the spring survey recorded no vegetation of significance or the presence of priority flora.

6. REFERENCES

Beard, J.S. (1981). *Vegetation Survey of Western Australia Swan*. University of Western Australia Press, Crawley

Beard, J.S. (1990). *Plant Life of Western Australia*. Kangaroo Press, Kenthurst NSW

Biggs, E.R. and Wilde, S.A. (1980). *Geology, Mineral Resources and Hydrology of the Darling System, Western Australia*. Department of Conservation and Environment, Perth, Western Australia

Churchward, H.M. and McArthur, W.M. (1980). *Landform and Soils of the Darling System* In *Atlas of Natural Resources, Darling System, Western Australia*. Department of Conservation and Environment, Perth, Western Australia

Commonwealth of Australia (2001). *National Objectives and Targets for Biodiversity Conservation 2001-2005.* Environment Australia; Department of Environment and Heritage, Canberra

Department of Environment and Conservation (2011a). *Declared Rare and Priority List for Western Australia.* Published list by the Department of Conservation and Land Management, Western Australia

Department of Environment and Conservation (2011b). *List of Threatened Ecological Communities on the Department of Environment and Conservation Threatened Ecological Communities (TEC) Database endorsed by the Minister for the Environment.* http://www.naturebase.net/plants_animals/watscu/pdf/tec/endorsed_tec_list_jan04.pdf

Department of Sustainability, Environment. Water. Populations and Communities (2011). *EPBC Act List of Threatened Flora.* http://www.deh.gov.au/

Environmental Protection Authority (2000). *Environmental Protection of Native Vegetation in Western Australia. EPA Position Statement No. 2.* EPA, Perth

Environmental Protection Authority (2004). *Guidance for the Assessment of Environmental Factors, Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia. No. 51.* EPA, Perth

Gibson, N., Keighery, B.J., Keighery, G.J., Burbidge, A.H. and Lyons, M.N. (1994). *A Floristic Survey of the southern Swan Coastal Plain.* Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)

Government of Western Australia (2000). *Bush Forever*. Department of Environmental Protection, WA

Havel, J.J. (2002). *Review of Management Options of Poorly Represented Vegetation Complexes*. Unpublished report for the Conservation Commission

Hearn, R., Williams, K., Comer, S. and Beecham, B. (2002). *Jarrah Forest 2 (JF2 – Southern Jarrah Forest subregion)* In *A Biodiversity Audit of Western Australia's 53 Biogeographical subregions*. Department of Conservation and Land Management

Heddle, E.M., Loneragan, O.W. and Havell, J.J. (1980). *Vegetation of the Darling System* In *Atlas of Natural Resources, Darling System, Western Australia*. Department of Conservation and Environment, Perth, Western Australia

Hussey, B.M.J., Keighery, G.J., Cousens, R.D., Dodd, J. and Lloyd, S.G. (1997). *Western Weeds – A guide to the weeds of Western Australia.* Plant Protection Society of Western Australia

Keighery, B.J. (1994). *Bushland Plant Survey: a Guide to Plant Community Surveys for the Community.* Wildflower Society of Western Australia (Inc.) Nedlands, Western Australia

Mitchell, D., Williams, K. and Desmond, A. (2002). *Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion)* In *A Biodiversity Audit of Western Australia's 53 Biogeographical subregions*. Department of Conservation and Land Management

Muir, B.G. (1977). *Biological Survey of the Western Australian Wheatbelt. Part II: Vegetation and habitat of Bendering Reserve*. Records of the Western Australian Museum, Supplement No. 3

Shepherd, D.P., Beeston, G.R. and Hopkins, A.J.M. (2002). *Native Vegetation in Western Australia Extent, Type and Status. Resource Management Technical Report 249.* Department of Agriculture, Government of Western Australia

Thackway, R. and Cresswell I. D. (1995). *An Interim Biogeographical Regionalisation for Australia: a Framework for Setting Priorities in the National Reserves System Cooperative Program.* Australian Nature Conservation Agency, Canberra, ACT

Western Australian Herbarium (2011). *Florabase*. Department of Environment and Conservation. http://www.calm.wa.gov.au/science/florabase.html

APPENDIX A

Quadrat Data

QUADRAT 4-1

GPS: 388563E; 6424322N
Vegetation Description: Forest of *Eucalyptus marginata* subsp. *marginata*, *Allocasuarina fraseriana* and *Banksia attenuata* over Open Low Scrub B of *Acacia pulchella* var. *glaberrima* and *Macrozamia riedlei* over Dwarf Scrub C dominated by *Hibbertia hypericoides* over Dense Tall Grass dominated by **Ehrharta calycina* in grey sand.
Vegetation Condition: Good to degraded

SPECIES	HEIGHT (cm)	% COVER
Allocasuarina fraseriana	1000	2
**Arctotheca calendula*	40	<1
Banksia attenuata	1800	15
Banksia menziesii	700	10
**Briza maxima*	60	2
Conostylis aculeata subsp. *preissii*	30	<1
Corymbia calophylla	1200	2
Dichopogon preissii	70	1
**Ehrharta calycina*	120	95
Eucalyptus marginata subsp. *marginata*	1400	25
**Euphorbia terracina*	70	2-15
Hibbertia hypericoides	60	<1
Macrozamia riedlei	90	1
**Oxalis corymbosa*	20	<1
Phyllanthus calycinus	70	<1
**Romulea rosea*	50	<1

SPECIES	HEIGHT	% COVER
**Sparaxis bulbifera*	70	<1
**Ursinia anthemoides*	50	5
Acacia pulchella var. *glaberrima*	Opportunistic	
**Bromus diandrus*	Opportunistic	
**Carpobrotus edulis*	Opportunistic	
Dryandra sessilis	Opportunistic	
**Eucalyptus cornuta*	Opportunistic	
Hardenbergia comptoniana	Opportunistic	
**Heliophila pusilla*	Opportunistic	
Jacksonia furcellata	Opportunistic	
Kunzea glabrescens	Opportunistic	
Leucopogon propinquus	Opportunistic	
**Lupinus cosentinii*	Opportunistic	
**Pelargonium capitatum*	Opportunistic	
**Schinus terebinthifolia*	Opportunistic	

QUADRAT 4-2

GPS: 388853E; 6424326N
Vegetation Description: Forest of *Eucalyptus marginata* subsp. *marginata*, *Allocasuarina fraseriana* and *Banksia attenuata* over Thicket of *Kunzea glabrescens* and *Jacksonia furcellata* over Dwarf Scrub C of mixed taxa dominated by *Acacia pulchella* and *Gastrolobium calycinum* over Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by *Phlebocarya ciliata* over Open Low Sedges dominated by *Lepidosperma squamatum* in grey sand
Vegetation Condition: Very good to good

SPECIES	HEIGHT	% COVER
Acacia pulchella var. *glaberrima*	220	5
Acacia stenoptera	20	<1
**Arctotheca calendula*	30	<1
**Avena barbata*	120	<1
Banksia attenuata	1400	5
**Briza maxima*	50	<1
Burchardia umbellata	70	5
Caesia micrantha	70	10
Chamaescilla corymbosa	50	<1
Conostylis aculeata subsp. *preissii*	50	1
**Crassula colorata*	10	<1
Dasypogon bromeliifolius	50	3
Daviesia triflora	70	<1
Desmocladus flexuosa	50	1
Dianella revoluta var. *divaricata*	50	<1
Drosera erythrorhiza	2	<1

SPECIES	HEIGHT	% COVER
**Ehrharta calycina*	140	5
Eucalyptus marginata subsp. *marginata*	200	12
Gastrolobium capitatum	60	10
Hibbertia hypericoides	70	5
Hibbertia racemosa	50	<1
Hybanthus calycinus	20	<1
**Hypochaeris glabra*	50	2
**Isolepis marginata*	10	<1
Jacksonia furcellata	300	5
Kennedia prostrata	2	<1
Kunzea glabrescens	500	3
Lomandra caespitosa	30	<1
Lomandra sericea	60	<1
Lomandra suaveolens	30	<1
Lyginia barbata	70	5
Macrozamia riedlei	120	1
Mitrasacme paradoxa	10	<1
Phlebocarya ciliata	50	1
Podotheca gnaphalioides	20	<1
Pterostylis vittata	40	<1
Ptilotus drummondii	70	<1
**Romulea rosea*	50	<1
Scaevola canescens	15	<1
**Sonchus oleraceus*	50	<1
Sowerbaea multiflora	70	2
Stirlingia latifolia	70	10
Thysanotus manglesianus	twiner	<1
Tricoryne elatior	70	<1
**Trifolium campestre*	25	<1
**Ursinia anthemoides*	60	1
**Wahlenbergia capensis*	10	<1
**Zantedeschia aethiopica*	25	<1
**Acacia longifolia*	Opportunistic	
Allocasuarina fraseriana	Opportunistic	
Banksia ilicifolia	Opportunistic	
**Euphorbia terracina*	Opportunistic	
**Fumaria capreolata*	Opportunistic	
Gompholobium tomentosum	Opportunistic	
Hardenbergia comptoniana	Opportunistic	
Hypocalymma robustum	Opportunistic	
Jacksonia sternbergiana	Opportunistic	
Lepidosperma squamatum	Opportunistic	
Leucopogon propinquus	Opportunistic	
Lomandra hermaphrodita	Opportunistic	
Pimelea rosea	Opportunistic	

QUADRAT 7-1

GPS: 388488E; 6424072N
Vegetation Description: Woodland of *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* over Low Forest A of *Banksia attenuata* and *Banksia ilicifolia* over Scrub of *Kunzea glabrescens* and *Jacksonia furcellata* over Dwarf Scrub C dominated by *Acacia pulchella* var. *glaberrima*, *Acacia stenoptera*, *Xanthorrhoea brunonis* and *Gastrolobium capitatum* over Very Open Herbs of *Lomandra hermaphrodita* and *Lomandra caespitosa* over Dense Tall Grass dominated by **Ehrharta calycina* in grey sand.
Vegetation Condition: Good to degraded

SPECIES	HEIGHT	% COVER
Acacia pulchella var. *glaberrima*	120	<1
Banksia attenuata	600	1
Banksia ilicifolia	800	20
Banksia menziesii	600	1
**Briza maxima*	50	10
Burchardia umbellata	70	1
Caesia micrantha	50	25
Caladenia flava	30	<1
Chamaescilla corymbosa	50	3
Conostylis aculeata subsp. *preissii*	40	<1
Dampiera linearis	15	<1
Dasypogon bromeliifolius	60	1
Dianella revoluta var. *divaricata*	60	<1
**Disa bracteata*	25	<1
Drosera macrantha	twiner	<1

SPECIES	HEIGHT	% COVER
**Ehrharta calycina*	100	10
Gastrolobium capitatum	50	<1
Gompholobium tomentosum	60	<1
**Hypochaeris glabra*	60	<1
Kunzea glabrescens	600	5
Lepidosperma squamatum	70	<1
Leucopogon propinquus	20	<1
Lomandra hermaphrodita	30	<1
Lomandra suaveolens	20	<1
Lyginia barbata	70	<1
Microtis media	50	<1
Pimelea rosea	60	<1
Podolepis gracilis	40	<1
Pterostylis vittata	25	<1
Sowerbaea multiflora	60	3
Stylidium ciliatum	50	<1
Tetraria octandra	70	15
Tetrarrhena laevis	50	<1
Thysanotus arenarius	40	5
Thysanotus manglesianus	25	<1
Trachymene pilosa	10	<1
**Ursinia anthemoides*	70	1
Xanthorrhoea brunonis	100	10
Acacia stenoptera	Opportunistic	
Allocasuarina fraseriana	Opportunistic	
Austrostipa campylachne	Opportunistic	
Corymbia calophylla	Opportunistic	
Dichopogon capillipes	Opportunistic	
Drosera erythrorhiza	Opportunistic	
Drosera stolonifera	Opportunistic	
Eucalyptus marginata subsp. *marginata*	Opportunistic	
**Euphorbia terracina*	Opportunistic	
**Gladiolus caryophyllaceus*	Opportunistic	
Hakea lissocarpha	Opportunistic	
Hibbertia hypericoides	Opportunistic	
Jacksonia furcellata	Opportunistic	
Lomandra caespitosa	Opportunistic	
**Lysimachia arvensis*	Opportunistic	
Macrozamia riedlei	Opportunistic	
Ptilotus drummondii	Opportunistic	
**Sonchus oleraceus*	Opportunistic	
Xanthosia huegelii	Opportunistic	

QUADRAT 7-2

GPS: 388536E; 6424049N
Vegetation Description: Woodland of *Corymbia calophylla*, *Allocasuarina fraseriana* and *Eucalyptus marginata* subsp. *marginata* over Low Forest A of *Banksia attenuata* over Dwarf Scrub D of *Hibbertia hypericoides*, *Petrophile linearis*, *Calytrix flavescens*, *Daviesia triflora* and *Gompholobium tomentosum* over Dense Tall Grass dominated by **Ehrharta calycina* in grey sand
Vegetation Condition: Good to degraded

SPECIES	HEIGHT	% COVER
Acacia pulchella var. *glaberrima*	150	1
Allocasuarina fraseriana	800	5
**Arctotheca calendula*	15	<1
Bossiaea eriocarpa	60	1
**Briza minor*	30	<1
Burchardia umbellata	70	5
Caesia micrantha	60	3
Calytrix flavescens	10	<1
Chamaescilla corymbosa	50	3
Conostylis aculeata subsp. *preissii*	40	1
Daviesia triflora	70	<1
Desmocladus flexuosa	30	<1
Dianella revoluta var. *divaricata*	70	1
Dichopogon preissii	50	<1
Drosera erythrorhiza	2	<1
Drosera stolonifera	40	<1

SPECIES	HEIGHT	% COVER
**Ehrharta calycina*	140	15
Eucalyptus marginata subsp. *marginata*	600	10
Gastrolobium capitatum	70	<1
Hibbertia hypericoides	60	5
**Hypochaeris glabra*	50	3
Jacksonia furcellata	140	1
**Juncus bufonius*	5	<1
Leucopogon propinquus	80	3
**Lolium multiflorum*	70	<1
Lomandra caespitosa	25	3
Lomandra hermaphrodita	40	<1
Lomandra suaveolens	30	<1
Lyginia barbata	70	1
Macrozamia riedlei	90	2
Podolepis gracilis	40	<1
**Romulea rosea*	70	5
**Silene gallica*	5	<1
Sowerbaea multiflora	50	5
Thysanotus patersonii	twiner	<1
**Trifolium campestre*	30	<1
**Ursinia anthemoides*	60	5
Xanthorrhoea brunonis	120	5
Banksia attenuata	Opportunistic	
Banksia ilicifolia	Opportunistic	
Banksia menziesii	Opportunistic	
Corymbia calophylla	Opportunistic	
**Crassula decumbens*	Opportunistic	
Glischrocaryon aureum	Opportunistic	
Gompholobium tomentosum	Opportunistic	
Kunzea glabrescens	Opportunistic	
Petrophile linearis	Opportunistic	
Rhagodia baccata	Opportunistic	

QUADRAT 312

GPS: 388168E; 6424525N
Vegetation Description: Woodland of *Eucalyptus gomphocephala* over Scrub of *Acacia rostellifera* over Dense Tall Grass of **Ehrharta calycina* in grey sand
Vegetation Condition: Degraded to completely degraded

SPECIES	HEIGHT	% COVER
Acacia rostellifera	275	12
Austrostipa flavescens	150	<1
**Acetosella vulgaris*	30	5
**Arctotheca calendula*	10	<1
**Bromus diandrus*	70	10
**Carpobrotus edulis*	5	5
**Cerastium glomeratum*	10	<1
**Ehrharta calycina*	120	25
**Ehrharta longiflora*	60	10
Eucalyptus gomphocephala	2000	10
Eucalyptus species seedlings	100	20
**Euphorbia terracina*	60	20
**Fumaria capreolata*	twiner	<1
Geranium retrorsum	30	<1
**Lolium multiflorum*	60	2
**Lupinus angustifolium*	60	<1
**Lupinus cosentinii*	60	<1
**Oxalis corniculata*	15	<1

SPECIES	HEIGHT	% COVER
**Rumex brownii*	80	<1
**Solanum nigrum*	50	<1
Solanum symonii	130	<1
**Acacia iteaphylla*	Opportunistic	
Acacia pulchella var. *glaberrima*	Opportunistic	
**Avena barbata*	Opportunistic	
Corymbia calophylla	Opportunistic	
**Erodium botrys*	Opportunistic	
Juncus pallidus	Opportunistic	
**Lagurus ovatus*	Opportunistic	
**Oxalis pes-caprae*	Opportunistic	
Pimelea rosea	Opportunistic	
**Romulea rosea*	Opportunistic	
**Solanum laciniatum*	Opportunistic	
**Trifolium campestre*	Opportunistic	
**Ursinia anthemoides*	Opportunistic	

Another photograph of Lot 312 illustrating the completed degraded condition of most of this lot.. The red colouration is **Ehrharta calycina*

QUADRAT 313-1

GPS: 377808E; 6424595N
Vegetation Description: Open Woodland of *Eucalyptus gomphocephala* over Thicket of *Acacia rostellifera* and **Rhamnus alaternus* over Dense Tall Grass of **Ehrharta calycina* in grey sand
Vegetation Condition: Degraded to completely degraded

SPECIES	HEIGHT	% COVER
Acacia rostellifera	450	85
**Asparagus asparagoides*	twiner	<1
Clematis microphylla	twiner	<1
**Ehrharta calycina*	130	25-95
**Ehrharta longiflora*	55	5
Eucalyptus gomphocephala	1800	10
**Euphorbia terracina*	60	3
**Hypochaeris glabra*	50	1
**Arctotheca calendula*	Opportunistic	
**Bromus diandrus*	Opportunistic	
**Dischisma capitatum*	Opportunistic	
**Lupinus cosentinii*	Opportunistic	
**Oxalis pes-caprae*	Opportunistic	
**Rhamnus alaternus*	Opportunistic	

QUADRAT 313-2

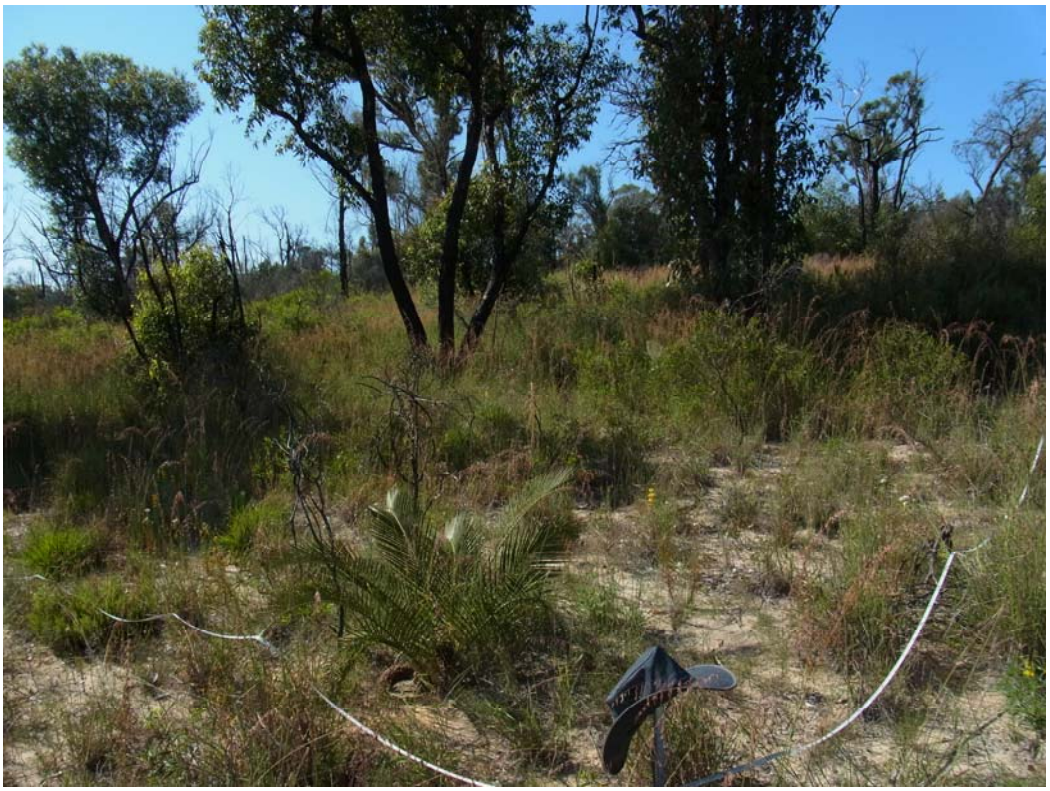
GPS: 387871E; 6424294N
Vegetation Description: Open Low Woodland B of *Banksia attenuata* and *Banksia menziesii* over Scrub of *Jacksonia furcellata* over Open Low Scrub B of *Acacia pulchella* var. *glaberrima* and *Macrozamia riedlei* over Dense Tall Grass of **Ehrharta calycina* over Open herbs of *Corynotheca micrantha* and *Conostylis aculeata* subsp. *preissii* in yellow sand
Vegetation Condition: Good

SPECIES	HEIGHT	% COVER
Acacia pulchella var. *glaberrima*	60	2
**Arctotheca calendula*	10	<1
Banksia attenuata	600	2
Banksia menziesii	600	2
**Brassica tournefortii*	60	<1
**Briza maxima*	50	1
Conostylis aculeata subsp. *preissii*	50	30
Corynotheca micrantha	50	1
Daviesia triflora	70	1
**Dischisma capitatum*	5	5
**Ehrharta calycina*	100	15
**Erodium botrys*	20	<1
**Gladiolus caryophyllaceus*	50	<1
Gompholobium tomentosum	60	1
**Hypochaeris glabra*	50	15
Jacksonia furcellata	600	25
**Lupinus luteus*	40	5

SPECIES	HEIGHT	% COVER
**Petrorhagia dubia*	30	1
**Silene gallica*	40	3
**Ursinia anthemoides*	20	10
**Wahlenbergia capensis*	30	<1
Eucalyptus marginata subsp. *marginata*	Opportunistic	
**Lupinus cosentinii*	Opportunistic	
Macrozamia riedlei	Opportunistic	
Melaleuca systena	Opportunistic	

QUADRAT 313-3

GPS: 387966E; 6424282N
Vegetation Description: Open Low Woodland A of *Eucalyptus marginata* subsp. *marginata* over Heath B of *Acacia rostellifera* over Dense Tall Grass of **Ehrharta calycina* over Open Herbs of *Lomandra suaveolens* and *Conostylis aculeata* subsp. *preissii* in yellow sand
Vegetation Condition: Good to degraded



SPECIES	HEIGHT	% COVER
Acacia rostellifera	170	35-60
Conostephium pendulum	50	<1
Conostylis aculeata subsp. *preissii*	50	1
Corynotheca micrantha	50	5
**Crassula colorata*	10	<1
Dichopogon preissii	30	<1
**Ehrharta calycina*	120	45
Eucalyptus marginata subsp. *marginata*	1200	10
Glischrocaryon aureum	70	<1
Gompholobium tomentosum	20	<1
**Heliophila pusilla*	20	<1
Hibbertia hypericoides	60	1
**Hypochaeris glabra*	60	1
Jacksonia sternbergiana	175	1
Lomandra suaveolens	15	<1
**Lupinus luteus*	30	<1
**Lupinus mutabilis*	50	<1
Macrozamia riedlei	150	2

SPECIES	HEIGHT	% COVER
Petrophile linearis	40	1
**Silene gallica*	50	<1
**Ursinia anthemoides*	60	<1
**Wahlenbergia capensis*	40	<1
**Arctotheca calendula*	Opportunistic	
**Bromus diandrus*	Opportunistic	
**Dischisma capitatum*	Opportunistic	
**Lolium multiflorum*	Opportunistic	
**Petrorhagia velutina*	Opportunistic	

QUADRAT 313-4

GPS: 388028E; 6424303N
Vegetation Description: Dense regrowth of *Eucalyptus gomphocephala* (<4m tall) over Heath B of *Acacia rostellifera* over Dense Tall Grass of **Ehrharta calycina* in yellow sand.
Vegetation Condition: Degraded

SPECIES	HEIGHT	% COVER
Acacia pulchella var. *glaberrima*	75	1
Acacia rostellifera	300	15
**Arctotheca calendula*	10	<1
**Crassula colorata*	10	<1
**Ehrharta calycina*	120	85
Eucalyptus gomphocephala	400	15
Eucalyptus marginata subsp. *marginata*	150	15
Glischrocaryon aureum	40	1
**Lolium multiflorum*	55	<1
**Medicago polymorpha*	10	<1
**Petrorhagia dubia*	20	<1
**Ehrharta longiflora*	Opportunistic	
Macrozamia riedlei	Opportunistic	
Xanthorrhoea brunonis	Opportunistic	

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APPENDIX C – BOTANICAL ASSESSMENT REPORT FOR LOT 5 BALDIVIS ROAD (BENNETT ENVIRONMENTAL CONSULTING, 2011)

Botanical Assessment of Lot 5
Baldivis Road

Prepared for:
COTERRA ENVIRONMENT
19/336 Churchill Avenue,
SUBIACO WA 6008

Prepared by:
Bennett Environmental Consulting Pty Ltd

Sollya heterophylla

PO Box 341
KALAMUNDA 6926

April 2011

STATEMENT OF LIMITATIONS

Scope of Services

This report ("the report") has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Eleanor Bennett ("the Author"). In some circumstances a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services.

Reliance on Data

In preparing the report, the Author has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise stated in the report, the Author has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. The Author will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to the Author.

Environmental Conclusions

In accordance with the scope of services, the Author has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

The conclusions are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. Also it should be recognised that site conditions, can change with time.

Within the limitations imposed by the scope of services, the field assessment and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and no other party. The Author assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of the Author or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

Other Limitations

The Author will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report. The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in the report nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

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SUMMARY

Bennett Environmental Consulting Pty Ltd undertook a level 1 vegetation survey (Environmental Protection Authority, 2004) of Lot 5 Baldivis Road on 6th April 2011.

The dominant vegetation of the remnant bushland was: Forest of *Eucalyptus marginata* subsp. *marginata, Allocasuarina fraseriana* and *Banksia attenuata* over Open Low Scrub B of *Acacia pulchella* and *Macrozamia riedlei* over Dense Tall Grass dominated by **Ehrharta calycina* over Open Dwarf Scrub C dominated by *Hibbertia hypericoides* over Very Open Herbs dominated by *Phlebocarya ciliata.*
Vegetation condition was good to degraded as most of the understorey had been replaced by grass weeds.

The second most common vegetation unit was:
Forest of *Eucalyptus marginata* subsp. *marginata, Allocasuarina fraseriana* and *Banksia attenuata* over Open Scrub of *Kunzea glabrescens* and *Jacksonia furcellata* over Open Dwarf Scrub C of mixed taxa dominated by *Acacia pulchella* and *Gastrolobium capitatum* over Tall Grass dominated by **Ehrharta calycina* over Very Open Herbs dominated by *Phlebocarya ciliata* over Open Low Sedges dominated by *Desmocladus flexuosus.*
Vegetation condition was degraded.

The final vegetation unit was:
Open Tall Woodland of *Eucalyptus gomphocephala* over weeds and bare ground. This vegetation unit was restricted along the edge of the property facing Baldivis Road.
Vegetation condition was completely degraded although the Tuarts were healthy and of a good height.

A spring survey is recommended as there is the potential for additional ephemeral and annual plants to be recorded.

1 INTRODUCTION

1.1 Background

Bennett Environmental Consulting Pty Ltd (2011) was contracted by Coterra Environment to undertake a Level 1 survey of Lot 5 (See Figure 1).

Figure 1. Location of the Lot 5 (extracted from Google Maps)

1.2 Scope of Works

The requirements for this project were to:

i. Undertake a Level 1 vegetation survey (Environmental Protection Authority, 2004); and to

ii. Search for and record all significant species at the site.

2 BACKGROUND INFORMATION

2.1 Geology and Landform

The survey lot is located in the Spearwood Dunes, which consists of a core of limestone overlain by yellow sand. Differential wind erosion has produced two different landscapes but the site is within the Karrakatta unit, which is described as having deep yellow brown sands (Churchward and McArthur, 1980).

2.2 Vegetation

The Interim Biogeographical Regionalisation for Australia (IBRA) (Thackway and Cresswell, 1995) recognizes 85 bioregions. The IBRA is used as the common unit to compare biological and biophysical attributes. Bioregions represent a landscape-based approach to classifying the land surface and each region is defined by a set of major environmental influences, which shape the occurrence of flora and fauna and their interaction with the physical environment. Baldivis occurs in the Swan Coastal Plain, which has been subdivided into the northern section and the southern section. The study area is located in the southern section, abbreviated SWA2 (Mitchell *et al*., 2002).

The survey lot is mapped as a Medium Woodland of *Eucalyptus gomphocephala* and *Eucalyptus marginata* (abbreviated e2,4Mi). Shepherd *et al.* (2002) have determined the pre-European and current extent of the vegetation associations described by Beard. In addition they have assessed the percentage of each vegetation association remaining, the amount in IUCN reserves and the percentage in other reserves. The pre-European area of e2,3Mi is estimated to be 79,001ha, the current extent 18,398ha which represents 23.2% remaining vegetated of which 38% is included in conservation.

Heddle *et al.* (1980) described the vegetation complexes of the Darling System at a scale of 1: 250 000. There was found to be a distinct pattern of plant distribution linked to landforms, soils and climate. The most obvious trend was associated with increasing aridity from west to east on the Darling Plateau. The vegetation changes observed were a decrease in height and percentage cover of the tallest stratum and a distinct change in floristics. Baldivis occurs between two vegetation complexes. These are:

- Karrakatta Complex – Central and South. The vegetation is predominantly an Open Forest of *Eucalytus gomphocephala – Eucalyptus marginata* subsp. *marginata – Corymbia calophylla* and Woodland of *Eucalyptus marginata* subsp. *marginata* and *Banksia* species.
- Cottesloe Conmplex – Central and South. The vegetation is a mosaic consisitng of a Woodland of *Eucalyptus gomphocephala*; an Open Forest of *Eucalyptus gomphocephala – Eucalyptus marginata* subsp. *marginata – Corymbia calopphylla;* and a Closed Heath on the limestone outcrops..

Bush Forever (Government of Western Australia, 2000) states that 18% of the original area of the Karakatta Complex Central and South and 36% of the Cottesloe Complex Central and South remain vegetated within the Swan Coastal Plain. The area proposed for protection (Government of Western Australia, 2000) is 8% and 18% for Karakatta Complex Central and South and Cottesloe Complex Central and South respectively.

2.3 Threatened Ecological Communities

An ecological community is a naturally occurring biological assemblage that occurs in a particular type of habitat. A Threatened Ecological Community is one which falls into one of the following categories, presumed totally destroyed, critically endangered, endangered or vulnerable (Department Environment and Conservation, 2011b).

A possible ecological community which does not meet the above is added to the Priority Ecological Community List. Priorities 1, 2, and 3 are adequately known but are not currently believed to be threatened. Those that have recently been removed from the threatened list are listed as Priority 4. Conservation dependent ecological communities are placed in Priority 5.

2.4 Significant Flora

Prior to undertaking the field work a search was undertaken of the Department of Conservation and Environment Rare Flora Database using NatureMap (Department of Environment and Conservation, 2011c) for a 40km radius from 32°18’36”S and 115°48’56”E No Declared Rare or Priority Flora were recorded during this search.

Table 1. Code and description of Rare and Priority Flora (Department Environment and Conservation, 2011a)

Code	Declared Rare and Priority Flora Categories
R	DRF (Declared Rare Flora) -Extant Taxa. Taxa, which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection.
X	DRF (Declared Rare Flora) -Presumed Extinct Taxa. Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently.
1	Priority One -Poorly Known Taxa. Taxa, which are known from one or a few (generally <5) populations, which are under threat.
2	Priority Two -Poorly Known Taxa. Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat.
3	Priority Three -Poorly Known Taxa. Taxa, which are known from several populations, at least some of which are not believed to be under immediate threat.
4	Priority Four -Rare Taxa. Taxa which are considered to have been adequately surveyed and which whilst being rare, are not currently threatened by any identifiable factors.

Table 1 presents the definitions of Declared Rare and the four Priority Flora ratings under the Wildlife Conservation Act (1950) as extracted from Department of Environment and Conservation (2011a). Table 2 presents the definitions of the threatened species under the Environmental Protection and Biodiversity Conservation Act, 1999 (Department of Sustainability, Environment, Water, Populations and Communities, 2011).

Table 2. Categories of Threatened Flora Species (Department of Sustainability, Environment, Water, Populations and Communities, 2011)

Code	Declared Rare and Priority Flora Categories
Ex	Extinct Taxa which at a particular time if, at that time, there is no reasonable doubt that the last member of this species has died.
ExW	Extinct in the Wild Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	Critically Endangered Taxa which at any particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	Endangered Taxa, which is not critically endangered, and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	Vulnerable Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	Conservation Dependent Taxa which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

3. METHODS

Transects were walked through the remnant bushland listing the vegetation units in the area and the dominant taxa. As this was being undertaken the bushland was searched for Declared Rare and Priority Flora. As a Level 1 vegetation survey was required no quadrats were recorded. The vegetation at the site is described using the vegetation classification of Muir (1977) as set out in Table 3.

Table 3 Vegetation Classification (from Muir, 1977)

LIFE FORM / HEIGHT CLASS	Canopy Cover			
	DENSE 70 % - 100%	**MID DENSE 30% - 70%**	**SPARSE 10% - 30%**	**VERY SPARSE 2% - 10%**
Trees > 30 m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
Trees 15 – 30 m	Dense Forest	Forest	Woodland	Open Woodland
Trees 5 – 15 m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
Trees < 5 m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
Mallee (tree form)	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Mallee (shrub form)	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs > 2 m	Dense Thicket	Thicket	Scrub	Open Scrub
Shrubs 1.5 – 2 m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
Shrubs 1 - 1.5 m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
Shrubs 0.5 – 1 m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
Shrubs 0 - 0.5 m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
Mat plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
Hummock grass	Dense Hummock Grass	Mid-Dense Hummock Grass	Hummock Grass	Open Hummock Grass
Bunch grass > 0.5 m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
Bunch grass < 0.5 m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
Herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
Sedges > 0.5 m	Dense Tall sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
Sedges < 0.5 m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
Ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
Mosses, liverworts	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

4. RESULTS

Field work for Lot 5 was undertaken on 6th April 2011. Lot 5 has Lots 4 and 8 on the north and west sides respectively, Baldivis Road on the east and Ingram Road to the south.

4.1 Vegetation

About half of Lot 5 had remnant vegetation present with the remainder being utilized as a salvage yard (degraded in Figure 2).

The dominant vegetation at the site (5-1) was a Forest of *Eucalyptus marginata* subsp. *marginata*, *Allocasuarina fraseriana* and *Banksia attenuata* over Open Low Scrub B of *Acacia pulchella* and *Macrozamia riedlei* over Open Dwarf Scrub C dominated by *Hibbertia hypericoides* over Dense Tall Grass dominated by **Ehrharta calycina* over Very Open Herbs dominated by *Phlebocarya ciliata* in grey sand.
Vegetation Condition 4-5 due to dense tree cover – up to 40%.

Other vegetation unit at the site (5-2) – Forest of *Eucalyptus marginata* subsp. *marginata*, *Allocasuarina fraseriana* and *Banksia attenuata* over Open Scrub of *Kunzea glabrescens* and *Jacksonia furcellata* over Open Dwarf Scrub C of mixed taxa dominated by *Acacia pulchella* and *Gastrolobium capitatum* over Tall Grass dominated by **Ehrharta calycina* over Very Open Herbs dominated by *Phlebocarya ciliata* over Open Low Sedges dominated by *Desmocladus flexuosus* in grey sand.
Occasional plants of *Lomandra hermaphrodita* and *Lomandra caespitosa* were recorded from 5-2.
Vegetation Condition 4-5.

On eastern edge at Baldivis Road (5-3) - Open Tall Woodland of *Eucalyptus gomphocephala* over weeds and bare ground in grey sand.
Vegetation Condition 6.

Figure 2. Vegetation Units at Lot 5 (Extracted from Google Maps)

Allocasuarina fraseriana and many of the *Banksia attenuata* trees were of a good height but some of the *Eucalyptus marginata* subsp. *marginata* trees were multi-stemmed at the base, indicating that historically in the past the parent tree had been felled. This is not an uncommon occurrence within metropolitan Perth and does not detract from the overall value of the bushland.

There were many dead *Eucalyptus marginata* subsp. *marginata* and *Banksia attenuata* trees scattered through the remnant vegetation. These deaths could be caused by several factors including the dry winter followed by the long hot summer. The understorey was dominated by the grass weed **Ehrharta calycina* (Perennial veldt grass). The list of species recorded during the survey is provided in Appendix A.

Photograph 1. Illustrating deaths of trees and dense cover of grass weeds

4.2 Vegetation Condition

Bushland has been historically subject to ongoing degradation and is especially susceptible to disturbances arising as a result of indirect impacts from surrounding developments and human

activity. Degradation is caused by a wide range of factors, including isolation, edge effects, weed invasion, plant diseases, changes in fire frequency, landscape fragmentation, increased predation on native fauna by feral animals, decrease in species richness and general modification of ecological function. These issues can affect the biodiversity rating and ecological viability of areas of remnant vegetation and should be assessed in line with conservation values.

Vegetation condition was rated according to the vegetation condition scale used in Keighery (1994). The vegetation condition of the remnant vegetation at the survey site was mainly good to degraded with the salvage yard, including the Tuarts, completely degraded. Rubbish had been dumped mainly around the perimeter of the bushland. The vegetation condition of the site is mapped in Figure 3.

Table 4. Explanation of Vegetation Condition Rating (Keighery, 1994)

Rating	Description	Explanation
1	Pristine	Pristine or nearly so, no obvious signs of disturbance.
2	Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
3	Very Good	Vegetation structure altered, obvious signs of disturbance.
4	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it.
5	Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management.
6	Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.

Figure 3. Vegetation condition at Lot 5 (Extracted from Google Maps)

5. DISCUSSION

Lot 5 had the large area of remnant vegetation remaining but the understorey appeared to have been largely replaced by the grass weed, Perennial veldt grass (**Ehrharta calycina*). A spring survey may record additional ephemeral and annual species. The tree cover was good, up to 40% cover, but there were many deaths of Jarrah (*Eucalyptus marginata* subsp. *marginata*) and Narrow-leaf Banksia (*Banksia attenuata*) recorded across the area.

It is recommended that the Tuarts along the road edge at Lot 5 be considered for retention with any proposed development as the trees were of a good height and in reasonable condition. It is also recommended that a section of the remnant bushland along the northern boundary with the adjoining property be retained as public open space.

6. REFERENCES

Beard, J.S. (1981). *Vegetation Survey of Western Australia Swan.* University of Western Australia Press, Crawley

Beard, J.S. (1990). *Plant Life of Western Australia*. Kangaroo Press, Kenthurst NSW

Bennett Environmental Consulting Pty Ltd (2011). *Botanical Assessment of Selected Sites along Baldivis Road and Fifty Road.* Unpublished report for Coterra Environment, Subiaco, Western Australia

Biggs, E.R. and Wilde, S.A. (1980). *Geology, Mineral Resources and Hydrology of the Darling System, Western Australia*. Department of Conservation and Environment, Perth, Western Australia

Churchward, H.M. and McArthur, W.M. (1980). *Landform and Soils of the Darling System* In *Atlas of Natural Resources, Darling System, Western Australia*. Department of Conservation and Environment, Perth, Western Australia

Commonwealth of Australia (2001). *National Objectives and Targets for Biodiversity Conservation 2001-2005.* Environment Australia, Department of Environment and Heritage, Canberra

Department of Environment and Conservation (2011a). *Declared Rare and Priority List for Western Australia.* Published list by the Department of Conservation and Land Management, Western Australia

Department of Environment and Conservation (2011b). *List of Threatened Ecological Communities on the Department of Environment and Conservation Threatened Ecological Communities (TEC) Database endorsed by the Minister for the Environment.* http://www.naturebase.net/plants_animals/watscu/pdf/tec/endorsed_tec_list_jan04.pdf

Department of Environment and Conservation (2011c). NatureMap. http://naturemap.dec.wa.gov.au/

Department of Sustainability, Environment,. Water, Populations and Communities (2011). *EPBC Act List of Threatened Flora.* http://www.deh.gov.au/

Environmental Protection Authority (2000). *Environmental Protection of Native Vegetation in Western Australia. EPA Position Statement No. 2.* EPA, Perth

Environmental Protection Authority (2004). *Guidance for the Assessment of Environmental Factors, Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia. No. 51.* EPA, Perth

Gibson, N., Keighery, B.J., Keighery, G.J., Burbidge, A.H. and Lyons, M.N. (1994). *A Floristic Survey of the southern Swan Coastal Plain.* Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)

Government of Western Australia (2000). *Bush Forever*. Department Environmental Protection, WA

Havel, J.J. (2002). *Review of Management Options of Poorly Represented Vegetation Complexes*. Unpublished report for the Conservation Commission

Hearn, R., Williams, K., Comer, S. and Beecham, B. (2002). *Jarrah Forest 2 (JF2 – Southern Jarrah Forest subregion)* In *A Biodiversity Audit of Western Australia's 53 Biogeographical subregions.* Department of Conservation and Land Management

Heddle, E.M., Loneragan, O.W. and Havell, J.J. (1980). *Vegetation of the Darling System* In *Atlas of Natural Resources, Darling System, Western Australia*. Department of Conservation and Environment, Perth, Western Australia

Hussey, B.M.J., Keighery, G.J., Cousens, R.D., Dodd, J. and Lloyd, S.G. (1997). *Western Weeds – A guide to the weeds of Western Australia.* Plant Protection Society of Western Australia

Keighery, B.J. (1994). *Bushland Plant Survey: a Guide to Plant Community Surveys for the Community.* Wildflower Society of Western Australia (Inc.) Nedlands, Western Australia

Mitchell, D., Williams, K. and Desmond, A. (2002). *Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion)* In *A Biodiversity Audit of Western Australia's 53 Biogeographical subregions*. Department of Conservation and Land Management

Muir, B.G. (1977). *Biological Survey of the Western Australian Wheatbelt. Part II: Vegetation and habitat of Bendering Reserve*. Records of the Western Australian Museum, Supplement No. 3

Shepherd, D.P., Beeston, G.R. and Hopkins, A.J.M. (2002). *Native Vegetation in Western Australia Extent, Type and Status. Resource Management Technical Report 249.* Department of Agriculture, Government of Western Australia

Thackway, R. and Cresswell I. D. (1995). *An Interim Biogeographical Regionalisation for Australia: a Framework for Setting Priorities in the National Reserves System Cooperative Program.* Australian Nature Conservation Agency, Canberra, ACT

Western Australian Herbarium (2011). *Florabase*. Department of Environment and Conservation. http://www.calm.wa.gov.au/science/florabase.html

Western Australian Herbarium (2010). *Max*. Department of Environment and Conservation

APPENDIX A

List of Species Recorded From Each Vegetation Unit

SPECIES	VEGETATION UNIT		
	5-1	5-2	5-3
TREES			
Allocasuarina fraseriana	☑	☑	
Banksia attenuata	☑	☑	
Banksia ilicifolia		☑	
Banksia menziesii	☑		
Eucalyptus gomphocephala			☑
Eucalyptus marginata subsp. *marginata*	☑	☑	
SHRUBS			
Acacia pulchella	☑	☑	
Acacia stenoptera	☑	☑	
Conostephium preissii	☑		
Gastrolobium capitatum	☑		
Hibbertia hypericoides	☑	☑	
Hypocalymma robustum	☑		
Jacksonia furcellata		☑	
Jacksonia sternbergiana	☑		
Kunzea glabrescens		☑	
Macrozamia riedlei	☑	☑	
**Pelargonium capitatum*		☑	
Persoonia saccata	☑		
Petrophile linearis	☑		
**Ricinus communis*		☑	
Xanthorrhoea brunonis	☑	☑	
TWINER			
Hardenbergia comptoniana	☑	☑	
HERBS			
**Acetosella vulgaris*		☑	
Burchardia congesta	☑	☑	
**Carpobrotus edulis*	☑	☑	☑
Conostylis aculeata	☑	☑	
Dasypogon bromeliifolius	☑	☑	
Dianella divaricata	☑	☑	
Lomandra caespitosa	☑	☑	
Lomandra hermaphrodita		☑	
**Lupinus cosentinii*	☑	☑	
Opercularia hispidula	☑		
Phlebocarya ciliata	☑	☑	
GRASSES			
**Ehrharta calycina*	☑	☑	☑
**Eragrostis curvula*	☑	☑	☑
SEDGES			
Desmocladus flexuosa	☑	☑	

NOTE: * denotes the plant is a weed

APPENDIX D – LEVEL 1 FAUNA SURVEY AND GRACEFUL SUN-MOTH SURVEY (BAMFORD CONSULTING ECOLOGISTS)

Fauna Assessment of Lots along Fifty and Eighty Roads, Baldivis

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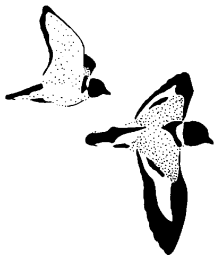

23rd May 2011

EXECUTIVE SUMMARY

Spatial Property Group, on behalf of the landowners (Carcione Group of Companies), are currently progressing the proposed development of Lots 313 and 312 Fifty Road, and Lots 2, 4, 7, and 8 Eighty Road, Baldivis. As part of the review of environmental constraints across these landholdings, Bamford Consulting Ecologists was commissioned by Coterra Environment, on behalf of the Spatial Property Group, to conduct a fauna survey comprising a literature review and site inspection to identify fauna and habitat values.

The key objectives of this fauna survey were to:

- conduct a desktop review to identify the vertebrate fauna assemblage that may be present and review this with respect to fauna habitats present;
- investigate the likelihood of conservation significant species being present, and locate and record evidence of these;
- identify and describe general vegetation and soil associations ("habitats") present, particularly those that are significant or fragile; and
- identify potential impacts upon fauna and provide recommendations for the mitigation of these.

The desktop survey identified 168 vertebrate fauna species as potentially occurring in the Baldivis study areas. A total of 13 native and three introduced fauna species were recorded during the site inspection. This comprised 10 native and two introduced birds, one native and one introduced mammal and two native reptile species. Conservation significant species recorded included a number of CS3 bird species listed as declining on the Swan Coastal Plain. There is habitat suitable for at least one invertebrate species of conservation significance i.e. the Graceful Sunmoth-Moth *Synemon gratiosa*, although detailed surveys in March 2011 did not record the species, indicating that it does not occur in the study area.

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1. INTRODUCTION

1.1 Introduction

The Spatial Property Group, on behalf of the landowners (Carcione Group of Companies), are proposing to develop Lots 312 and 313 Fifty Road, and Lots 2, 4, 7 and 8 Eighty Road, Baldivis (see Figure 1) for urban development. The site is 52.3 ha in size and is located between Fifty Road, Eighty Road and Baldivis Road, Baldivis, in the City of Rockingham, approximately 40 km south of Perth.

Bamford Consulting Ecologists (BCE) was commissioned by Coterra Environment on behalf of Spatial Property Group to undertake a site inspection, targeted fauna search and assessment of significant habitats within the study areas.

1.2 Study Objectives

The objectives of fauna studies as outlined in the EPA's Guidance Statement No. 56 – *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (2004) are broadly to determine the fauna values of a site and the likely impacts of a proposed development. This provides government agencies with the information needed to assess the significance of impacts under state and federal legislation. The key objectives of this fauna survey are to:

- conduct a desktop review to identify the vertebrate fauna assemblage that may be present and review this with respect to fauna habitats present;
- investigate the likelihood of conservation significant species being present within the site, and locate and record evidence of these;
- identify and describe general vegetation and soil associations ("habitats") present, particularly those that are significant or fragile; and
- identify potential impacts upon fauna and provide recommendations for the mitigation of these.

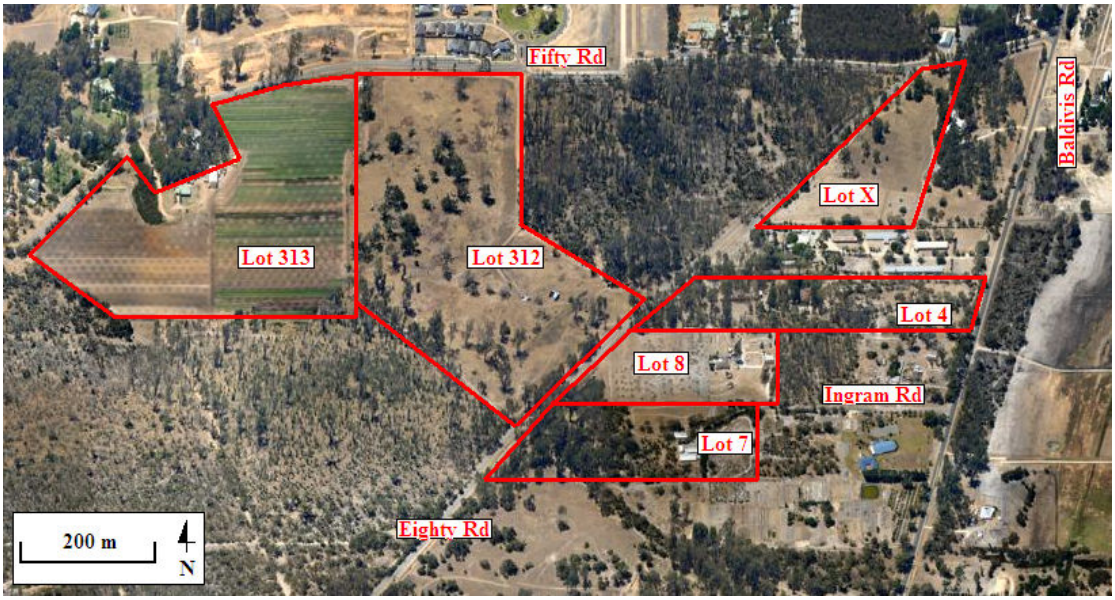

Figure 1. The location of Lots within the Baldivis study area.

2. BACKGROUND

2.1 Description and vegetation of the project areas

Eighty Rd

Lot 2: This lot covers an area of approximately 4ha. It is largely cleared with a high density of weeds and some introduced tree species.

Lot 4: This lot covers an area of approximately 5.7ha. It is partly cleared with some areas of slightly degraded remnant vegetation, including numerous mature Tuarts that have the potential to provide nesting hollows for conservation significant *Calyptorhynchus* spp. Cockatoos and other species.

Lot 7: This lot covers an area of approximately 4.3ha and is partly cleared with remnant vegetation in relatively good condition despite significant weed coverage. It also supports a number of mature Eucalypt/*Corymbia* trees that have the potential to provide nesting hollows for conservation significant *Calyptorhynchus* spp. Cockatoos and other species.

Lot 8: This lot covers an area of approximately 3.4ha and is almost completely cleared, except for a very small dam/soak in the south-west corner vegetated with introduced grasses and *Typha* sp.

Fifty Rd

Lot 312: This lot covers an area of approximately 17.9 ha. The native understorey has been removed, but a number of mature remnant trees have been retained. Many of these potentially provide habitat viability such as nesting hollows to a range of fauna species, including conservation significant bird species.

Lot 313: This lot covers an area of approximately 15.5ha and is currently used for market gardening.

The remnant native vegetation present within these study areas predominantly consists of a mixed Tuart (*Eucalyptus gomphocephala*), Jarrah (*E. marginata*) and Marri (*Corymbia calophylla*) Woodland over mixed shrubland. Adjacent uncleared areas were more intact with a more diverse shrub layer including *Banksia*, *Jacksonia* and *Acacia* species.

2.2 Assessment of Conservation Significance

The conservation status of fauna species in Australia is assessed under Commonwealth and State Acts such as the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) and the *Western Australian Wildlife Conservation Act* 1950 (Wildlife Conservation Act). In addition, the Western Australian DEC recognises priority levels, while local populations of some species may be significant even if the species as a whole has no formal recognition. Therefore, three broad

levels of conservation significance can be recognised and are used for the purposes of this report. A full description of the conservation significance categories, schedules and priority levels mentioned below is provided in Appendix 1. These levels are:

***Conservation Significance (CS) 1*: Species listed under State or Commonwealth Acts.**

Species listed under the EPBC Act are assigned to categories recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN) and reviewed by Mace and Stuart (1994), or are listed as migratory. Migratory species are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA), the Republic of South Korea Australia Migratory Bird Agreement (ROKAMBA), and/or the Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animals). The Wildlife Conservation Act uses a series of Schedules to classify status, but also recognizes the IUCN categories.

***Conservation Significance (CS) 2*: Species listed as Priority by the DEC but not listed under State or Commonwealth Acts.**

In Western Australia, the DEC has produced a supplementary list of Priority Fauna, being species that are not considered threatened under the Wildlife Conservation Act but for which the DEC feels there is cause for concern. Some Priority species are also assigned to the Conservation Dependent category of the IUCN.

***Conservation Significance (CS) 3*: Species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.**

This level of significance has no legislative or published recognition and is based on interpretation of distribution information, but is used here as it may have links to preserving biodiversity at the genetic level (EPA 2002). If a population is isolated but a subset of a widespread (common) species, then it may not be recognised as threatened, but may have unique genetic characteristics. Conservation significance is applied to allow for the preservation of genetic richness at a population level, and not just at a species level. Species on the edge of their range, or that are sensitive to impacts such as habitat fragmentation, may also be classed as CS3, as may colonies of waterbirds. The Western Australian Department of Environmental Protection, now DEC (2000), used this sort of interpretation to identify significant bird species in the Perth metropolitan area as part of Perth Bushplan.

In addition to these conservation levels, species that have been introduced (INT) are indicated throughout the report. Introduced species may be important to the native fauna assemblage through effects by predation and/or competition.

3. METHODS

3.1 Nomenclature and Taxonomy

As per the recommendations of the EPA in Guidance Statement No. 56 (2004), the nomenclature and taxonomic order presented in this report are based on the Western Australian Museum's *Checklist of the Vertebrates of Western Australia* (Nov 2010 update). The authorities used for each vertebrate group are: amphibians (Doughty and Maryan, 2010a) reptiles (Doughty and Maryan, 2010b), birds (Christidis and Boles 2008; Johnstone 2010), and mammals (How *et al.* 2010).

3.2 Sources of Information on Fauna in the Area

Information for this fauna assessment was drawn primarily from the DEC's Naturemap database (2011), the Birds Australia Atlas Database (Birdata; 2011) and the EPBC Protected Matters Search Tool. All databases were interrogated in February 2011 (Table 1). This information was supplemented with species expected in the area based on general patterns of distribution. Sources of information used for these general patterns were: frogs (Tyler *et al.* 2000), reptiles (Bush *et. al.* 1995; Storr *et al.* 1983, 1990, 1999 and 2002; Wilson and Swan, 2003), birds (Barrett *et al.* 2003; Johnstone and Storr 1998; Johnstone and Storr 2004; Storr 1984), and mammals (Churchill 2008; Strahan 1995; Menkhorst and Knight 2001).

Table 1. Sources of information (database searches) for desktop assessment. Note databases were accessed in February 2010.

Database	Type of records held on database	Area searched
NatureMap	Records of specimens held in the WA Museum. DEC records, Information and records on Threatened and Priority species in Western Australia. Includes historical data.	Rectangle: NW:32.24804ºS, 115.77593ºE SE:32.39557ºS, 115.88139ºE
Birds Australia Atlas Database	Records of bird observations in Australia, 1998-2011.	Species list for the 1 degree grid cell containing 32.31248ºS, 115.81482ºE.
EPBC Protected Matters Search Tool	Records on matters protected under the EPBC Act, including threatened species and conservation estate.	Point search centred on 32.31248ºS, 115.81482ºE, with a 10km buffer.

3.3 Interpretation of Species Lists

Species lists generated from the review of sources of information are generous as they include records drawn from a large region and possibly from environments not represented in the study area. Therfore, the species lists produced from the desktop assessment were reviewed on the basis of habitas present, size of area and personal experience so that species are only included if they have been observed or there is a reasonable expectation they rely on the site, even if such reliance might be seasonal or episodic. The lists also exclude some species that may have appeared in databases but are obviously likely on the site only as vagrants, such as seabirds, or for which the site has no suitable habitat, such as marine mammals.

Despite this review process, the species lists may include species that do not or rarely occur in the project area, on the basis that for the management of impacts it is better to make errors of inclusion than exclusion.

3.4 Site Inspection

The site inspection of the project area was conducted on Tuesday 1st February 2011, by Mr Brenden Metcalf (BCE) and Mr Robert Browne-Cooper (EcoLogical Australia). During the site inspection, all six lots were investigated with a focus on Lots 4, 7 and 312 as the remaining lots had little native vegetation (see Section 2.1). During the site inspection all fauna habitats encountered were recorded and opportunistic fauna observations were recorded.

The aim of the site inspection was to develop an understanding of the fauna habitats occurring within the project area, and to search for evidence of conservation significant species. Habitats present within the project area were assessed as to the likelihood of supporting species of conservation significance known to occur in the region. All fauna species observed during the site inspection were recorded.

Fauna survey techniques used during the site inspection consisted of:

- searching for evidence of significant species such as diggings and burrows, roost hollows, tracks, scats, shelters etc;
- bird sightings and other opportunistic observations;
- aural frog calls; and
- habitat assessment.

Specific information was collected on potential hollow-bearing trees e.g. Eucalypts and/or *Corymbia* with a Diameter-at-Breast-Height (DBH) of 500mm or greater. These trees are considered by SEWPaC to be capable of containing hollows suitable for use by black-cockatoos, either now or within 50 yrs. These raw data are provided in Appendix 2. Breeding habitat is recognised, as a minimum, as 0.5ha with at least three potential nesting trees (Tara Harris, SEWPaC, February 2010). The significance of breeding habitat depends on factors such as context and level of usage.

Information was also collected on *Lomandra hermaphrodita,* one of the larval host plants for the Graceful Sun-Moth *Synemon gratiosa*. This information has been included within the report detailing Graceful Sun-Moth surveys conducted in March 2011 (see Appendix 3).

3.5 Limitations

The EPA Guidance Statement 56 (EPA 2004) outlines a number of limitations that may arise during surveying. These survey limitations are addressed in Table 2.

Table 2. Survey limitations as outlined by EPA Guidance Statement 56 (EPA 2004).

Limitation	Comment
Level of survey.	Level 1 (desktop study and reconnaissance survey). Survey intensity was deemed adequate due to the small size of project.
Competency/experience of the consultant(s) carrying out the survey.	The authors have had extensive experience in conducting desktop reviews and site inspections.
Scope. (What faunal groups were sampled and were some sampling methods not able to be employed because of constraints?)	Birds were surveyed however due to the nature of the survey, low level sampling was conducted for reptiles, frogs, amphibians, mammals and SREs.
Proportion of fauna identified, recorded and/or collected.	No species collected, all fauna observed identified.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data.	Sources include databases (BA, DEC, EPBC) and Bush Forever report (DEP 2000).
The proportion of the task achieved and further work which might be needed.	Site inspection completed, further surveys for Graceful Sunmoth conducted in March 2011.
Timing/weather/season/cycle.	Site inspection conducted January 2011.
Disturbances (e.g. fire, flood, accidental human intervention etc.) which affected results of survey.	No disturbances affected the survey.
Intensity. (In retrospect, was the intensity adequate?)	Survey intensity was low (desktop study and site inspection) but sufficient to satisfy EPA guidelines and extensive background data available.
Completeness (e.g. was relevant area fully surveyed).	Desktop study covered project area and adjacent habitats. Site inspection covered all areas of the proposed conservation area and adjacent habitats.
Resources (e.g. degree of expertise available in animal identification to taxon level).	All species identified to taxon level.
Remoteness and/or access problems.	No access problems encountered.
Availability of contextual (e.g. biogeographic) information on the region.	Extensive regional (e.g. Swan Coastal Plain) information was available and was consulted.

4. RESULTS

4.1 Fauna Habitats

The fauna habitats present within the study area ranged from slightly degraded open woodland through to completely cleared near coastal sandplain. :

- Lots 8 and 313 (see Plate 1) were completely cleared with no remnant vegetation recorded;
- Lots 2 and 312 (see Plate 1 and
- Plate 3) were largely cleared, with some mature trees retained. The trees within Lot 312 were considered to have higher habitat value given their age and subsequent likelihood of suitable nesting hollows being available to a range of fauna species (see Appendix 2 for raw data on 'Mature' trees); and
- Lots 4 and 7 (see
- Plate 3) were partially cleared, but with pockets of "remnant open woodland over shrubland" across the Lots. These may provide some linkage value to surrounding bushland areas. A number of trees within these two Lots are considered to have high habitat value given their age and subsequent likelihood of suitable nesting hollows being available to a range of fauna species (see Appendix 2 for raw data on 'Mature' trees).

Lot 312, although dry during the site inspection, may occasionally support a small seasonal wetland that would provide seasonal habitat for a small number of waterbirds and other fauna species.

Plate 1. Lot 2, Eighty Rd

Plate 2. Lot 8, Eighty Rd

Plate 3. Lot 7, Eighty Rd

Plate 4. Lot 312, Fifty Rd.

4.2 Vertebrate fauna

The desktop survey identified 168 vertebrate fauna species as potentially occurring in the Baldivis study areas (see Table 3), with 16 of these recorded during the site visit (see

Table **4** - Table 7 for further details). Species of conservation significance returned in the literature review but considered to be locally extinct are listed in Table 8.

Table 3. Summary of Vertebrate Fauna species potentially occurring/recorded at the Baldivis study areas.

	Total Species	Introduced Species	Conservation Significant Species			Species Recorded
			Level 1	Level 2	Level 3	
Frogs	8	0	0	0	0	0
Reptiles	41	0	1	3	0	2
Birds	100	7	5	0	27	12
Mammals	19	5	1	3	1	2
TOTAL	168	12	7	6	28	16

The faunal assemblage expected is typical of bushland on the southern Swan Coastal Plain. Most fauna species occurring or expected to occur in the project area are widespread but some species may have restricted or limited habitat distributions and some fauna species are expected to have declined in the region. Conservation significant fauna species occurring or likely to occur in the project area are discussed below.

4.2.1 Amphibians

Eight species of frog may occur in the Baldivis study areas (Table 5), although it should be noted that some of these species may rely on habitat in adjacent areas. All eight species are widespread and none was recorded during the site inspection.

4.2.2 Reptiles

Forty-one reptile species may occur in the Baldivis study areas (Table 5), although some may only use it irregularly. Two species, the Fence Skink *Cryptoblepharus buchanani* and the Marbled Gecko *Christinus marmoratus*, were recorded during the site visit. Several reptiles of conservation significance may be present and are described below.

Conservation Significance Level 1 (CS1)

South-western Carpet Python ***Morelia spilota imbricata***
The South-western Carpet Python is listed under Schedule 4 of the WA Wildlife Conservation Act as "Specially Protected Fauna" and as Priority 4 by the DEC. Habitat loss is considered the main threat to this species.

Conservation Significance Level 2 (CS2)

a skink ***Ctenotus gemmula*** (Swan Coastal Plain popn.)

The Swan Coastal Plain population of the skink *Ctenotus gemmula* is listed as Priority 3 by the DEC. This species has a disjunct population across southern and south-western WA, with the SCP population impacted by loss of habitat

Lined Skink ***Lerista lineata***

The Lined Skink is listed as Priority 3 by the DEC. This species has a limited range along the southern Swan Coastal Plain, with much of its habitat threatened by residential development.

Black-striped Snake ***Neelaps calonotos***

The Black-striped Snake is listed as Priority 3 by the DEC. This species has a limited range along the Swan Coastal Plain, where its preferred sandplain habitats are impacted by residential developments.

4.2.3 Birds

One hundred bird species may occur in the Baldivis study areas, with 12 of these recorded during the site inspection (see Table 6). The 100 total excludes species returned during the literature review that may overfly but not utilise Baldivis study areas. Birds of conservation significance that have been so excluded are listed on Table 8. There remains 32 conservation significant species considered likely to occur in the areas, which are described below.

Conservation Significance Level 1 (CS1)

Falco peregrinus **Peregrine Falcon (DEC Schedule 4)**

The Peregrine Falcon is classified as "Specially Protected Fauna" under Schedule 4 of the Wildlife Conservation Act. This species is found in a variety of habitats, including rocky ledges, cliffs, watercourses, open woodland and acacia shrublands. The Peregrine Falcon lays its eggs in recesses of cliff faces, tree hollows or in large abandoned nests of other birds (Birds Australia, 2008). Blakers *et al.* (1984) consider that Australia is one of the strongholds of the species, since it has declined in many other parts of the world.

The Peregrine Falcon is a wide-ranging bird of prey that may be an occasional visitor to the Baldivis study areas.

Calyptorhynchus banksii naso **Forest Red-tailed Black-Cockatoo**

Listed as Schedule 1 (Vulnerable) under the WA Wildlife Conservation Act and as Vulnerable under the EPBC Act, this species is of concern because clearing and forestry have reduced the available breeding and feeding habitat, while feral bees and Galahs compete with it for nesting hollows. The species may utilise the study area for foraging, and possibly for breeding as well.

Calyptorhynchus latirostris **Carnaby's Black-Cockatoo**

Listed as Endangered under the EPBC Act and Schedule 1 (Endangered) under the WA Wildlife Conservation Act. Carnaby's Cockatoo was heard in the area during the site visit, and is likely to forage and perhaps breed within the study area. A number of

Eucalypts large enough to support nesting hollows for these species were recorded during the site visit (see Appendix 2 for details).

Carnaby's Cockatoo has declined due to loss of breeding habitat in the wheatbelt and foraging habitat throughout their range, partly due to urban expansion. While small areas of foraging habitat around the metropolitan area support only small numbers of birds for short periods of time, the progressive loss of such small areas is an ongoing concern for this species.

Apus pacificus **Fork-tailed Swift**

Merops ornatus **Rainbow Bee-eater**

Both these species are listed as Migratory under the EPBC Act. *A. pacificus* breeds in Siberia and the Himalayas and migrates to arrive in Australia in October, returning to the breeding grounds by May or June. Movements within Australia are in response to weather patterns, with this species often following thunderstorms. It is a highly aerial species that rarely comes to ground in Australia, and is thus largely independent of remnants such as those in the Baldivis study area.

The Rainbow Bee-eater has a very widespread distribution over Australia, wintering in northern Australia and Indonesia, and migrating south during September and October (Johnstone & Storr, 1998). It breeds during summer in southern Australia, usually digging a burrow into a sand bank to nest in. The Rainbow Bee-eater is likely to utilise the Baldivis study areas for nesting, due to sandy habitats. Although a species of high conservation significance, it is abundant and versatile in its selection of nest sites.

Conservation Significance Level 3 (CS3)

Declining Birds on the Swan Coastal Plain

A number of bird species have been identified by the WA Department of Environmental Protection (DEP, 2000) and the Perth Bird Study (Gole 2003, 2004) as having declined in the Perth area due to impacts associated with urban development. A few of these are birds of prey, but the majority are small birds that rely on woodlands and shrublands where they are either residents (eg. fairy-wrens and thornbills) or seasonal visitors (honeyeaters). The fairy-wrens and thornbills are particularly sensitive to habitat loss and fragmentation, whereas the honeyeaters have a greater ability to access suitable habitat even when it is fragmented by urban development. The majority of the species listed by the DEP (2000) are also noted as having declined Australia-wide by more than 20% in the New Atlas of Australian Birds (Barrett *et al.* 2003). The 27 species listed as CS3 likely to occur in the project area are listed in Table 6.

4.2.4 Mammals

Nineteen mammal species, including 14 native and five introduced species, are considered likely to occur in the Baldivis study area (see Table 7). Several of the native species may only utilise the area occasionally. The five conservation significant mammal species that may be present are outlined below. Locally extinct species are listed in Table 8.

Conservation Significance Level 1 (CS1)

Dasyurus geoffroii **Chuditch**

The Chuditch is listed as Vulnerable under both the Commonwealth's EPBC Act and Schedule 1 of the WA Wildlife Conservation Act. It uses a variety of habitats; Threats to the species include introduced predators (cats and foxes), habitat loss and altered fire regimes (Maxwell *et al.* 1996). A resident population is very unlikely, but the species may only utilise the site occasionally as a habitat corridor.

Conservation Significance Level 2 (CS2)

Isoodon obesulus fusciventer **Southern Brown Bandicoot/ Quenda**

The Quenda is listed as Priority 5 by DEC and has declined in the Perth area. It occurs in the south-west of Western Australia north to Yanchep and Gingin, south to Albany and east to Esperance. This species previously occurred north to at least Moore River but like many mammals in the region has undergone a large range reduction (Maxwell *et al.* 1996). Threats to the species include land clearance, habitat degradation and feral predators (Maxwell *et al.* 1996). Although no evidence of Quenda was recorded from the study areas, local residents indicated they were seen regularly.

Macropus irma **Brush Wallaby**

The Brush Wallaby is listed as Priority 4 by the DEC. It appears to be impacted by introduced predators, particularly foxes, as evidenced by its population increases in areas subject to fox baiting (Maxwell *et al.*, 1996). Because of the extent of clearing and habitat fragmentation a resident population is very unlikely, but individuals of this species may utilise the site occasionally as a habitat corridor.

Falsistrellus mackenziei **Western False Pipistrelle**

Listed as Priority 4 by DEC. The Western False Pipistrelle occurs in the wet sclerophyll and higher rainfall areas of dry sclerophyll forest in the south-west of Western Australia, but there is a recent record from woodland near Jandakot (Hosken and O'Shea 1994). Therefore this species may be an occasional visitor to the project area.

Conservation Significance Level 3 (CS3)

Trichosurus vulpecula vulpecula **Common Brushtail Possum**

The Common Brush-tail Possum has declined within the Perth metropolitan area (DEP, 2000), but may persist in the Baldivis study area, especially given the areas close proximity to large tracts of native bushland. Threats to the species is likely to include feral predators i.e. cats and foxes (Maxwell *et al.* 1996).

4.3 Short-range Endemic Invertebrates

Invertebrates in general are generally considered beyond the scope of assessment for environmental impact assessment because there are so many species and their taxonomy is so poorly understood, but it is possible to focus on a small range of taxa that are short-range endemics. Harvey (2002) notes that the majority of invertebrate species that have been classified as short-range endemics have common life history characteristics such as poor powers of dispersal or confinement to discontinuous habitats. Several groups, therefore, have particularly high instances of short-range endemic species: Gastropoda (snails and slugs), Oligochaeta (earthworms), Onychophora (velvet worms), Araneae (mygalomorph spiders), Schizomida (schizomids; spider-like arachnids), Diplopoda (millipedes), Phreatoicidea (phreatoicidean crustaceans), and Decapoda (freshwater crayfish).

The only information on invertebrate fauna in this area is for threatened species listed in the DEC's Naturemap database. A search of database indicated that one conservation significant invertebrate species, the Graceful Sunmoth *Synemon gratiosa*, may occur in the study area, although more intensive surveys may reveal the presence of others.

During the site inspection *Lomandra hermaphrodita*, one of the preferred host plants of Graceful Sun-Moth larvae, was recorded from Lots 4 and 7. Following guidelines detailed in Bishop *et al.* (2010), detailed *Lomandra* surveys and Graceful Sunmoth surveys were conducted in March 2011. The results of those surveys are presented in the report provided in Appendix 3.

4.4 Overview of Fauna Values

The fauna values of the Baldivis study areas are the habitats and the fauna assemblage, particularly focussing on species of conservation significance. These are summarised below.

4.4.1 Habitat

Habitats of conservation significance tend to be those that are both rare across the landscape and that are important for significant species and/or for biodiversity. Key features of fauna habitats occurring within the study area are:

1. Large Eucalypt trees: a significant resource in the region. Provide roosting and breeding opportunities for many species including species of conservation significance e.g. the *Calyptorhynchus* black-cockatoo species. A total of 129 'Mature' trees (DBH ≥ 500mm) with the potential to support large nest hollows were recorded from the study area: 19 trees from Lot 7, 26 from Lot 4 and 84 from Lot 312. The locations of such trees within Lots 4, 7 and 312 are shown in Figure 2; further details are provided in Appendix 2. Note that trees with a DBH ≥1000mm are indicated in Figure 2, and in Appendix 2, as these are likely to be of higher value for the provision of hollows than trees 500-1000mm DBH.

2. Shrubland/Woodland: The tall shrubland/woodland on Lots 4 and 7, and the open forest on Lot 312, contain numerous species of Proteaceae and is considered suitable foraging habitat for both Carnaby's Black-Cockatoo and the Forest Red-tailed Black Cockatoo. This area also supports a number of declining CS3 birds.

3. *Lomandra hermaphrodita*: areas of *L. hermaphrodita* in Lots 4 and 7 may provide habitat for the Graceful Sunmoth.

4. Overall, the remnant native vegetation on Lots 4 and 7 forms part of series of local bushland remnants that may allow for the movement of local fauna., between the bushland adjacent to Lot 312 and the remnants further eastward e.g. along Baldivis Rd. It is likely that a range of bird and mammal species use these Lots as a habitat corridor on a daily basis.

The habitats are suitable for a range of species, including some that are classified as conservation significant species, of which many are declining due to the gradual loss of habitat resulting from residential developments along the Swan Coastal Plain. The numerous large Eucalypt trees and the presence of *L. hermaphrodita* are considered the more significant aspects of the fauna habitats available.

4.4.2 Significant Species

Thirty-nine vertebrate species of conservation significance may occur in the Baldivis study areas. Based on the observations made during the site inspection, the most notable feature of the assemblage of conservation significant species is the presence

of a number of bird species which are identified as CS3 species. As such they are not listed under Acts or in publications, but are considered of at least local significance due to a decline in the Perth region. More detailed studies would be required to ascertain the presence/absence of other conservation significant fauna.

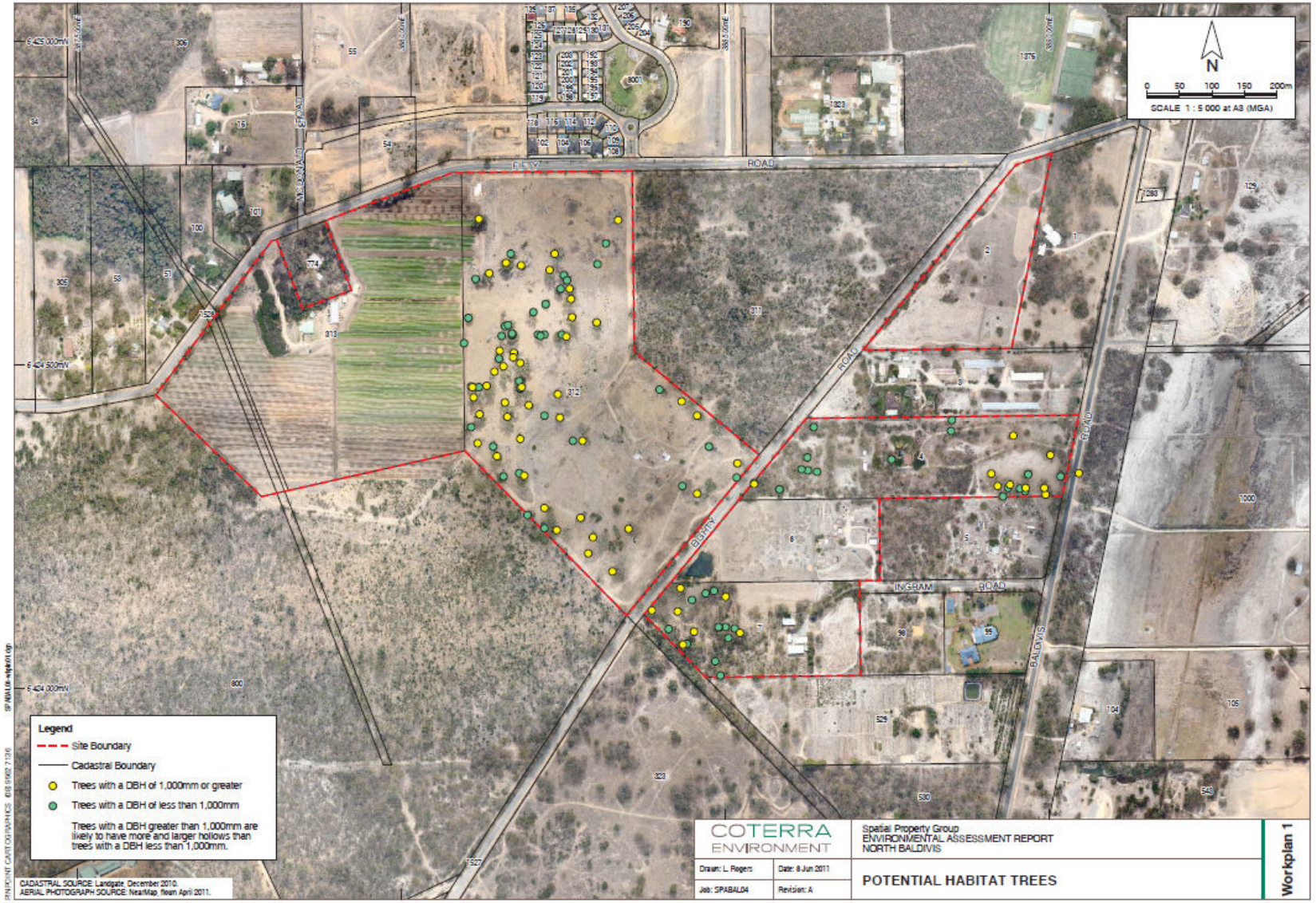

Figure 2. Location of Potential Black-Cockatoo nest hollow trees on Lots 4, 7 and 312

5. IMPACT ASSESSMENT

Development of the project area is likely to impact on a number of native fauna species directly (i.e. through the initial land-clearing and habitat loss) and indirectly (i.e. through habitat fragmentation and ongoing disturbance). The impacts can be related to ecological processes. This is recognised in relevant literature and under the EPBC Act, in which threatening processes are listed (see Appendix 1). Ecological processes that may impact fauna values with respect to the proposed development of the Baldivis study area are discussed below. Impacts upon ecological processes may be significant if large numbers of species or large proportions of populations are affected.

5.1 Loss of habitat leading to population decline

Clearing for a development can lead to direct mortality and habitat loss for species with a consequent decline in population size. This may be significant if the smaller population has reduced viability. Conservation significant species or species that already occur at low densities may be particularly sensitive to population decline, including the Quenda. How and Shine (1999) found that fossorial snakes such as the significant Black-striped Snake tended not to persist due to reduced population size in habitats fragmented by clearing. Some loss of habitat is inevitable but can be minimised through adequate planning, controls during initial clearing and revegetation of adjacent cleared areas. Of greatest concern is the loss of habitat that supports significant species within the area. Within the context of the current project, this would be the tall shrubland/woodland on Lots 4 and 7, and the large Eucalypt/*Corymbia* trees on Lot 312. With innovative project design these habitats can be retained as part of the development. The largest of the large trees would be the most important to retain where possible.

5.2 Increased mortality

Increased mortality can occur as a result of changed land use at a development site; such as from roadkill. For example, roadkill as a cause of population decline has been documented for the Eastern Barred Bandicoot *Peremeles gunni* (Dufty 1989), Eastern Quoll *Dasyurus viverrinus* and Tasmanian Devil *Sarcophilus harrisii* (Jones 2000). Increased mortality due to roadkill is often more prevalent in habitats that have been fragmented (Jackson and Griffen 2000; Scheik and Jones 1999; Clevenger and Waltho 2000).

Increased mortality of common species during development is unavoidable and may not be significant for a population. However, the cumulative impacts of increased mortality of conservation significant species or species that already occur at low densities may have a significant impact on the population. In the Baldivis project area, some mammals (eg. Quenda) and some large reptiles (eg. Gould's Goanna) could be vulnerable to increased roadkill.

5.3 Loss of habitat affecting population movements and gene flow

Within the Perth Metropolitan Area there are few large areas of native vegetation available for conservation, with many bush remnants small in size (less than 100 ha)

and isolated from other conservation areas (DEP, 2000). Issues of particular concern in fragmented ecosystems are:

- The requirement of vertebrates (such as some bird, mammal and reptile species) for a large area for their home range for survival;
- The movement of animals is essential in maintaining genetic diversity in plant communities by moving pollen from one remnant to another;
- That populations of plants and animals are effectively isolated from other populations leaving some plant and animal populations susceptible to local extinction; and
- The loss of genetic diversity through in-breeding (DEP, 2000).

As a consequence, connectivity between areas of remnant vegetation is essential in maintaining biodiversity values in a fragmented landscape. Retaining vegetation corridors throughout the study areas will aid connectivity with adjacent remnants.

5.4 Species interactions, including predators and other feral species

Introduced species, including the Feral Cat, Fox and Rabbit, may have adverse impacts upon native species. In particular, some mammal species expected in the area are sensitive to predation by Cats and Foxes, and these species can increase in abundance with human activities. The Rabbit occurs in the greater area, increasing grazing pressure on native vegetation and contributing to the degradation of fauna habitats.

Populations of the Black Rat and House Mouse may also occur in the area as these species often occur in urban areas. The Black Rat has been associated with declines in the populations of many bird species as a result of predation on eggs (DEWHA, 2010). Both the House Mouse and Black Rat may also utilise resources that would otherwise be used by native fauna.

Additionally, weed invasion poses a significant threat to the fauna and flora values of the site and adjacent areas of remnant vegetation. Several weed species occur throughout the bushland remnants on Lots 4 and 7.

The study area is therefore sensitive to pressures associated with exotic species, including both from introduced mammals (such as the Feral Cat, Fox and Black Rat) and from introduced weed species. The management plan of the proposed conservation area should address this to avoid further pressure from feral species and include:

1. Criteria for controlling and minimising the spread of weeds;
2. Exclusion of household pets and other introduced species (fauna and flora) from the adjacent bushland areas;
3. Prohibit dumping of rubbish and garden waste within the retained remnant bushland.

5.5 Hydroecology

Interruptions of hydroecological processes can have massive effects because they underpin primary production in ecosystems and there are specific, generally rare habitats that are hydrology-dependent. The proposed project could alter both surface

and sub-surface hydrology, and there appears to be a small, seasonal wetland on Lot 312 that could be affected by such changes. Therefore, hydroecological impacts from the proposed project need to be carefully managed to ensure fauna habitats in the area are not degraded.

5.6 Fire

Fire is a natural feature of the environment but frequent, extensive fires may adversely impact some fauna, particularly mammals and short-range endemic species. Fire can severely degrade remnant vegetation by removing habitat and increasing both weed invasion and predation pressure. Fire Management strategies may be implemented as part of management of the retained bushland areas to protect habitats that may be important for fauna.

5.7 Light and noise

Impacts of light and noise upon fauna are difficult to predict; urban light pollution has been found to contribute to local extinction of some insects due to mortality around lights (Rich and Longcore 2006). Although increased levels of light pollution are almost an inevitable result of residential developments, it may be minimised by addressing the issue in the design phase of the project. For example, lighting could be directed away from the proposed conservation area to minimise impacts.

5.8 Phytophthora cinnamomi (Dieback)

The root-rot (Dieback) fungus *Phytophthora cinnamomi* is known to occur within remnant vegetation within the region. This fungus causes the roots of susceptible plants to rot and is a major threat to biodiversity in the south-west, and species in the Proteaceae family are particularly susceptible to this pathogen. Impacts associated with *P. cinnamomi* include the modification of the structure and composition of ecological communities, local extinction of some plant species and loss of habitat and food sources for many fauna species. The management of *P. cinnamomi* may be included as part of the management of the site.

6. CONCLUSIONS

The main issues of conservation significance relating to fauna within the study area/s are:

- the presence of numerous large, potentially hollow-bearing trees, that may provide nest hollows for conservation significant fauna such as Carnaby's Black-Cockatoo; and
- remnant vegetation that may provide habitat for a range of fauna species; in some cases acting as habitat corridors, allowing them to move through the landscape.
- Following the completion of a Graceful Sun-Moth survey programme in March 2011 (see Appendix 3) it is considered that this species does not occur in the study area.

Table 4. Frogs Recorded or Expected in the Baldivis study areas.
Levels of Conservation Significance are discussed in the "Assessment of Conservation Significance" section. No frog species were recorded from the site inspection.

FROG SPECIES		Status	Recorded
MYOBATRACHIDAE ('ground' frogs)			
Crinia georgiana	Quacking Frog		
Crinia glauerti	Clicking Frog		
Crinia insignifera	Squelching Frog		
Pseudophryne guentheri	Crawling Toadlet		
LIMNODYNASTIDAE ('swamp' frogs)			
Heleioporus eyrei	Moaning Frog		
Limnodynastes dorsalis	Western Banjo Frog		
HYLIDAE (tree-frogs)			
Litoria adelaidensis	Slender Tree Frog		
Litoria moorei	Motorbike Frog		

Table 5. Reptiles Recorded or Expected in the Baldivis study areas.

Levels of Conservation Significance are discussed in the "Assessment of Conservation Significance" section. Species recorded during the site inspection are noted 'x'.

REPTILE SPECIES		Status	Recorded
CHELUIDAE (side-necknecked tortoises)			
Chelodina oblonga	Oblong Tortoise		
AGAMIDAE (dragons)			
Ctenophorus adelaidensis	Southern Heath Dragon		
Pogona minor	Western Bearded Dragon		
GEKKONIDAE (geckoes)			
Christinus marmoratus	Marbled Gecko		x
Nephrurus milii	Barking Gecko		
Strophurus spinigerus			
PYGOPODIDAE (legless-lizards)			
Aprasia repens			
Delma fraseri			
Delma grayii			
Lialis burtonis	Burton's Legless-Lizard		
Pygopus lepidopodus	Common Scaly Foot		

REPTILE SPECIES		Status	Recorded
SCINCIDAE (skinks)			
Acritoscincus trilineatum	South-western Cool Skink		
Cryptoblepharus buchananii	Fence Skink		x
Ctenotus australis			
Ctenotus fallens			
Ctenotus gemmula		CS2	
Ctenotus impar			
Ctenotus labillardieri			
Egernia kingii	King's Skink		
Egernia napoleonis	Salmon Bellied Skink		
Hemiergis quadrilineata			
Lerista elegans			
Lerista lineata		CS2	
Menetia greyii			
Morethia lineoocellata			
Morethia obscura			
Tiliqua occipitalis	Western Bluetongue		
Tiliqua rugosa	Bobtail		
VARANIDAE (goannas)			
Varanus gouldii	Gould's Sand Monitor		
Varanus rosenbergii	Rosenberg's Monitor		
Varanus tristis	Racehorse Monitor		
TYPHLOPIDAE (blind snakes)			
Ramphotyphlops australis			
Ramphotyphlops pinguis			
BOIDAE (pythons)			
Morelia spilota imbricata	South-west Carpet Python	CS1	
ELAPIDAE (front-fanged snakes)			
Brachyurophis semifasciata			
Demansia psammophis			
Elapognathus coronatus	Crowned Snake		
Neelaps bimaculatus	Black-naped Snake		
Neelaps calonotos	Black-striped Snake	CS2	
Notechis scutatus	Tiger Snake		
Parasuta gouldii	Gould's Snake		
Pseudonaja affinis	Dugite		
Pseudonaja nuchalis	Gwardar		
Simoselaps bertholdi	Jan's Banded Snake		

Table 6. Birds Recorded or Expected in the Baldivis study areas.

Levels of Conservation Significance are discussed in the "Assessment of Conservation Significance" section. Species recorded during the site inspection are noted 'x'.

BIRD SPECIES		Status	Recorded
PHASIANIDAE (true quail)			
Stubble Quail	*Coturnix pectoralis*		
ANATIDAE (ducks)			
Australian Shelduck	*Tadorna tadornoides*		
Australian Wood Duck	*Chenonetta jubata*		
Grey Teal	*Anas gracilis*		
Pacific Black Duck	*Anas superciliosa*		
PODICIPEDIDAE (grebes)			
Australasian Grebe	*Tachybaptus novaehollandiae*		
COLUMBIDAE (ducks and pigeons)			
Rock Dove	*Columba livia*	INT	
Brush Bronzewing	*Phaps elegans*	CS3	
Common Bronzewing	*Phaps chalcoptera*	CS3	
Spotted Turtle-Dove	*Streptopelia chinensis*	INT	
Laughing Turtle-Dove	*Streptopelia senegalensis*	INT	
Crested Pigeon	*Ocyphaps lophotes*		
PODARGIDAE (frogmouths)			
Tawny Frogmouth	*Podargus strigoides*		
APODIDAE (swifts)			
Fork-tailed Swift	*Apus pacificus*	CS1	
PHALACROCORACIDAE (cormorants)			
Little Pied Cormorant	*Microcarbo melanoleucos*		
ARDEIDAE (herons and egrets)			
White-faced Heron	*Egretta novaehollandiae*		
Rufous Night Heron	*Nycticorax caledonicus*	CS3	
THRESKIORNITHIDAE (ibis and spoonbills)			
Australian White Ibis	*Threskiornis molucca*		
Straw-necked Ibis	*Threskiornis spinicollis*		
ACCIPITRIDAE (hawks and allies)			
Black-shouldered Kite	*Elanus axillaris*		
Square-tailed Kite	*Lophoictinia isura*	CS3	
Whistling Kite	*Haliastur sphenurus*	CS3	
Collared Sparrowhawk	*Accipiter cirrocephalus*	CS3	
Brown Goshawk	*Accipiter fasciatus*	CS3	
Swamp Harrier	*Circus approximans*		
Little Eagle	*Hieraaetus morphnoides*	CS3	
Wedge-tailed Eagle	*Aquila audax*	CS3	

BIRD SPECIES		Status	Recorded
FALCONIDAE (falcons)			
Brown Falcon	*Falco berigora*	CS3	
Nankeen Kestrel	*Falco cenchroides*		
Australian Hobby	*Falco longipennis*		
Peregrine Falcon	*Falco peregrinus*	CS1	
RALLIDAE (rails and allies)			
Purple Swamphen	*Porphyrio porphyrio*		
Eurasian Coot	*Fulica atra*		
Australian Spotted Crake	*Porzana fluminea*		
Baillon's Crake	*Porzana pusilla*		
Spotless Crake	*Porzana tabuensis*		
TURNICIDAE (button-quail)			
Painted Button-quail	*Turnix varius*	CS3	x
PSITTACIDAE (cockatoos and parrots)			
Red-tailed Black-Cockatoo	*Calyptorhynchus banksii*	CS1	
Carnaby's Black-Cockatoo	*Calyptorhynchus latirostris*	CS1	x
Galah	*Eolophus roseicapillus*		
Little Corella	*Cacatua sanguinea*	INT	
Eastern Long-billed Corella	*Cacatua tenuirostris*	INT	
Rainbow Lorikeet	*Trichoglossus haematodus*	INT	x
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*		
Western Rosella	*Platycercus icterotis*	CS3	
Regent Parrot	*Polytelis anthopeplus*		
Australian Ringneck	*Barnardius zonarius*		
Red-capped Parrot	*Purpureicephalus spurius*		
Elegant Parrot	*Neophema elegans*		
CUCULIDAE (cuckoos)			
Horsfield's Bronze Cuckoo	*Chalcites basalis*		
Shining Bronze-Cuckoo	*Chalcites lucidus*		
Pallid Cuckoo	*Cacomantis pallidus*		
Fan-tailed Cuckoo	*Cacomantis flabelliformis*		
STRIGIDAE (hawk owls)			
Boobook Owl	*Ninox novaeseelandiae*		
TYTONIDAE (barn owls)			
Eastern Barn Owl	*Tyto javanica*		
HALCYONIDAE (kingfishers and kookaburras)			
Laughing Kookaburra	*Dacelo novaeguineae*	INT	x
Sacred Kingfisher	*Todiramphus sanctus*		
MEROPIDAE (bee-eaters)			
Rainbow Bee-eater	*Merops ornatus*	CS1	
MALURIDAE (Australian wrens)			
Splendid Fairy-wren	*Malurus splendens*	CS3	

ACANTHIZIDAE (thornbills and allies)			
White-browed Scrubwren	*Sericornis frontalis*	CS3	
Weebill	*Smicrornis brevirostris*	CS3	x
Western Gerygone	*Gerygone fusca*		
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	CS3	
Western Thornbill	*Acanthiza inornata*	CS3	x
Inland Thornbill	*Acanthiza apicalis*	CS3	x
PARDALOTIDAE (pardalotes)			
Spotted Pardalote	*Pardalotus punctatus*		
Striated Pardalote	*Pardalotus striatus*		
MELIPHAGIDAE (honeyeaters)			
Western Spinebill	*Acanthorhynchus superciliosus*		
Singing Honeyeater	*Lichenostomus virescens*		
Western Wattlebird	*Anthochaera lunulata*	CS3	
Red Wattlebird	*Anthochaera carunculata*		
White-fronted Chat	*Epthianura albifrons*		
Brown Honeyeater	*Lichmera indistincta*		x
New Holland Honeyeater	*Phylidonyris novaehollandiae*	CS3	
White-cheeked Honeyeater	*Phylidonyris melanops*	CS3	
White-naped Honeyeater	*Melithreptus lunatus*	CS3	
NEOSITTIDAE (sittella)			
Varied Sittella	*Daphoenositta chrysoptera*	CS3	x
CAMPEPHAGIDAE (cuckoo-shrikes)			
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*		x
White-winged Triller	*Lalage sueurii*		
PACHYCEPHALIDAE (whistlers and allies)			
Golden Whistler	*Pachycephala pectoralis*		
Rufous Whistler	*Pachycephala rufiventris*		
Grey Shrike-thrush	*Colluricincla harmonica*	CS3	
ARTAMIDAE (woodswallows)			
Black-faced Woodswallow	*Artamus cinereus*	CS3	
Grey Butcherbird	*Cracticus torquatus*		
Pied Butcherbird	*Cracticus nigrogularis*		
Australian Magpie	*Cracticus tibicen*		x
Grey Currawong	*Strepera versicolor*	CS3	
RHIPIDURIDAE (fantails)			
Grey Fantail	*Rhipidura albiscapa*		x
Willie Wagtail	*Rhipidura leucophrys*		
CORVIDAE (crows and ravens)			
Australian Raven	*Corvus coronoides*		
MONARCHIDAE (monarchs and allies)			
Magpie-lark	*Grallina cyanoleuca*		

PETROICIDAE (Australian robins) Scarlet Robin *Petroica boodang*	CS3	
ACROCEPHALIDAE (reed-warblers) Australian Reed-Warbler *Acrocephalus australis*		
MEGALURIDAE (grassbirds) Little Grassbird *Megalurus gramineus* Brown Songlark *Cincloramphus cruralis*		
TIMALIIDAE (white-eyes) Silvereye *Zosterops lateralis*		
HIRUNDINIDAE (swallows and martins) Welcome Swallow *Hirundo neoxena* Tree Martin *Petrochelidon nigricans*		
NECTARINIIDAE (flowerpeckers) Mistletoebird *Dicaeum hirundinaceum*		
MOTACILLIDAE (pipits and wagtails) Australasian Pipit *Anthus novaeseelandiae*		

Table 7. Mammals Recorded or Expected in the Baldivis study areas.

Levels of Conservation Significance are discussed in the "Assessment of Conservation Significance" section. Species recorded during the site inspection are noted 'x'.

MAMMAL SPECIES		Status	Recorded
TACHYGLOSSIDAE (echidnas)			
Tachyglossus aculeatus	Echidna		
DASYURIDAE (carnivorous marsupials)			
Dasyurus geoffroii	Chuditch	CS1	
PERAMELIDAE (bandicoots)			
Isoodon obesulus fusciventer	Quenda	CS2	
MACROPODIDAE (kangaroos and wallabies)			
Macropus fuliginosus	Western Grey Kangaroo		x
Macropus irma	Brush Wallaby	CS2	
PHALANGERIDAE (brushtail possums)			
Trichosurus vulpecula	Common Brushtail Possum	CS3	
VESPERTILIONIDAE (evening bats)			
Chalinolobus gouldii	Gould's Wattled Bat		
Falsistrellus mackenziei	Western False Pipistrelle	CS2	
Nyctophilus geoffroyi	Lesser Long-eared Bat		
Nyctophilus gouldii	Gould's Long-eared Bat		
Nyctophilus major	Greater Long-eared Bat		
Vespadelus regulus	Southern Forest Bat		
MOLOSSIDAE (freetail bats)			
Mormopterus planiceps	Southwestern Freetail Bat		
Tadarida australis	White-striped Freetail Bat		
MURIDAE (rodents)			
Mus musculus	House Mouse	INT	
Rattus rattus	Black Rat	INT	
LEPORIDAE (hares and rabbits)			
Oryctolagus cuniculus	European Rabbit	INT	x
FELIDAE (cats)			
Felis catus	Feral Cat	INT	
CANIDAE (dogs)			
Vulpes vulpes	European Fox	INT	

Table 8. Fauna of conservation significance considered to be locally extinct.

The listed species were returned in the database review but are considered locally extinct or extremely unlikely to occur in the project area.

	EPBC	WA Wildlife Conservation Act	DEC	CS3
Barking Owl (SW) *Ninox c. connivens*			Priority 2	
Masked Owl (SW) *Tyto n. novaehollandiae*			Priority 3	
Mardo *Antechinus flavipes*				x
Brush-tailed Phascogale *Phascogale tapoatafa*	Vulnerable	Schedule 1 (Vulnerable)		
Western Pygmy-possum *Cercartetus concinnus*				x
Bush Rat *Rattus fuscipes*				x
Water Rat, Rakali *Hydromys chrysogaster*			Priority 4	
Ashy-grey Mouse *Pseudomys albocinereus*				X

7. REFERENCES

Barrett, G.. Silcocks, A., Barry, S., Cunningham, R. and Poulter, R. (2003). *The New Atlas of Australian Birds*. Melbourne: Royal Australasian Ornithologists Union

Birds Australia (2010). Birds Australia Database. www.birdsaustralia.com.au (accessed Feb 2011).

Bush, B., Maryan, B., Browne-Cooper, R. and Robinson, D. (1995). Reptiles and Frogs of the Perth Region. University of Western Australia Press, Perth.

Christidis, L. and Boles, W.E. (2008). Systematics and Taxonomy of Australian Birds. CSIRO Publishing, Victoria, Australia.

Churchill, S. (2008). Australian Bats, 2nd Ed. Allen and Unwin, Sydney.

Clevenger, A. P. and Waltho, N. (2000). Factors Influencing the Effectiveness of Wildlife Underpasses in Banff National Park, Alberta, Canada. *Conservation Biology* **14**: 1-11

Department of Environment and Conservation (2011). NatureMap Database. Accessed Feb 2011.

Department of Environmental Protection (2000). Bush Forever Volume 2. Government of Western Australia, Perth.

Department of Environment, Water, Heritage and the Arts (2010). Threatened Species Profiles. Available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66699

Doughty, P. and Maryan, B. (2010a). Checklist of Western Australian Amphibians (www.museum.wa.gov.au); updated version downloaded 8th Feb 2011.

Doughty, P. and Maryan, B. (2010b). Checklist of Western Australian Reptiles (www.museum.wa.gov.au); updated version downloaded 8th Feb 2011.

Dufty, A.C. (1989). Some Population characteristics of *Perameles gunnii* in Victoria. Wildlife Research: **18** (3) 355 – 365.

Environmental Protection Authority. (2002). Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3. Environmental Protection Authority, Perth, Western Australia.

Environmental Protection Authority. (2004). Guidance for the assessment of environmental factors: Terrestrial fauna surveys for environmental impact assessment in Western Australia. No. 56. Environmental Protection Authority, Perth, Western Australia.

Harvey, M. (2002). Short-range Endemism amongst the Australian fauna: examples from non-marine environments. Invertebrate Systematics, 16: 555-570.

How, R.A. and Shine, R. (1999). Ecological traits and conservation biology of five fossorial "sand-swimming" snake species (*Simoselaps*: Elapidae) in south-western Australia. Journal of Zoology, London. 249: 269-282.

How, R., Cooper, N. and Bannister, J.L. (2010). Checklist of Western Australian Mammals (www.museum.wa.gov.au); updated version downloaded 8th Feb 2011.

Gole, C. (2003). Bird surveys in selected Perth metropolitan reserves, Part A: Main Report. A joint biodiversity conservation project between birds Australia and the Perth Biodiversity Project, Perth.

Gole, C. (2004). Bird surveys in selected Perth metropolitan reserves: Rounds 1 and 2 survey reports, Part A: Main Report. A joint biodiversity conservation project between birds Australia and the Perth Biodiversity Project, Perth.

Jackson, S. D. and Griffin, C. R. (2000). A Strategy for Mitigating Highway Impacts on Wildlife. Pp. 143 – 159, In Messmer, T. A and B. West, (eds) Wildlife and Highways: Seeking Solutions to an Ecological and Socio – economic Dilemma. The Wildlife Society.

Johnstone, R.E. (2010). Checklist of Western Australian Birds (www.museum.wa.gov.au); updated version downloaded 8th Feb 2011.

Johnstone, R.E. and Storr, G.M. (1998). Handbook of Western Australian Birds Vol 1 – Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth.

Johnstone, R.E. and Storr, G.M. (2004). Handbook of Western Australian Birds. Vol 2: Passerines (Blue-winged Pitta to Goldfinch). Western Australian Museum, Perth.

Jones, M.E. (2000). Road upgrade, road mortality and remedial measures: impacts on a population of eastern quolls and Tasmanian devils. *Wildlife Research* **27**: 289 – 296.

Mace, G. and Stuart, S. (1994). Draft IUCN Red List Categories, Version 2.2. Species; Newsletter of the Species Survival Commission. IUCN - The World Conservation Union. No. 21-22: 13-24.

Maxwell, S., Burbidge, A.A. and Morris, K. (1996). Action Plan for Australian Marsupials and Monotremes. Environment Australia, Canberra.

Menkhorst, P. and Knight, F. (2001). A Field Guide to the Mammals of Australia. Oxford University Press, Melbourne.

Rich, C. and Longcore, T. (2006). *Ecological Consequences of Artificial Night Lighting*. Island Press.

Scheick, B.K. and Jones, M.D. (1999). Locating Wildlife Underpasses Prior To The Expansion Of Highway 64, In North Carolina. In Proceedings of the International Conference on Wildlife 1999.

Storr, G.M., Smith, L.A. and Johnstone, R.E. (1983). Lizards of Western Australia. II. Dragons and Monitors. W.A. Museum, Perth.

Storr, G.M., Smith, L.A. and Johnstone, R.E. (1990). Lizards of Western Australia. III. Geckoes and Pygopodids. W.A. Museum, Perth.

Storr, G.M., Smith, L.A. and Johnstone, R.E. (1999). Lizards of Western Australia. I. Skinks. Revised Edition. W.A. Museum, Perth.

Storr, G.M., Smith, L.A. and Johnstone, R.E. (2002). Snakes of Western Australia. W.A. Museum, Perth.

Strahan, R. (ed.). (1995). The Australian Museum Complete Book of Australian Mammals. Angus and Robertson, Sydney.

Taylor, B.D. and Goldingay, R.L. 2004. A survey of wildlife killed on three major roads in northeast New South Wales. *Wildlife Research* 31: 83-91.

Tregonning, J. (2009). Fauna of the Baldivis Childrens Forest - www.baldivis-childrens-forest.com.au (downloaded on the 6th Feb 2011).

Tyler, M.J., Smith, L.A. and Johnstone, R.E. (2000). Frogs of Western Australia. W.A. Museum, Perth.

Wilson, S. and Swann, G. (2003). *Reptiles of Australia*. Princeton University Press, Australia.

Appendix 1. ***Categories used in the assessment of conservation status.***

IUCN categories (based on review by Mace and Stuart 1994) as used for the Environmental Protection and Biodiversity Conservation (EPBC) Act and the WA Wildlife Conservation Act.

Extinct. Taxa not definitely located in the wild during the past 50 years.

Extinct in the Wild. Taxa known to survive only in captivity.

Critically Endangered. Taxa facing an extremely high risk of extinction in the wild in the immediate future.

Endangered. Taxa facing a very high risk of extinction in the wild in the near future.

Vulnerable. Taxa facing a high risk of extinction in the wild in the medium-term future.

Near Threatened. Taxa that risk becoming Vulnerable in the wild.

Conservation Dependent. Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.

Data Deficient (Insufficiently Known). Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.

Least Concern. Taxa that are not Threatened.

Schedules used in the WA Wildlife Conservation Act.

Schedule 1. Rare and Likely to become Extinct.
Schedule 2. Extinct.
Schedule 3. Migratory species listed under international treaties.
Schedule 4. Other Specially Protected Fauna.

WA Department of Conservation and Land Management Priority species

(species not listed under the Conservation Act, but for which there is some concern).

Priority 1. Taxa with few, poorly known populations on threatened lands.

Priority 2. Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.

Priority 3. Taxa with several, poorly known populations, some on conservation lands.

Priority 4. Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.

Priority 5. Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

Appendix 2. ***Location and other details of potential hollow-bearing trees within the Baldivis study areas. Tress with a DBH ≥1000mm are shaded.***

Wypt Code	UM Co-ordinates	Tree Species	DBH (cm)	Lot Location
4	50 H 388523 6424085	Marri	120	#7
5	50 H 388515 6424092	Marri	90	#7
6	50 H 388501 6424094	Jarrah	50	#7
7	50 H 388505 6424077	Marri	75	#7
9	50 H 388491 6424093	Marri	90	#7
10	50 H 388490 6424094	Marri	85	#7
11	50 H 388493 6424019	Tuart	55	#7
12	50 H 388485 6424041	Jarrah	80	#7
13	50 H 388435 6424067	Jarrah	150	#7
14	50 H 388441 6424068	Jarrah	80	#7
15	50 H 388413 6424091	Tuart	90	#7
16	50 H 388387 6424120	Tuart	210	#7
17	50 H 388452 6424087	Tuart	200	#7
18	50 H 388427 6424118	Tuart	110	#7
19	50 H 388431 6424154	Tuart	110	#7
20	50 H 388449 6424136	Marri	90	#7
21	50 H 388470 6424146	Marri	80	#7
22	50 H 388483 6424150	Marri	85	#7
23	50 H 388501 6424141	? (Dead)	115	#7
25	50 H 389002 6424360	Tuart	120	#4
26	50 H 389046 6424332	Tuart	120	#4
27	50 H 389018 6424327	Marri	55	#4
28	50 H 388995 6424299	Tuart	130	#4
29	50 H 388993 6424309	Tuart	140	#4
30	50 H 388963 6424304	Tuart	90	#4
31	50 H 388964 6424309	Tuart	110	#4
32	50 H 388968 6424330	Tuart	70	#4
33	50 H 388955 6424308	Tuart	80	#4
34	50 H 388940 6424314	Tuart	140	#4
35	50 H 388937 6424309	Tuart	60	#4
36	50 H 388929 6424296	Tuart	90	#4
37	50 H 388921 6424312	Tuart	100	#4
38	50 H 388911 6424331	Tuart	100	#4
40	50 H 388642 6424334	Jarrah	80	#4
41	50 H 388628 6424336	Jarrah	80	#4
42	50 H 388618 6424338	Jarrah	90	#4
43	50 H 388545 6424315	Jarrah	160	#4
44	50 H 388545 6424317	Marri	50	#4
45	50 H 388584 6424307	Jarrah	80	#4
46	50 H 388627 6424356	Jarrah	55	#4
47	50 H 388637 6424403	Jarrah	80	#4
48	50 H 388757 6424353	Jarrah	90	#4
50	50 H 388849 6424397	Jarrah	60	#4
51	50 H 388850 6424414	Jarrah	60	#4
52	50 H 388945 6424390	Jarrah	120	#4

Wypt Code	UM Co-ordinates	Tree Species	DBH (cm)	Lot Location
53	50 H 388335 6424723	Tuart	180	#312
54	50 H 388316 6424687	Marri	95	#312
55	50 H 388303 6424655	Marri	70	#312
56	50 H 388237 6424671	Tuart	220	#312
57	50 H 388229 6424646	Tuart	110	#312
58	50 H 388251 6424638	Tuart	80	#312
59	50 H 388256 6424630	Marri	70	#312
60	50 H 388246 6424617	Marri	90	#312
61	50 H 388260 6424617	Marri	130	#312
62	50 H 388262 6424601	Tuart	260	#312
63	50 H 388264 6424573	Tuart	140	#312
64	50 H 388302 6424565	Jarrah	130	#312
65	50 H 388255 6424543	Marri	130	#312
66	50 H 388248 6424546	Marri	80	#312
67	50 H 388242 6424454	Marri	110	#312
68	50 H 388245 6424418	Marri	100	#312
69	50 H 388221 6424421	? (Dead)	80	#312
70	50 H 388184 6424385	Tuart	150	#312
71	50 H 388190 6424328	Tuart	170	#312
72	50 H 388182 6424332	Tuart	90	#312
73	50 H 388158 6424327	Marri	90	#312
74	50 H 388148 6424358	Tuart	200	#312
75	50 H 388142 6424373	Tuart	95	#312
76	50 H 388118 6424378	Marri	120	#312
77	50 H 388108 6424403	Tuart	80	#312
78	50 H 388121 6424423	Tuart	110	#312
79	50 H 388112 6424449	Marri	110	#312
80	50 H 388108 6424466	Marri	60	#312
81	50 H 388110 6424465	Tuart	190	#312
82	50 H 388112 6424465	Tuart	80	#312
83	50 H 388120 6424465	Tuart	70	#312
84	50 H 388132 6424467	Tuart	110	#312
85	50 H 388160 6424441	Tuart	180	#312
86	50 H 388164 6424419	Tuart	110	#312
87	50 H 388197 6424437	Tuart	140	#312
88	50 H 388184 6424462	Marri	90	#312
89	50 H 388184 6424463	Marri	90	#312
90	50 H 388186 6424465	Marri	100	#312
91	50 H 388182 6424474	Marri	90	#312
92	50 H 388144 6424489	Tuart	140	#312
93	50 H 388158 6424497	Tuart	140	#312
94	50 H 388151 6424509	Tuart	80	#312
95	50 H 388152 6424521	Tuart	100	#312
96	50 H 388174 6424518	Tuart	140	#312
97	50 H 388173 6424511	Tuart	120	#312
98	50 H 388184 6424502	Tuart	170	#312
99	50 H 388171 6424545	Marri	85	#312
100	50 H 388172 6424547	Marri	60	#312

Wypt Code	UM Co-ordinates	Tree Species	DBH (cm)	Lot Location
101	50 H 388171 6424548	Marri	70	#312
102	50 H 388155 6424544	Marri	90	#312
103	50 H 388160 6424559	Marri	70	#312
104	50 H 388165 6424561	Marri	75	#312
105	50 H 388211 6424546	Jarrah	60	#312
106	50 H 388221 6424546	Jarrah	55	#312
107	50 H 388215 6424544	Jarrah	55	#312
108	50 H 388223 6424593	Jarrah	80	#312
109	50 H 388204 6424581	Tuart	90	#312
110	50 H 388104 6424572	Marri	65	#312
111	50 H 388097 6424533	? (Dead)	50	#312
112	50 H 388115 6424632	Marri	70	#312
113	50 H 388136 6424641	Tuart	140	#312
114	50 H 388120 6424725	Marri	140	#312
115	50 H 388169 6424671	Marri	70	#312
116	50 H 388162 6424657	Tuart	120	#312
117	50 H 388185 6424653	Tuart	100	#312
118	50 H 388399 6424461	Jarrah	70	#312
119	50 H 388433 6424443	Jarrah	130	#312
120	50 H 388457 6424421	Tuart	130	#312
121	50 H 388519 6424347	Jarrah	100	#312
122	50 H 388518 6424325	Jarrah	80	#312
123	50 H 388475 6424373	Jarrah	70	#312
124	50 H 388457 6424300	Tuart	110	#312
125	50 H 388434 6424312	Marri	80	#312
126	50 H 388351 6424246	Marri	160	#312
127	50 H 388326 6424180	Tuart	150	#312
128	50 H 388289 6424208	Tuart	180	#312
129	50 H 388296 6424233	Tuart	140	#312
130	50 H 388277 6424263	Tuart	120	#312
131	50 H 388240 6424244	Tuart	150	#312
132	50 H 388221 6424247	Marri	80	#312
133	50 H 388195 6424267	Marri	90	#312
134	50 H 388221 6424278	Tuart	100	#312
136	50 H 388280 6424382	Tuart	180	#312
137	50 H 388265 6424382	Marri	90	#312

Appendix 3. Graceful Sun-Moth Survey Report

Graceful Sun-Moth Survey
Lots 4 and 7, Eighty Rd, Baldivis
March 2011

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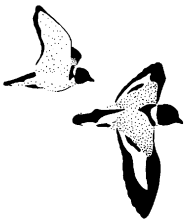

14 June 2010

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1. INTRODUCTION

The Department of Environment and Conservation (DEC) requires development proponents on the Swan Coastal Plain to conduct surveys for the Graceful Sun-Moth and its associated habitat as a component of environmental impact assessments. To address this requirement, Bamford Consulting Ecologists was commissioned by Coterra Environment, on behalf of the Spatial Property Group and the Carcione Group of Companies, to conduct a survey of the Graceful Sun-Moth *Synemon gratiosa* on Lots 4 and 7, Eighty Rd. The study objectives were to:

1) identify areas of suitable habitat and calculate density of plant species important to the Graceful Sun-Moth (e.g. the sedge *Lomandra hermaphrodita*); and
2) determine the presence and abundance of Graceful Sun-Moths within the survey area.

2. BACKGROUND

2.1 Graceful Sun-Moth *Synemon gratiosa*

The Graceful Sun-Moth is listed as specially protected fauna (Schedule 4) under the WA Wildlife Conservation Act 1950 and as Endangered under the Commonwealth Environment Protection and Biodiversity Conservation Act (1999) (EPBC Act). The species is a small, diurnal moth endemic to south-west Western Australia, and its current known distribution is limited to the Swan Coastal Plain from Leeman to Preston Beach (Bishop, *et al.* 2010). There are few known populations, with almost all known populations on small isolated bush remnants and at high risk of local extinction. Adult moths live for only 2 to 10 days, but appear at a particular site over a four week or longer period (Bishop, *et al.* 2010).

2.2 *Lomandra hermaphrodita*

Lomandra hermaphrodita is one of the few plant species upon which the larvae of the Graceful Sun-Moth feed. Adult moths are closely associated with this plant species in the short time they are active. As such, it is important to conduct the Graceful Sun-Moth surveys in areas containing *L. hermaphrodita*. Furthermore, the DEC requires *L. hermaphrodita* density information from remnant vegetation across

the Swan Coastal Plain to contribute to the understanding of the distribution of potential habitat for the Graceful Sun-Moth in the region. While the Graceful Sun-Moth is also associated with the closely related *L. maritima*, this species was not considered as it is not known to occur in the survey area.

2.3 Description of Survey Area

The survey area comprises two lots, Lot 4 (5.6ha) and Lot 7 (4.3ha), along Eighty Rd in Baldivis (see Figure 3). Both of these comprised slightly (in some cases greatly) degraded Mixed Eucalypt/ Corymbia woodland over mixed shrubland.

Figure 3. Lots 4 and 7, Eighty Rd, Baldivis

3. METHODS

3.1 Survey Dates and Personnel

The *L. hermaphrodita* density survey was carried out on 8th and 15th March 2011. Graceful Sun-Moth surveys were carried out on 1st, 8th, 11th, 15th, 23rd and 28th March 2011. This report was prepared by Mr Brenden Metcalf (BSc Env. Sci, Hons Env Sci), with fieldwork being conducted by Mr Brenden Metcalf and Ms Natalia Huang (BSc Zool., Hons Biol.).

Surveys for *L. hermaphrodita* and the Graceful Sun-Moth were carried out in accordance with recommendations made in the methods document provided by the DEC (Bishop *et al.* 2010), although due to the small size of the two project areas (Lot 4 was 5.6ha and Lot 7 was 4.3ha) the *L. hermaphrodita* surveys were carried out concurrently with the Graceful Sun-Moth surveys. Moth surveys were not conducted over consecutive days and moth surveys were completed before the end of March.

3.2 *Lomandra hermaphrodita* Survey

The *L. hermaphrodita* density survey was conducted by sampling 2 x 2 m quadrats at random points through the survey area. Details of the Lot sizes and number of quadrats sampled is provided in Table 9. Survey effort was based on the area of remnant vegetation, rather the total area of the two Lots, which included pasture and building envelopes. Coordinates of each quadrat are given in Appendix 2; locations of quadrats are shown in Figure 3.

Table 9. Details of survey effort based on area of remnant vegetation in the project areas

Lot	Total Size (ha)	Area of remnant vegetation (ha)	2x2 metre habitat assessment quadrats	Sun-Moth survey transect (km)
4	5.6	3.1	15	1.5
7	4.3	1.8	10	1.2

As defined by the DEC, data collected within each quadrat included slope, vegetation condition, aspect, position in landscape, surface soil, sub-surface soil, % bare ground, % exposed rock, vegetation structure and counts of *L. hermaphrodita*. Opportunistic sightings of *L. hermaphrodita* between quadrats were also recorded using qualitative descriptions (common, uncommon). As required by the DEC, data collected throughout the *L. hermaphrodita* survey were forwarded to the DEC.

3.3 Graceful Sun-Moth Survey

The moth survey involved walking transects defined by the presence of *L. hermaphrodita*. Details of the transects walked (i.e. length and route taken) are provided in Table 9 and Figure 4. These surveys were carried out on warm sunny days, usually between 9am and 2pm. Weather data were recorded from the Bureau of Meteorology each day, including temperature, cloud cover and wind speed and direction (see Table 10). As per the requirements of the DEC, data collected throughout the Graceful Sun-Moth survey were forwarded to the DEC.

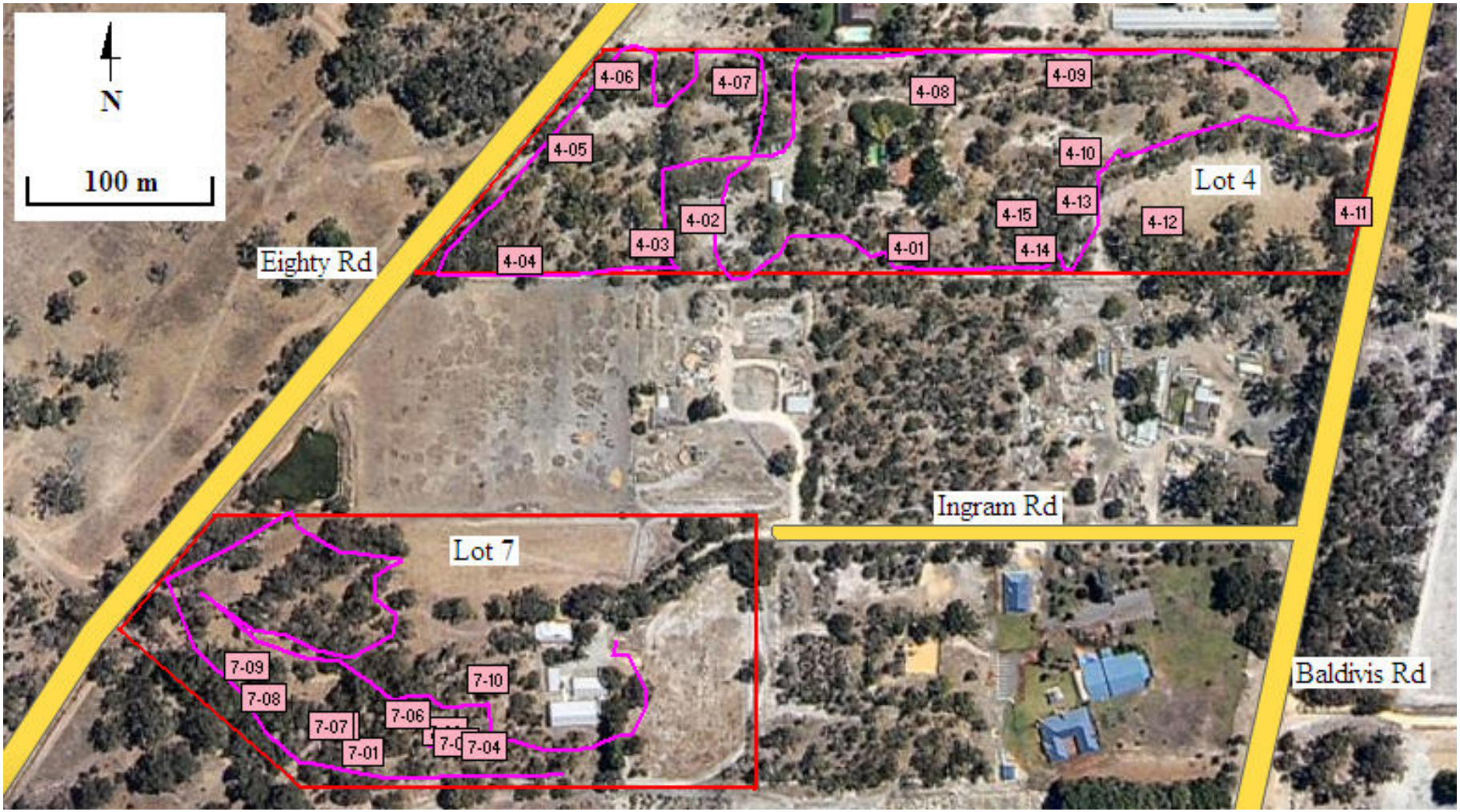

Figure 4. Graceful Sun-Moth survey effort, including walking transects and *l. hermaphrodita* quadrat locations.

4. RESULTS AND DISCUSSION

4.1 *Lomandra hermaphrodita* Survey

Of the quadrats surveyed within the two lots, *L. hermaphrodita* was recorded in 33% (5 of 15) from Lot 4 and 80% (8 of 10) from Lot 7. The location of these quadrats is shown in Figure 4. Raw data collected at each quadrat are presented in Appendix 4 and Appendix 53. Typically, *L. hermaphrodita* occurred within areas containing a diverse understorey of shrubs, mat plants, herbs and grasses.

4.2 Graceful Sun-Moth Survey

No Graceful Sun-Moths were recorded. During the survey, the weather was suitable for surveying this species: temperatures were warm, and wind speed and cloud cover were variable (Table 10). Graceful Sun-Moths appear to be active on warm days but cloud cover and reasonable wind speed do not appear to influence their activity (N. Huang, pers. obs.). Several other flying invertebrates were active throughout the site each day including dragonflies, native flies, wasps, butterflies, bees and other species of moths.

The Graceful Sun-Moth is reliant on *L. hermaphrodita* and associated suitable habitat for breeding (DEC 2010). It is considered unlikely to occur in the survey area due to the generally low quality of habitat for the species.

Table 10. Weather during the Graceful Sun-Moth surveys

Date	Survey times		Weather			
	Start	Finish	Temp (ºC)	Wind		Cloud Cover (%)
				Speed (km/h)	Direction	
01/03/11	11:02am	12:01am	31	24	N	0
08/03/11	09:00am	10:30am	30	28	N	5
11/03/11	09:00am	10:30am	24	19	SE	5
15/03/11	09:00am	10:30am	26	26	NE	5
23/03/11	09:00am	10:30am	26	0	n/a	5
28/03/11	09:00am	10:30am	27	2	SE	60

REFERENCES

Bishop, C., Williams, M., Mitchell, D. and Gamblin, T. (2010). Survey guidelines for the Graceful sun-moth (*Synemon gratiosa*) & site habitat assessments. V1.2. WA Dept of Environment and Conservation.

Appendix 4. Raw Data of *L. hermaphrodita* survey quadrats: General description, coordinates and site details.

Date	Quadrat number	Easting	Northing	Aspect	% bare ground	Slope	Position	Vegetation condition	Surface soil	Sub-surface soil	% exposed rock	Recent Burn	L. hermaphrodita (number plants)
LOT 4													
15 Mar	1	388784	6424311	S	10	Very gently inclined 1 to 2°	Upper slope	Degraded	Brown sand	Yellow sand	0	None	11
15 Mar	2	388731	6424301	S	0	Very gently inclined 1 to 2°	Upper slope	Degraded	Brown sand	Yellow sand	0	None	0
15 Mar	3	388646	6424312	S	0	Very gently inclined 1 to 2°	Upper slope	Degraded	Brown sand	Yellow sand	0	None	0
15 Mar	4	388575	6424302	S	5	Very gently inclined 1 to 2°	Mid slope	Degraded	Brown sand	Yellow sand	0	None	0
15 Mar	5	388602	6424362	SW	5	Very gently inclined 1 to 2°	Mid slope	Degraded	Brown sand	Yellow sand	0	None	0
15 Mar	6	388627	6424401	N	5	Very gently inclined 1 to 2°	Mid slope	Degraded	Brown sand	Yellow sand	0	None	0
15 Mar	7	388690	6424400	W	0	Very gently inclined 1 to 2°	Mid slope	Degraded	Brown sand	Yellow sand	0	None	0
15 Mar	8	388797	6424395	S	0	Very gently inclined 1 to 2°	Mid slope	Degraded	Brown sand	Yellow sand	0	None	0
15 Mar	9	388871	6424405	W	0	Gently inclined 3 to 9°	Mid slope	Degraded	Brown sand	Yellow sand	0	None	0
15 Mar	10	388877	6424363	SW	80	Gently inclined 3 to 9°	Mid slope	Poor	Grey sand	Yellow sand	0	None	53
15 Mar	11	389024	6424333	NW	0	Very gently inclined 1 to 2°	Lower Slope	Poor	Grey sand	Yellow sand	0	None	0
15 Mar	12	388922	6424326	W	0	Very gently inclined 1 to 2°	Lower Slope	Degraded	Grey sand	Yellow sand	0	None	0
15 Mar	13	388875	6424336	S	5	Very gently inclined 1 to 2°	Lower Slope	Poor	Grey sand	Yellow sand	0	None	20
15 Mar	14	388853	6424311	W	10	Very gently inclined 1 to 2°	Mid slope	Poor	Grey sand	Yellow sand	0	None	12
15 Mar	15	388843	6424330	SW	5	Very gently inclined 1 to 2°	Mid slope	Poor	Grey sand	Yellow sand	0	None	9
Date	Quadrat number	Easting	Northing	Aspect	% bare ground	Slope	Position	Vegetation condition	Surface soil	Sub-surface soil	% exposed rock	Recent Burn	L. hermaphrodita (number plants)
LOT 7													
1 Feb	1	388493	6424036	S	15	Gently inclined 3 to 9°	Mid slope	Poor	Pale grey	Dark grey/brown	0	None	5
1 Feb	2	388537	6424048	S	10	Gently inclined 3 to 9°	Mid slope	Poor	White	Black	0	None	4
1 Feb	3	388543	6424042	SE	20	Very gently inclined 1 to 2°	Mid slope	Poor	White	Black	0	None	5
1 Feb	4	388558	6424040	S	50	Gently inclined 3 to 9°	Mid slope	Poor	White	Black	0	None	3
1 Feb	5	388478	6424050	N	17	Gently inclined 3 to 9°	Lower Slope	Poor	Pale Grey	Orange/grey	0	None	3
15 Mar	6	388516	6424056	SW	70	Gently inclined 3 to 9°	Flat	Poor	Brown sand	Yellow sand	0	None	9
15 Mar	7	388475	6424051	NE	0	Gently inclined 3 to 9°	Flat	Poor	Brown sand	Yellow sand	0	None	0
15 Mar	8	388439	6424065	N	0	Gently inclined 3 to 9°	Flat	Poor	Brown sand	Yellow sand	0	None	1
15 Mar	9	388429	6424082	S	0	Very gently inclined 1 to 2°	Flat	Degraded	Brown sand	Yellow sand	0	None	0
15 Mar	10	388559	6424076	S	50	Gently inclined 3 to 9°	Flat	Poor	Brown sand	Yellow sand	0	None	31

Appendix 5. Raw Data of quadrats: Vegetation Structure

Life Form/ Height Class	Trees over 30m					Trees 10 - 30m					Trees under 10m					Shrubs over 2m					Shrubs 1 - 2m					Shrubs under 1m					Mat plants					Grasses					Herbs					Sedges				
Canopy Cover	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%
LOT 4																																																	
1					1				1				1							1					1					1						1								1					1
2					1					1		1						1					1						1					1	1								1					1
3					1					1				1						1					1				1						1									1					1
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5					1			1					1							1					1					1						1							1						1
6					1				1				1							1					1					1						1							1						1
7					1					1					1			1					1						1					1	1													1
8					1					1			1							1					1					1					1	1								1					
9					1					1			1							1					1					1					1	1								1					1
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15					1					1				1						1				1					1					1		1									1					1

Life Form/ Height Class	Trees over 30m					Trees 10 - 30m					Trees under 10m					Shrubs over 2m					Shrubs 1 - 2m					Shrubs under 1m					Mat plants					Grasses					Herbs					Sedges				
Canopy Cover	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%	Dense 70-100%	Mid-Dense 70-30%	Sparse 10-30%	Very sparse 2-10%	Absent 0%
LOT 7																																																	
1					1					1				1						1				1				1					1				1					1				1		
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9					1					1					1					1					1					1					1				1					1					1
10					1					1					1					1					1				1					1				1					1					1

APPENDIX E – APPROVAL UNDER THE EPBC ACT (NOT A CONTROLLED ACTION DETERMINATION) (SEWPaC, JANUARY 2012)

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

Mr Bruce Young
Managing Director
Spatial Property Group Pty Ltd
Unit 1
896 Canning Highway
APPLECROSS WA 6153

Date: 12 January 2012
EPBC Ref: 2011/6195
EPBC contact: Dionne Cassanell
02 7274 2114
dionne.cassanell@environment.gov.au

Dear Mr Young

Decision on referral
Urban Subdivision at Fifty Road and Eighty Road, Baldivis, WA
(EPBC 2011/6195)

This is to advise you of my decision, under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), about the proposed action to develop Lots 312 and 313 Fifty Road, and Lots 2,4,7 and 8 Eighty Road for urban subdivision in Baldivis, Western Australia.

As a delegate of the Minister for Sustainability, Environment, Water, Population and Communities, I have decided that the proposed action is not a controlled action. This means that the proposed action does not require further assessment and approval under the EPBC Act before it can proceed.

A copy of the document recording this decision is enclosed. This document will be published on the department's website.

Please note that this decision relates only to the specific matters protected under Chapter 2 of the EPBC Act.

This decision does not affect any requirement for separate state or local government environment assessment and approvals of the proposed action.

The department has an active audit program for proposals that have been referred under the EPBC Act. The audit program aims to ensure that proposals are implemented as planned. You should be aware that your project may be selected for audit by the department at any time and all related records and documents may be subject to scrutiny. Information about the department's audit strategy is enclosed.

I have written separately to Mr Anthony Sutton, Director Assessment Compliance Services, Office of the Environmental Protection Authority advising him of this decision.

If you have any questions about the referral process or this decision, please contact the EPBC project manager and quote the EPBC reference number shown at the beginning of this letter.

Yours sincerely

Barbara Jones
Assistant Secretary
Environment Assessment Branch

cc. Mr Luke Rogers, Coterra Environmental

APPENDIX F – LOT 3 POULTRY FARM ODOUR ASSESSMENT (THE ODOUR UNIT, 2010)

RPS

Odour Impact Assessment & Dispersion Modelling Study

Layertech Services

Baldivis W.A.

Final Report

April 2010

THE ODOUR UNIT (WA) PTY LTD

ACN 126 439 076

Perth, Western Australia
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Myaree, WA, 6154

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Project Number: W1542L

Report Revision		
Revision Number	**Date**	**Description**
Draft Report (version 1)	09.02.2010	Internal Review by The Odour Unit
Draft Report (version 1)	19.02.2010	Draft Report for Review by RPS
Final Report	14.04.2010	Final Report
Report Preparation		
Report Prepared By: J. Hurley		**Approved By:** T. Schulz
Report Title: Odour Impact and Dispersion Modelling Study of Baldivis Egg Layer and Hatchery		

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1 INTRODUCTION

In January 2010, RPS commissioned The Odour Unit WA Pty Limited (TOU) to conduct an Odour Investigation and Dispersion Modelling Study of potential odorous emissions emanating from the Baldivis Layertech Services Poultry (LSP) Farm, with a view to determining the resulting ground level off-site odour impacts by way of both Field Based Ambient Odour Surveys (FAOA's) and Dispersion Modelling.

The investigation was initiated in response to RPS seeking a more definitive description of the currently placed "generic" odour contour that applies to the LSP Farm operation.

RPS represents a land holding at Lot 61 Eighty Road, Baldivis. The land holding is North-West of the LSP Farm **(refer Figure 1).**

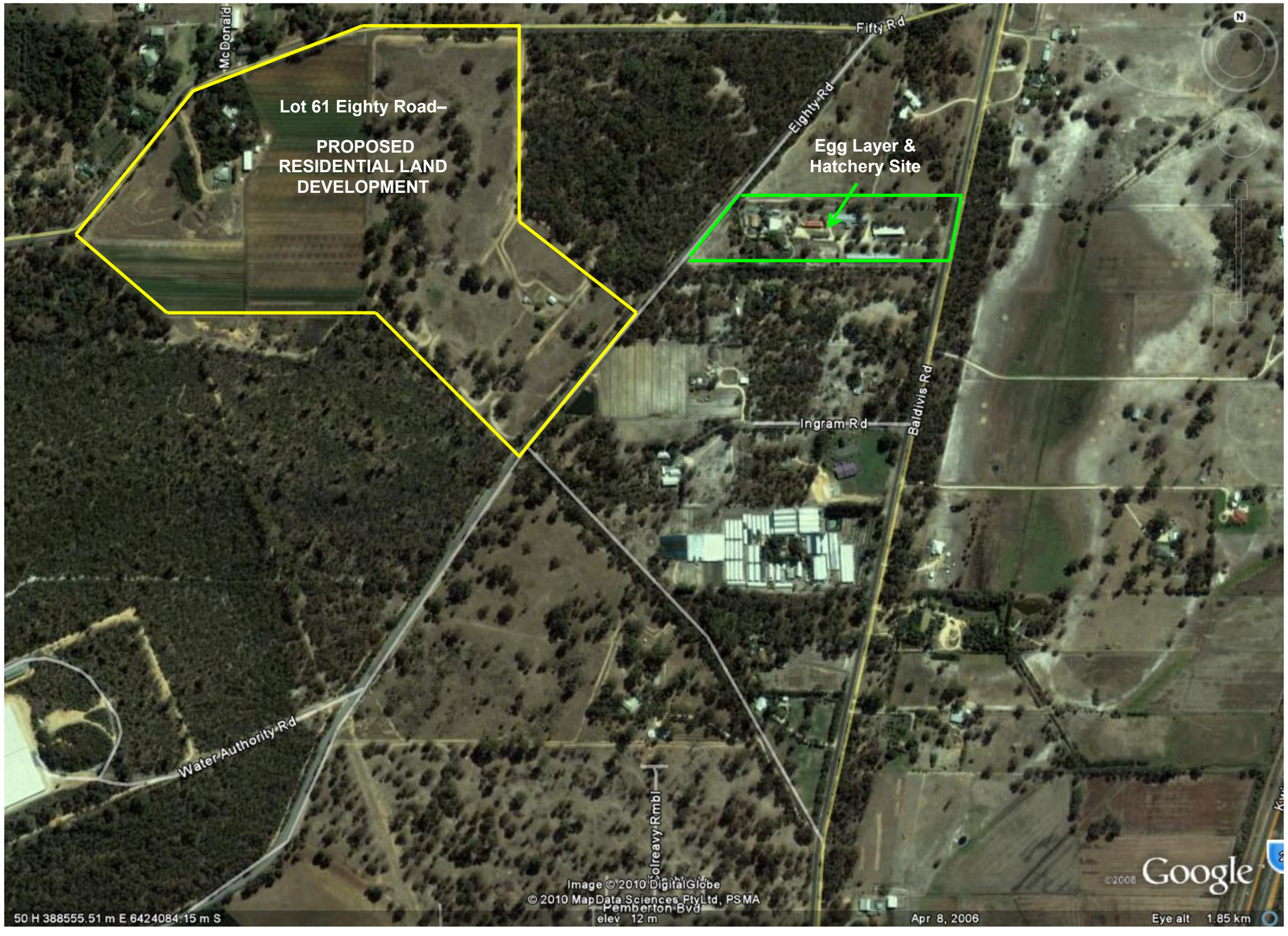


Figure 1: Aerial Plot Illustration of Proposed Residential Land Developments.

The Western Australian generic buffer distance in place for intensive farming in the Poultry Industry is 300m – 1000m depending on size. The size of the LSP Farm suggests that a 300m buffer would apply based on the Western Australian Environmental Protection Agencies document *"Guidance for the Assessment of Environmental Factors: Separation Distances between Industrial and Sensitive Land Uses No.3: June 2005".*

The LSP Farm however may not be perceived as an intensive farming practice as the animals are free-range. Additionally, the LSP Farm is not a meat producer and therefore a basis for a reduction in this 300m buffer range is being investigated herein.

The LSP Farm operation is an egg layer and hatchery facility located in a semi-rural land setting, on an area of approximately 40,000m^2. Multiple sheds are visible at the LSP Farm along with office facilities. Based on TOU's knowledge of shed layouts for poultry farm operations, TOU identified three sheds as potential odorous sources.

The assessment of potential odorous impacts was undertaken utilising two study methodologies. These study methods were Field Based Ambient Odour Assessments according to a modified version of the German VDI Standard 3940, and Dispersion Modelling assessments utilising the Victorian EPA's AUSPLUME modelling software. A total of five (5) field based ambient odour surveys (FAOA's) were conducted by TOU field technicians over the duration of the project. These FAOA's were undertaken over varied conditions and time of day.

The investigation of odorous impacts utilising a dispersion modelling approach requires, at best, site-specific emission data. Given that TOU were unable to gain access to the LSP Farm facility, and with a current lack of industry published data for Poultry Egg Layer and Hatchery Facilities, TOU sought the advise of the WA DEC. TOU was advised by the WA DEC that the LSP Farm facility should be conservatively viewed as a Poultry Broiler operation, although the LSP Farm is clearly not a broiler operation.

This advice essentially elevates the LSP Farm facility into a 'worst case' category for poultry odour emissions, as previous studies by Jiang and Sands (1998) on broiler farms suggest odour emission rate are approximately 2.5 times greater than Layer Shed and Hatchery operations.

TOU utilised odour emission data for input into the dispersion modelling study from the Jiang & Sands (CWWT, 1998) Technical Report entitled "Odour Emissions from Poultry Farms in Western Australia". The broiler (meat birds) odour emission rate, per bird, as reported by Jiang & Sands (1998) is 0.205ou.m^3 sec^{-1} $bird^{-1}$. The reported odour emission rate for layershed farms was 0.079ou.m^3 sec^{-1} $bird^{-1}$.

The results of the TOU field based ambient odour assessments were used to compare to the overly conservative odorous impact predictions of the dispersion modelling. This 'ground truthing' calibration is extremely valuable in validating the predicted odour contour/s from dispersion modelling.

To predict the potential odorous impacts emanating from the LSP Farm operation, TOU adopted the current Queensland Environmental Protection Agency (QEPA) 'Ecoaccess' odour performance criterion (OPC), in lieu of the now defunct WA DEC guidelines (Guidance 47). The QEPA OPC is currently accepted by the WA DEC as an 'interim' guidance whilst the WA DEC prepares a formal OPC.

This report documents the findings of both the field based ambient odour surveys and the plume dispersion modelling study. It describes the method used to undertake these field based ambient odour surveys, details the assumptions for odour emissions data, and presents the relevant WA DEC OPC and results of the odour dispersion modelling study.

2 REVIEW OF POULTRY INDUSTRY EMISSIONS DATA

The Poultry industry in Western Australia is a long-standing economic contributor. However, the extent of reliable peer-reviewed research undertaken into potential emissions from these poultry farms is not yet widespread. As a result of this lack of published information, TOU sought to review those guidelines and known publications that relate specifically to the LSP Farm operation.

2.1 WA DEC RECOMMENDED POULTRY EMISSION RATE

TOU liaises regularly with EPA bodies throughout Australia. At the commencement of this investigation, TOU discussed the requirements of this study with the WA DEC, specifically Mr. Dave Griffith. Mr. Griffith advised TOU that the WA DEC would currently accept published data by Jiang & Sands (1998) entitled 'Odour Emissions from Poultry Farms in Western Australia'.

The findings of the Jiang & Sands (1998) paper reports odour emission rate (OER) data for Poultry Broiler Farms as 0.205 odour units (ou) x m^3 sec^{-1} $bird^{-1}$. This emission rate is based on an average stocking density of 17.4 birds per m^2 of floor area. Given that the LSP Farm is a Layershed and Hatchery facility, the emission data prescribed by the WA DEC is highly conservative. The Jiang & Sands (1998) paper also investigated Layershed and Hatchery emissions reporting a single OER of 0.079ou.m^3 sec^{-1} $bird^{-1}$. The ratio of OER's for Broiler farms is therefore approximately 2.5 times greater than those from Layershed and Hatchery farms.

The 0.079ou's sec^{-1} $bird^{-1}$ is however largely insufficient for use in this study. The reasoning for this is that the Jiang & Sands (1998) study only collected one data point. Since TOU is not aware of other known data published for the Layershed and Hatchery industry relevant to the Western Australian climate, TOU will adopt the WA DEC prescribed 0.205ou.m^3 sec^{-1} $bird^{-1}$ as its basis for this study. The advantage of this however is that the scenario for predictive dispersion modelling will be highly conservative and hence 'worst-case'.

2.2 AUSTRALIAN MODEL CODE OF PRACTICE – POULTRY (4TH ED.)

The Australian Animal Welfare Committee (AWF) prescribes guidelines and ethical conducts for the welfare and husbandry of domestic poultry. Specifically, the AWF has published a report for the welfare of poultry entitled 'The Australian Model Code of Practice for the Welfare of Animals – Domestic Poultry'. The Primary Industries Ministerial Council (PIMC) endorsed this code in May 2002. The report advises that a review of the code will take place in 2010 providing that no new technologies offering significant welfare benefits are available prior to this review date. The 2010 review is yet to be formalised.

This Code of Practice (COP) reports various data for minimal acceptable standards for poultry stocking densities. This data is based on industry changes to 'caged' floor space allocation per bird.

This study has been structured to accommodate for a caged system of poultry housing at the LSP Farm.

To ensure a rigorous assessment of the LSP Farm facility, TOU has reviewed the COP and included the data in its dispersion modelling scenarios. This data differs from the WA DEC prescribed data in that it reports marginally greater stocking densities for facilities operating at best industry practices.

2.1.1 Stocking Densities for Cage Systems – Minimum Acceptable Standards

The following text has been extracted from Appendix 1 of the "Australian Model Code of Practice for the Welfare of Domestic Poultry (4th Edition)".

1. All new cage systems commissioned (i.e. point when the contract to purchase or lease the cages was signed) **from 1 January 2001 (i.e. post 1 Jan 2001 cages) must provide a minimum floor space allowance of 550 cm^2 per layer** for cages with three or more birds per cage where the birds weigh less than 2.4 kg.

2. Where a producer signed a contract to purchase or lease cages before 1 January 2001, to provide a space allowance of less than 550 cm^2 per bird, installation of these cages must be completed by 30 June 2001, or when legislation is operative after 1 January 2001, within six months of the legislation becoming operative. If these deadlines are not met, the cages will be designated as "post 1 Jan 01 cages" for the purposes of stocking density.

3. Cages other than "post 1 Jan 01" cages are designated as **"pre 1 Jan 01" cages and must provide a minimum floor space allowance of 450 cm^2 per layer** for cages with three or more birds per cage.

4. Minimal acceptable space allowances for caged laying or breeding fowls weighing up to 4.5 kg live weight are presented in the following table:

Pre January 2001 cages	Post 1 January 2001 cages
minimum cage floor area/bird	
3 or more fowls (<2.4 kg) per cage	
450 cm^2	550 cm^2
3 or more fowls (> 2.4 kg) per cage	
600 cm^2	600 cm^2
2 fowls per cage	
675 cm^2	675 cm^2
Single fowl cages	
1000 cm^2	1000 cm^2

*** These figures are recommended for inclusion into statute law of States and Territories as the minimum space allowance for layer hens in cages.**

5. Minimal acceptable space allowances for laying or breeding fowls weighing more than 4.5 kg live weight are presented in the following table:

Birds per Cage	Maximum live weight per unit of floor area from 1 January 1995
3 or more fowls per cage	46 kg / m^2
2 fowls per cage	40 kg / m^2
Single fowl cages	26 kg / m^2

6. Floor area is measured in a horizontal plane and includes the area under the egg/waste baffle and the area under the drinking nipples and vee-trough for water.

7. Maximum acceptable live weight density for rearing layer pullets or layer breeders is 40kg live weight per m2 cage floor area.

The recommendations of the COP relate to the LSP Farm on the basis of stocking densities as either PRE2001 or POST2001.

- The **PRE2001** data for stocking densities recommends a minimum of 450cm^2 (0.045m^2) per bird, which translates into **22.2 birds per m^2 of floor space**, and

- The **POST2001** data for stocking densities recommends a minimum of 550cm^2 (0.055m^2) per bird, which translates into **18.2 birds per m^2 of floor space.**

TOU has utilised both the PRE2001 and POST2001 stocking densities, along with the WA DEC prescribed data to simulate three dispersion modelling scenarios. Each odour source (i.e. layer shed or litter storage/layer shed) was evaluated for maximum surface area available for livestock based on Appendix 1, point 6 of the COP.

3 LAYERTECH SERVICES POULTRY (LSP) FARM

The Layertech Services Poultry (LSP) Farm is located approximately 50kms south west of the Perth Metropolitan CBD. The facility occupies approximately 40,000m^2 and maintains three operational sheds of which TOU has identified as potential odour sources. One of these sheds (Shed 3) may be utilised as a litter storage facility as many operators house their used litter and have it removed at designated intervals annually. **Figure 3.1** below illustrates the layout of the LSP Farm.

Figure 3.1: Layertech Services Poultry (LSP) Farm Layout.

The Storage Warehouse and Hatchery Shed were identified by TOU on the basis of their respective construction and layouts. The Warehouse (white roof) is surrounded by a hardstand and looks to facilitate the throughput of transport vehicles/trucks. The assumed hatchery (brown roof) was identified by TOU as such due to the apparent lack of feeder towers and roof ventilation. Hatcheries must be temperature maintained to ensure welfare and growth of the poultry chicks. TOU's experience with hatcheries would suggest that hatchery odours are largely minimal when compared to egg layer odours. For the purpose of this investigation, TOU has omitted the anticipated hatchery shed as a problematic odour source.

Both Shed 1 and 2 were identified by TOU as the principal Layersheds based largely on their layout and construction. Shed 3 however, although similar in construction to sheds 1 and 2, may be utilised as a storage facility for used Layershed litter to be disposed of at annual intervals. Irrespective of this, TOU has treated Shed 3 as a problematic emission source and modelled it as a functional Layershed. The designated offices/sales building has in part a shed that houses hens/chicks. This is clearly visible from Eighty Road (west side of LSP). TOU's observations downwind of this shed suggest that odours from this source are extremely low. The use of this shed is not clearly understood, however, it is anticipated that hens are held here for sale purposes, or as an intermittent holding shed for hens and chicks.

There are no other known or identified odour sources at the LSP Farm. The LSP Farm land itself is very clean and well managed and is well established for forestry and native shrub, which may serve as effective natural barriers for odour dispersion.

4 ODOUR SAMPLING METHOD

4.1 FIELD BASED AMBIENT ODOUR SURVEYS

The Odour Unit (TOU) uses a method for assessing the ground level impacts of odour emissions from a source that utilizes a modified version of the German standard VDI3940 – "Determination of Odorants in Ambient Air by Field Inspections". TOU's previous experience with ambient odour sampling and subsequent olfactometry analyses indicates that accurate and useful ambient odour concentration data is difficult to obtain using conventional techniques. Therefore, TOU has adopted a more practical approach based on the field measurement of odour intensity.

With this method, calibrated and experienced odour specialists traverses the downwind surrounds of the odour source/s in a strategically mapped pattern, assessing the presence, character and intensity of any odours both from the odour source/s, and those sources impacting on adjacent and adjoining sites, and records these observations along with wind speed and direction.

Five (5) field surveys were conducted over the study period, and were approximately two hours in duration.

Once the assessor/s had determined the wind direction across the locale, he/she would attempt to move around the surrounding areas, downwind of any odorous sources, and covering as much territory as possible. Assessment locations were numbered for each individual survey.

At each assessment location the following data was logged.

- Location reference position
- Time
- Wind direction
- Wind velocity
- Odour present (yes/no)
- Odour character
- Odour Intensity (rating 0-6)
- Comments

Prior to the commencement of each survey, the TOU technician would first survey local meteorological data to determine if the conditions were suitable for conducting a survey of the locale. Once the local weather conditions had been assessed, the assessor would spend up to ten minutes at each assessment location in order to gauge the effects of the odour impact. At each location, wind velocity was measured using a TSI Model Velocicheck hotwire anemometer, while wind direction was determined using a compass. During gusty, highly fluctuating wind conditions, the average velocity and/or a minimum/maximum range was recorded. The average was determined by the technician's observations.

TOU attempted to conduct each field based ambient survey when wind velocity was low to moderate. That is, when wind velocity was less than, or averaging 10.0 – 15.0km/h (2.78m s^{-1} – 4.17m s^{-1}).

If an odour was detected at a location, the trained assessor attempted to characterize it and define its source. Odours that were determined to be clearly unrelated to the LSP Farm were recorded in the comments section of the log sheets. Odours originating from the LSP Farm were rated in accordance with the VDI3882/3940 odour intensity scale.

The general aim was to determine the extent of the impact of odours at the LSP Farm boundary, and off-site of the LSP Farm, and rank their intensity. The ranking scale used by the German standard for Determination of Odour Intensity (VDI3882) and "Determination of Odorants in Ambient Air by Field Inspections" (VDI3940) was used.

The standard's ranking system is based on the following seven-point intensity scale:

TABLE 4.1: GERMAN INTENSITY STANDARD VDI3882/3940 SCALE

Intensity Scale	Description
0	Not detectable
1	Very Weak
2	Weak
3	Distinct
4	Strong
5	Very Strong
6	Extremely Strong

5 FIELD BASED AMBIENT ODOUR SURVEY RESULTS

The results of these surveys are depicted in two principal ways.

Firstly, odour observations from the field logs are statistically processed to derive the frequency of odour observations according to the odour intensity ranking system. The frequency of odour intensity observations is based on a 10-minute assessment interval at a given observation location.

The log sheets completed by the technician contain the unprocessed data for each location on each survey occasion. This data is quite extensive and, while valuable in examining the odour impacts at specific locations, does not enable a general visual assessment of the extent of the odour nuisance.

Secondly, the processed results of the individual field surveys are contained in the following odour impact maps, which are based on the log sheets for each survey. Each map illustrates the locations visited, and the frequency of odour intensity detected from the odour source (represented by a colour coded pie chart). Locations visited that recorded an odour intensity score of '0' (not detectable) were still recorded in order to outline the extent of the plume's limit. The location numbers that correspond to the locations where the survey was concentrated don't necessarily represent the order of locations surveyed for each day of survey. Where duplicate numbers are illustrated on the odour impact maps, the TOU field assessor has assessed that location multiple times to verify suspected odours, or a nil result at that location.

The results are as follows:

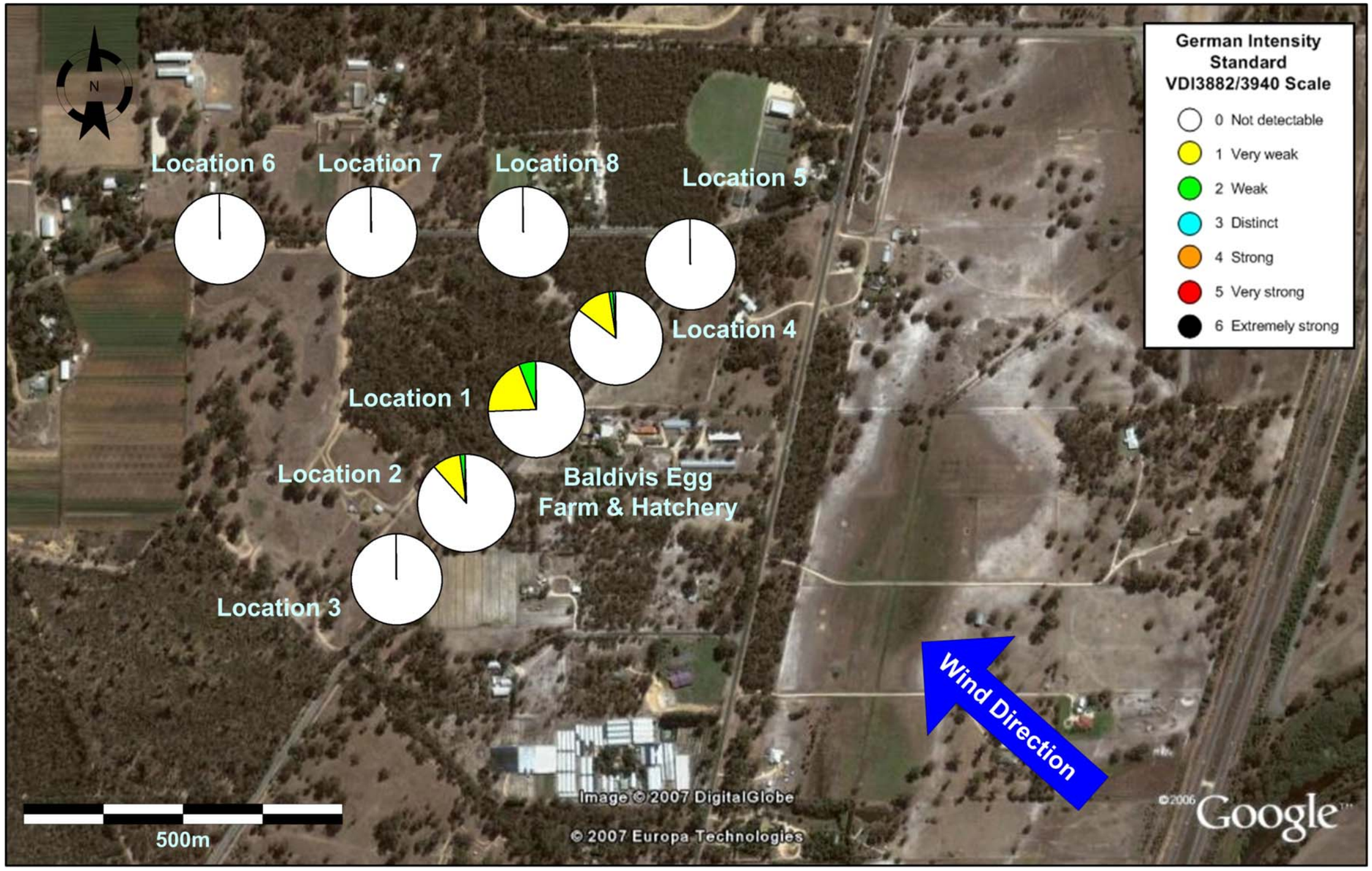
Survey #1:

- Tuesday 19th January 2010
- 08:00hrs to 11:00hrs
- Temperature = 30°C to 36°C
- Wind velocity 1m/s - 2.5m/s
- Wind direction SE to ESE

An initial traverse on Eighty Rd was performed to determine the optimal locations for assessors. This showed, with the wind coming from the SE, only slight odours (of intensity ranking 2 and less) were detected directly at the LSP Farm entrance gate on Eighty Rd. The intensity decreased to a ranking of 1 within 70m (from the entrance) in the northern direction along Eighty Rd, and 30m in the southern direction. Past this there were no odours detected (including Fifty Rd).

Survey Location	Intensity Frequencies (%) - Baldivis FAOA 19/01/2010						
	0	1	2	3	4	5	6
1	**74.0**	**20.0**	**6.0**	0	0	0	0
2	**87.0**	**11.0**	**2.0**	0	0	0	0
3	**100**	0	0	0	0	0	0
4	**85.0**	**12.5**	**1.7**	**0.8**	0	0	0
5	**100**	0	0	0	0	0	0
6	**100**	0	0	0	0	0	0
7	**100**	0	0	0	0	0	0
8	**100**	0	0	0	0	0	0

Odour impacts on this survey day were not considered problematic. An illustration of the odour frequencies and location is depicted below. The illustrated size of the frequency pie charts doesn't reflect the 'extent' of the impact. That is, for those frequency pie charts on Eighty Road, the observations are on the road itself and not within the adjoining land to the north-west.



RPS Group

Assessment Location: Baldivis Egg Layer and Hatchery
Weather Conditions: Fine & Sunny, 33°C, **SE to ESE winds at 1 - 3 m/s**
Date & Time: Tuesday 19th January, 08:00 - 11:00hrs

THE ODOUR UNIT

Figure 5.1: Field Based Ambient Odour Survey Result (19th January, 2010).

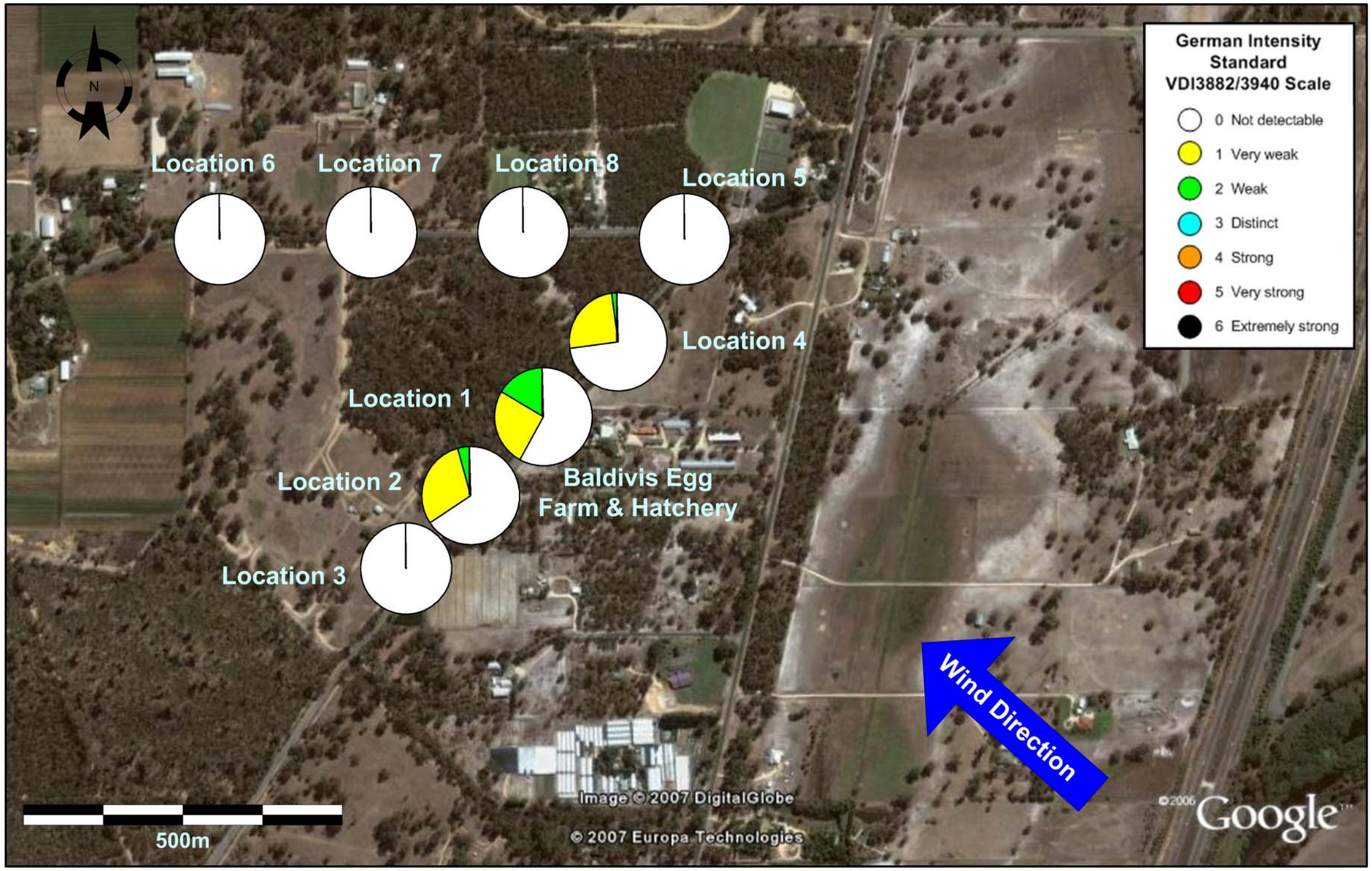
Survey #2:

- Wednesday 20th January 2010
- 13:00hrs to 16:00hrs
- Temperature = 26°C
- Wind velocity 2.5m/s - 5m/s
- Wind direction S to E

The assessors were set in the same initial locations as the first survey, as the wind conditions were similar. On Eighty Rd the highest intensity rank was 2, with greater frequency than the first survey. The highest frequency of 2's was located, again, directly at the Eighty Rd entrance gate. North on Eighty Rd, the plume was just detectable approximately 100m from the entrance at intermittent odour intensity of less than 2. Odour observations south of the Eighty road entrance were intermittently detectable up to 40m. No odours were detected on Fifty Rd.

Survey Location	Intensity Frequencies (%) - Baldivis FAOA 20/01/2010						
	0	1	2	3	4	5	6
1	60.0	25.0	15.0	0	0	0	0
2	66.0	30.0	4.0	0	0	0	0
3	100	0	0	0	0	0	0
4	74.0	24.0	2.0	0	0	0	0
5	100	0	0	0	0	0	0
6	100	0	0	0	0	0	0
7	100	0	0	0	0	0	0
8	100	0	0	0	0	0	0

Odour impacts on this survey day were not considered problematic. An illustration of the odour frequencies and location is depicted below. The illustrated size of the frequency pie charts doesn't reflect the 'extent' of the impact. That is, for those frequency pie charts on Eighty Road, the observations are on the road itself and not within the adjoining land to the north-west.



RPS Group

Assessment Location: Baldivis Egg Layer and Hatchery
Weather Conditions: Fine & Sunny, 26°C, **S to E winds at 2.5 - 5 m/s**
Date & Time: Wednesday 20th January, 13:00 - 16:00hrs

THE ODOUR UNIT

Figure 5.2: Field Based Ambient Odour Survey Result (20th January, 2010).

Survey #3:

- Thursday 21st January 2010
- 09:00hrs to 12:00hrs
- Temperature = 20°C to 26°C
- Wind velocity 2.5m/s - 4.5 m/s
- Wind direction S

With the wind coming from the south no odours were detected at the Eighty Rd entrance location. Approximately 70m north (still on Eighty Rd) intensity rankings of 1 and infrequent 2's were recorded. Assessors were located at various positions north of the facility on Fifty Rd and east on Baldivis Rd. No odours were detected at these locations.

Survey Location	Intensity Frequencies (%) - Baldivis FAOA 21/01/2010						
	0	1	2	3	4	5	6
1	**0.0**	0	0	0	0	0	0
2	**74.0**	**24.0**	**2.0**	0	0	0	0
3	**100**	0	0	0	0	0	0
4	**100.0**	0	0	0	0	0	0
5	**100**	0	0	0	0	0	0
6	**100**	0	0	0	0	0	0
7	**100**	0	0	0	0	0	0
8	**100**	0	0	0	0	0	0

Odour impacts on this survey day were not considered problematic. An illustration of the odour frequencies and location is depicted below. The illustrated size of the frequency pie charts doesn't reflect the 'extent' of the impact. That is, for those frequency pie charts on Eighty Road, the observations are on the road itself and not within the adjoining land to the north-west.

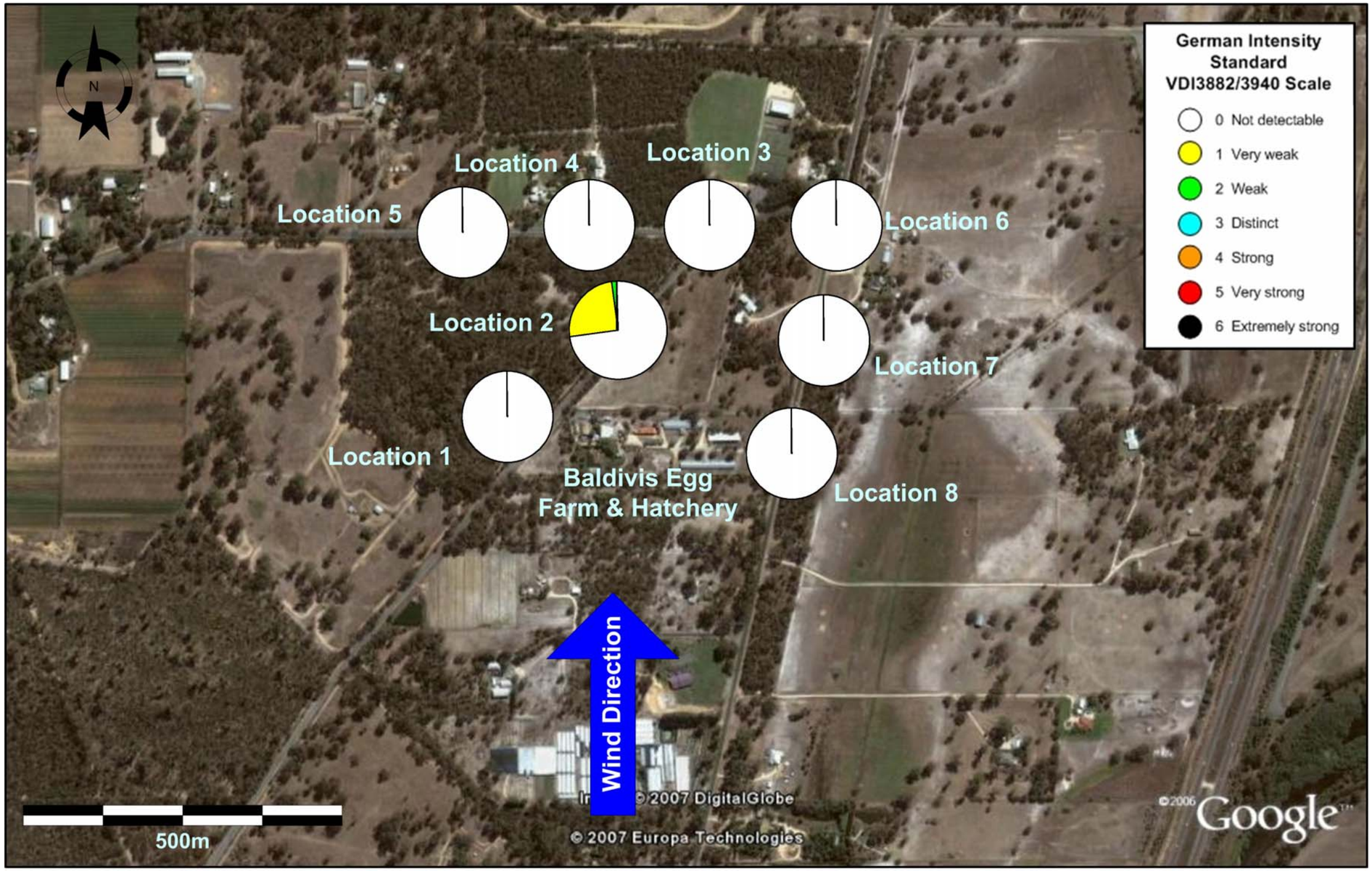


Figure 5.3: Field Based Ambient Odour Survey Result (21st January, 2010).

Survey #4:

- Friday 22nd January 2010
- 09:00hrs to 12:00hrs
- Temperature = 22°C to 28°C
- Wind velocity 1m/s - 3 m/s
- Wind direction E to S

Intensity rankings of 1 and 2 were recorded at the Eighty Rd entrance and also approximately 70m north of the entrance. No odours were detected south of the entrance. Assessors were spaced approximately 200m apart along Fifty Rd, no odours were detected. As with all surveys the direct surrounds, including Baldivis and Ingram Rd, were traversed to detect any possible effects of swinging winds. No odours observed.

Survey Location	Intensity Frequencies (%) - Baldivis FAOA 22/01/2010						
	0	1	2	3	4	5	6
1	**49.0**	**35.0**	**16.0**	0	0	0	0
2	**100.0**	0	0	0	0	0	0
3	**63.0**	**33.0**	**4.0**	0	0	0	0
4	**100.0**	0	0	0	0	0	0
5	**100**	0	0	0	0	0	0
6	**100**	0	0	0	0	0	0
7	**100**	0	0	0	0	0	0
8	**100**	0	0	0	0	0	0

Odour impacts on this survey day were not considered problematic. An illustration of the odour frequencies and location is depicted below. The illustrated size of the frequency pie charts doesn't reflect the 'extent' of the impact. That is, for those frequency pie charts on Eighty Road, the observations are on the road itself and not within the adjoining land to the north-west.

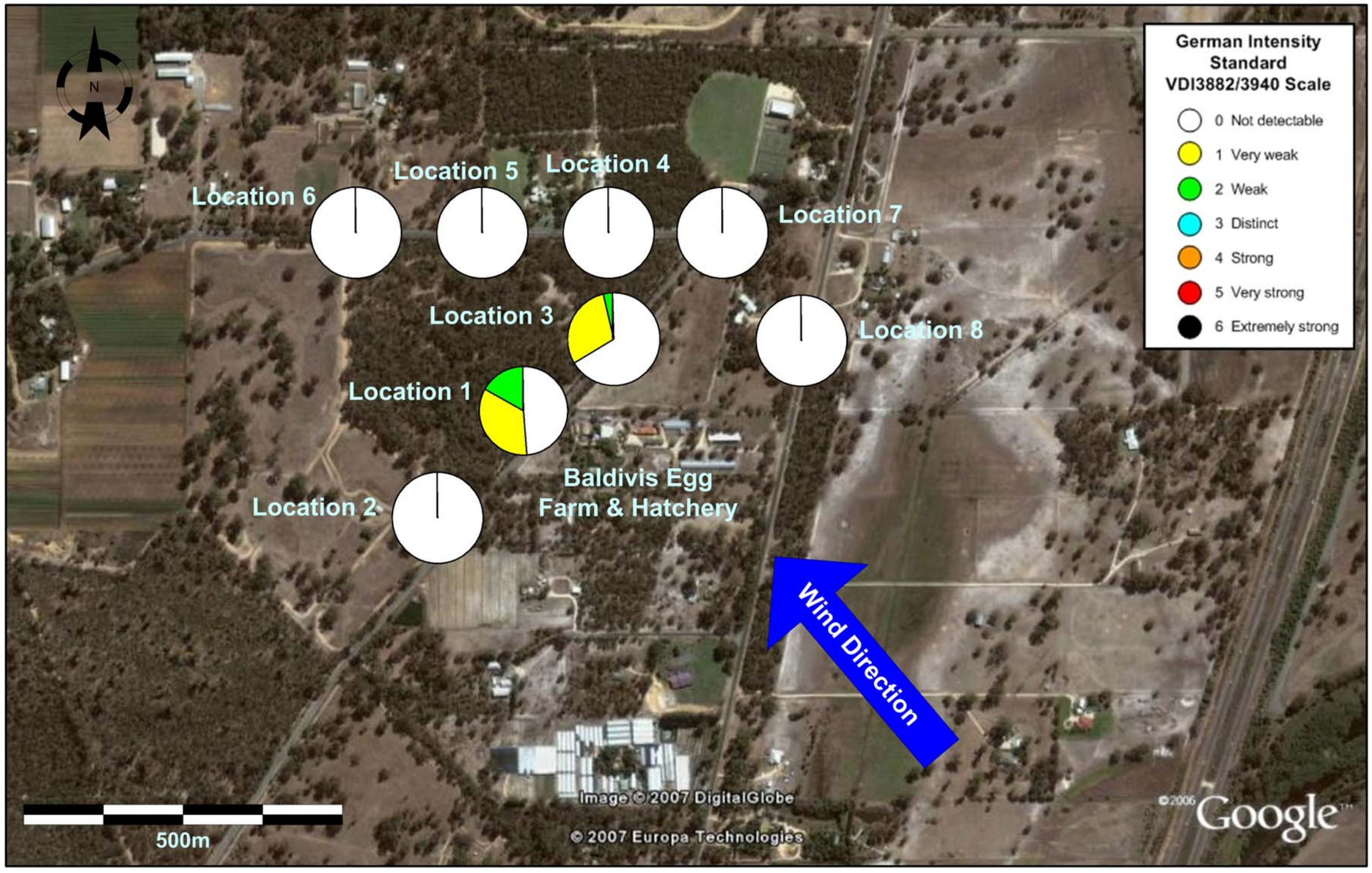


Figure 5.4: Field Based Ambient Odour Survey Result (22nd January, 2010).

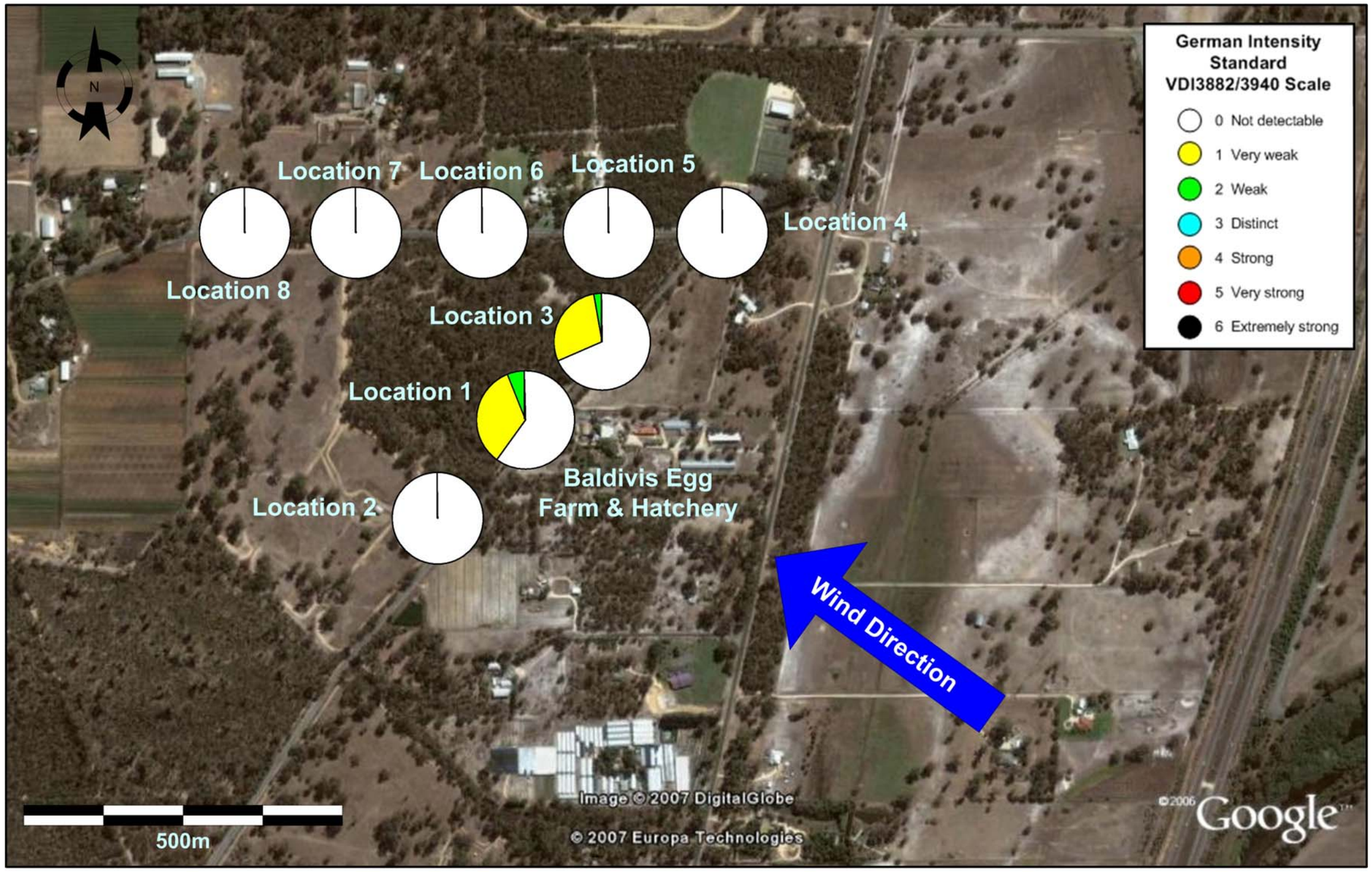
Survey #5:

- Monday 25th January 2010
- 09:00 to 12:00hrs
- Temperature = 25°C to 28°C
- Wind velocity 1m/s - 3 m/s
- Wind direction SE to ENE

As the wind was initially coming from the SE direction, the assessors were positioned at the Eighty Rd entrance gate. The LSP poultry odours detected were given rankings of 1 with a small number of 2 rankings. Approximately 50m to the north, intensity rankings of 1 and a small number of 2's were recorded. When assessors were positioned along Fifty Rd, approximately 200m apart, no odours could be detected. Baldivis and Ingram roads were traversed, which showed no upwind odour sources.

Survey Location	Intensity Frequencies (%) - Baldivis FAOA 25/01/2010						
	0	1	2	3	4	5	6
1	**60.0**	**34.0**	**6.0**	0	0	0	0
2	**100.0**	0	0	0	0	0	0
3	**63.0**	**33.0**	**4.0**	0	0	0	0
4	**100.0**	0	0	0	0	0	0
5	**100**	0	0	0	0	0	0
6	**100**	0	0	0	0	0	0
7	**100**	0	0	0	0	0	0
8	**100**	0	0	0	0	0	0

Odour impacts on this survey day were not considered problematic. An illustration of the odour frequencies and location is depicted below. The illustrated size of the frequency pie charts doesn't reflect the 'extent' of the impact. That is, for those frequency pie charts on Eighty Road, the observations are on the road itself and not within the adjoining land to the north-west.



RPS Group

Assessment Location: Baldivis Egg Layer and Hatchery
Weather Conditions: Fine & Sunny, 26°C, **SE to ENE winds at 1 - 3 m/s**
Date & Time: Monday 25th January, 09:00 - 12:00hrs

THE ODOUR UNIT

Figure 5.5: Field Based Ambient Odour Survey Result (25th January, 2010).

6 ODOUR CRITERIA AND DISPERSION MODEL GUIDELINES

Regulatory authority guidelines for odorous impacts of gaseous process emissions are not designed to satisfy a 'zero odour impact criteria', but rather to minimise the nuisance effect to acceptable levels of these emissions to a large range of odour sensitive receptors within the local community.

In Australia, each state and territory's environmental protection agency has developed its own unique odour performance criteria (OPC) for new and existing odour emitting facilities. In Western Australia, the DEC has withdrawn their OPC guideline document *No. 47: Guidance for the Assessment of Environmental Factors – Assessment of Odour Impacts from New Proposals (2002)*, but has yet to replace it. A suitable new OPC is currently being discussed.

In the absence of a current OPC guideline, the DEC notified TOU that the Queensland EPA's *Ecoaccess – Guideline: Odour Impact Assessment from Developments (2004)* is currently acceptable as an 'interim' OPC. The detail of the relevant QEPA OPC is as follows;

1. 2.5ou, 1-hour average, 99.5th percentile for ground-level sources and down-washed plumes from short stacks, and

    - Where a facility does not operate continuously, the 99.5th percentile must be applied to the actual hours of operation.

The WA DEC have also indicated an additional criterion for use in dispersion modelling of ground level volume and area sources. The additional criterion is:

2. 8ou, 1-hour average, 99.9th percentile.

Both criteria will be investigated in this study.

7 ODOUR DISPERSION MODELLING METHOD

The odour dispersion modelling study for the LSP Farm was carried out using AUSPLUME Version 6.0, a Gaussian, steady-state, plume dispersion model developed by the Victorian Environmental Protection Authority (EPA Victoria). Ausplume is the approved dispersion model recommended by all of the EPAs in Australia.

The AUSPLUME V6.0 atmospheric dispersion model is used to project downwind ground level concentrations of air contaminants by taking into consideration various factors including:

- Odour emissions data - odour emission rate and source dimensions;
- Site specific meteorology;
- Geophysical impact (topography); and
- Building wake effects.

For this study, the air contaminant was odour and ground level concentrations in odour units (ou) have been projected. It should be noted that terrain effects are incorporated within the model for point sources such as stacks and vents only, but not for area and volume sources. All of the sources input into this model were ground-level area sources.

7.1 METEOROLOGICAL DATASET

Available meteorological data in the area is not readily obtainable, nor do current meteorological weather stations exist in the area with suitable data. Previously, the Hope Valley station was an acceptable dataset, however, the WA DEC has withdrawn its support of this Hope Valley data. The DEC does however endorse the Caversham dataset (ca94-b) for metropolitan assessments west of the Darling Scarp. This dataset was developed from the WA DEC approved Caversham weather station which is situated approximately 21 kilometres inland from the coast and approximately 7

kilometres from the base of the Darling Scarp. The modelling results from ca94-b dataset can be considered to be representative of a “poor dispersion” year.

The Caversham site is approximately 50 kilometres north-north west of the LSP Farm. Additionally, the LSP Farm is approximately 10 kilometres inland from the coast, whereas the Caversham site is approximately 21 kilometres inland. The Caversham site represents meteorological observations near the Darling Scarp. Prevailing problematic winds are typically easterly, compounded by winds drainage flows from the escarpment. As such, the dataset is conservative in the westerly direction (i.e. from easterly winds).

Given the location of the LSP Farm it may not be affected by these strong easterly wind drainage flows and hence problematic easterlies may be less prevalent at this location. Summer prevailing winds at the LSP Farm are easterlies in the morning and south-westerlies in the early afternoon. The south-westerlies are generally strong and represent favourable conditions for dispersion. The early morning easterlies generally exist in stable conditions and therefore may represent poor dispersion.

Adverse odour impacts are likely to be more prevalent during warmer months, as elevated temperatures tend to result in higher odour emissions. It is also important to note that, while calm to light wind conditions are the most problematical in terms of poor dispersion and odour nuisance, the standard Gaussian dispersion formulation intrinsic to the Ausplume model fails to adequately cope with wind velocities below 0.5 m s^{-1}. As a result, all winds < 0.5 m s^{-1} are treated as 0.5 m s^{-1} by the model.

In addition to wind direction and speed, atmospheric stability is an important factor in odour transport and dispersion. Stability refers to the vertical movement of the atmosphere and subsequently the dispersion of pollutants vertically within the atmospheric boundary layer. Atmospheric stability is classified under the Pasquill-Gifford scheme where seven stability classes have been defined as: A – very unstable; B – unstable; C – slightly unstable; D – neutral; E – slightly stable; F – stable; and G – very stable. F and G tend to be grouped together as F in dispersion models. When the atmosphere is stable, vertical movement is suppressed and

dispersion is poor. This is the case for classes E and F, which are apparent during temperature inversions. Neutral conditions also result in poor vertical dispersion for ambient temperature or cool plumes.

Table 7.1 below represents meteorological observations from the Hope Valley dataset. Although the dataset is not used in the dispersion model, it is useful to 'interrogate' the data to understand the local conditions. Table 7.1 shows that the atmosphere in the Baldivis region is stable for 15.87% over the 1995 – 1997 yearly dataset and neutral for a further 27.08% over this three-year dataset.

Table 7.1: Distribution of PG stability classes vs. wind speed (Hope Valley data).

Pasquill Gifford Stability Class	Wind speed (m/s)						
	≤ 2	≤ 4	≤ 8	≤ 12	> 12	Total	%
A	450	533	-	-	-	983	3.74%
B	253	1785	490	-	-	2528	9.61%
C	149	1542	4417	179	-	6287	23.90%
D	168	1312	5419	224	-	7123	27.08%
E	224	4053	932	-	-	5209	19.80%
F	1401	2771	2	-	-	4174	15.87%

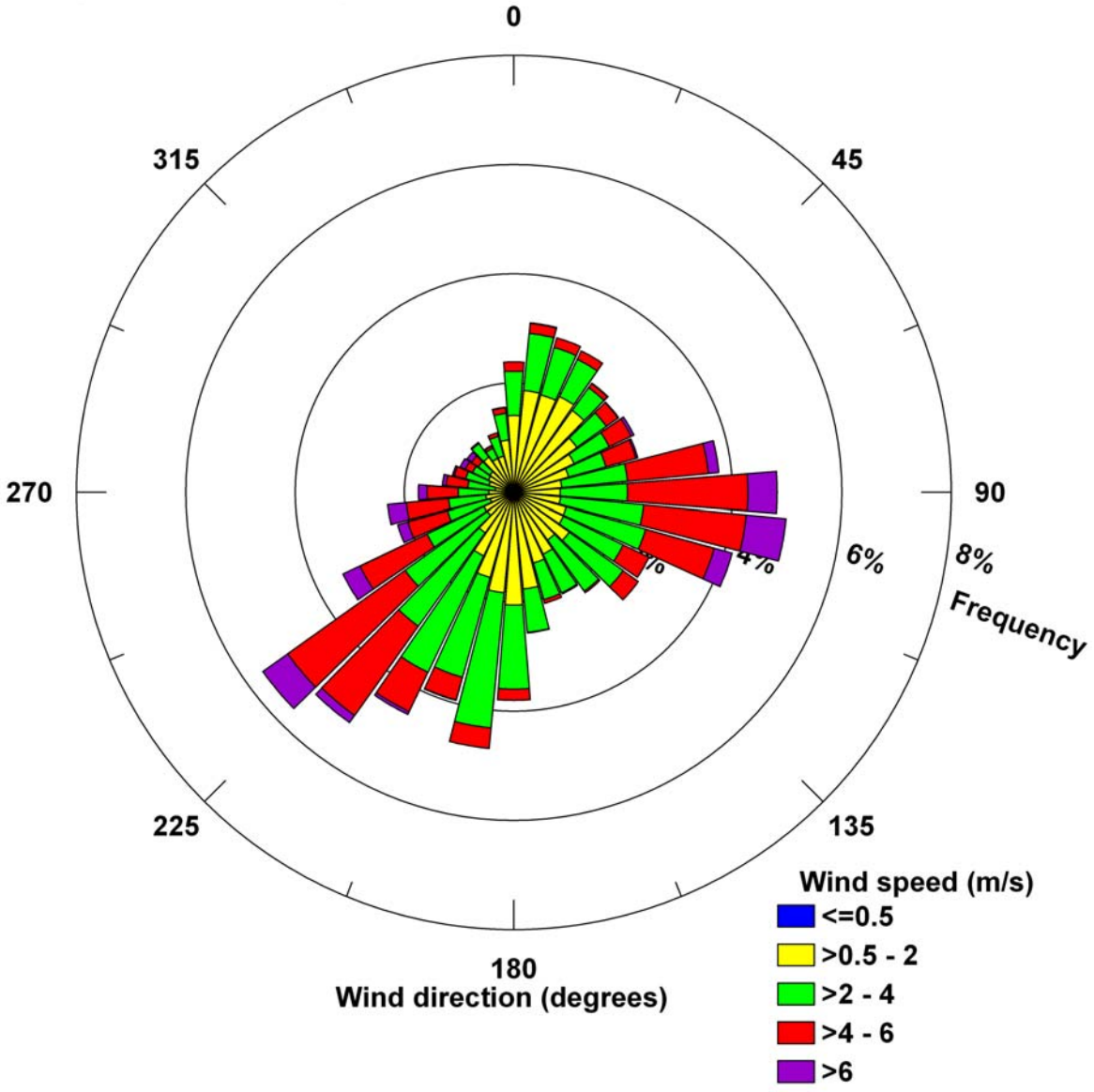
Table 7.2 below represents dispersion stability classes and time of day. Stable conditions (stability F) exist between 6pm to 8am for the three-year '95-'97 meteorological dataset, with the greatest stability occurring between the hours of 9pm through until 5am.

Table 7.2: Distribution of PG stability classes vs. time of day (Hope Valley data).									
Pasquill Gifford Stability Class	Time of day (hrs)								
	2400 - 0259	0300 - 0559	0600 - 0859	0900 - 1159	1200 - 1459	1500 - 1759	1800 - 2059	2100 - 2359	Total
A	-	-	17	393	408	150	15	-	983
B	-	1	96	785	999	573	74	-	2528
C	6	8	417	1501	1581	2083	689	2	6287
D	852	862	1469	602	300	482	1692	864	7123
E	1228	1284	803	5	-	-	539	1350	5209
F	1202	1133	486	2	-	-	279	1072	4174

The observations in **Table 7.2** represent local meteorological observations from the Hope Valley station in the Baldivis region approximately ten years ago. Local weather has changed over the last decade and has seen a shift in patterns where easterlies tend to remain for longer periods in the summer months. Typically, the period of December – March represents longer easterly conditions in the early morning with winds moving southerly and south-westerly in the early afternoon. Generally speaking, these easterly conditions can be considered the most problematic in the Perth region with respect to air dispersion. Moreover, under very calm conditions, odour plumes tend to elevate due to buoyancy, and increase in concentration, and are 'pushed, or moved' away from the source under low intermittent wind conditions. This often creates intermittent impacts off-site from a given odour source which under more constant wind conditions may have little odour impact due to the continual 'stripping' of the odour plume.

The windrow figure below illustrates the Caversham metrological dataset used in the dispersion modelling assessments.

Caversham Site Specific 1994 (ca94-b.met)



7.2 LOCAL LAND USE AND TOPOGRAPHY

The Baldivis LSP locale can be considered a 'flat to rolling rural' landscape southwest of the Perth Metropolitan CBD, where many properties are large hectare lots. The current trend of 'urban-sprawl' within the Perth Metropolitan area has seen a significant increase in residential developments encroaching into rural landscapes. The Baldivis LSP Farm is situated within a currently developing residential area and is largely surrounded by natural vegetation and large well-established forestry.

The topography in the immediate vicinity of the LSP Farm is both flat and rolling rural. The land elevation at the LSP Farm is approximately 15m Australian Height Datum (AHD).

The surface roughness category (Z_o) chosen for this dispersion model was 0.3, to reflect the surface friction created by the rolling rural landscape and the established flora on the adjoining and surrounding properties.

7.3 GRIDDED RECEPTOR FILE

The Receptor file used in the model was a Cartesian grid with receptors spaced at 50m by 50m intervals. The grid extended approximately 1,000m to the west of the LSP Farm, approximately 900m to the east, and both 700m and 500m to the north and south of the LSP Farm respectively. As Ausplume does not incorporate terrain elevation into the calculation for volume sources, terrain effects were ignored.

7.4 DISPERSION MODEL SOURCE AND EMISSION RATE CONFIGURATIONS

The dispersion model configuration for odour sources was developed from data estimated by TOU during the field based ambient surveys, and from aerial imagery data. Three odour sources were identified by TOU as follows:

Shed 1 – Layershed
Shed 2 – Layershed
Shed 3 – Layershed /or/ Litter Storage Shed

As discussed in **Section 2**, preferred odour emissions data was advised by the WA DEC and applied to the LSP Farm. In addition, TOU reviewed the "Australian Model Code of Practice for the Welfare of Animals - Domestic Poultry" (4th Edition), to ascertain the recommended stocking densities of poultry prescribed in the code. The estimated areas of each of the odour sources are presented in **Table 7.3.** The derived odour emission rates (OER's) are presented in **Tables 7.4; 7.5 & 7.6** with each table representing differing odour emissions data that reflects the individual emission scenarios discussed in Section 2.

Table 7.3: LSP Farm Estimated Individual Odour Source Dimensions.

Odour Source	Length (m)	Width (m)	Height (m)	Surface Area (m^2)
Shed 1 - Layershed	88	15	5	**1,320**
Shed 2 - Layershed	58	15	5	**870**
Shed 3 – Layershed/Litter Storage	50	18	5	**900**

Table 7.4: LSP Farm derived OER's based on "Poultry Code of Practice" **PRE2001**.			
Odour Source	# Birds[A]	**PRE2001** Stocking Density[B] (Birds / m^2)	Odour Emission Rate[C] ($ou.m^3\ sec^{-1}$)
Shed 1 - Layershed	**29,304**	22.2	**6,007**
Shed 2 - Layershed	**19,314**	22.2	**3,959**
Shed 3 – Layershed/Litter Storage	**19,980**	22.2	**4,096**

[A]Bird Numbers derived from source surface areas x Stocking Densities. [B]The "Code of Practice for the Welfare of Animals - Domestic Poultry" (4th Ed.) prescribes a minimal stocking Density, **PRE2001**, of 450cm^2 per bird (22.2 birds /m^2). [C]Odour Emission Rate (OER) derived from multiplying the bird numbers x 0.205$ou.m^3\ sec^{-1}$.

Table 7.5: LSP Farm derived OER's based on "Poultry Code of Practice" **POST2001**.			
Odour Source	# Birds[A]	**POST2001** Stocking Density[B] (Birds / m^2)	Odour Emission Rate[C] ($ou.m^3\ sec^{-1}$)
Shed 1 - Layershed	**24,024**	18.2	**4,925**
Shed 2 - Layershed	**15,834**	18.2	**3,246**
Shed 3 – Layershed/Litter Storage	**16,380**	18.2	**3,358**

[A]Bird Numbers derived from source surface areas x Stocking Densities. [B]The "Code of Practice for the Welfare of Animals - Domestic Poultry" (4th Ed.) prescribes a minimal stocking Density, **POST2001**, of 550cm^2 per bird (18.2 birds /m^2). [C]Odour Emission Rate (OER) derived from multiplying the bird numbers x 0.205$ou.m^3\ sec^{-1}$.

Table 7.6: LSP Farm derived OER's based on WA DEC advice of 0.205ou.m^3 sec^{-1}.			
Odour Source	# Birds[A]	**WA DEC** Stocking Density[B] (Birds / m^2)	Odour Emission Rate[C] (ou.m^3 sec^{-1})
Shed 1 - Layershed	**22,968**	17.4	**4,708**
Shed 2 - Layershed	**15,138**	17.4	**3,103**
Shed 3 – Layershed/Litter Storage	**15,660**	17.4	**3,210**

[A]Bird Numbers derived from source surface areas x Stocking Densities. [B]The WA DEC advised TOU on using the Jiang & Sands (1998) study for Broiler Farm emissions, which prescribes a stocking density of 17.4 birds per m^2. [C]Odour Emission Rate (OER) derived from multiplying the bird numbers x 0.205ou's sec^{-1}.

7.5 ODOUR DISPERSION MODELLING SCENARIOS

Three scenarios were modelled for this impact assessment study, with each scenario having differing emissions data according to either the WA DEC recommended, or the Code of Practice for Domestic Poultry **(refer Tables 7.4; 7.5 & 7.6 above).**

All three scenarios were modelled according to the QEPA OPC "Ecoaccess" criteria of 2.5ou, 1-hour averaging times at the 99.5th percentile.

In addition, each modelled scenario was further assessed at criteria of 8ou, 1-hour averaging times at the 99.9th percentile, which illustrates a predicted odour impact concentration 'near field' to the LSP Farm property boundary.

Importantly, all odour emission rates have been modelled as constant. It is highly unlikely that odours are constant from the LSP Farm given that the sheds are closed in the evening, and the life cycles of the birds would vary, and therefore odour emissions would vary. A constant emission rate represents the most conservative approach for dispersion modelling.

8 ODOUR DISPERSION MODELLING STUDY RESULTS

Figures 8.1; **8.2 and 8.3** present the results of the odour dispersion modelling study, presenting the odour contours relating to each emission rate scenario outlined in Tables 7.4; 7.5 and 7.6 of section 7.

All dispersion modelling was predicted with constant emission rates, and with emission rates exempt from temperature dependency.

Figure 8.1 illustrates modelled emissions based on the WA DEC recommended stocking density of 17.4 birds per m^2 of floor space. The emission rate applied to this stocking density was 0.205ou.m^3 sec^{-1} $bird^{-1}$ and was recommended by the WA DEC, and taken from Jiang & Sands (1998).

Figure 8.2 illustrates modelled emissions based on the Australian Model COP (POST2001) recommended stocking density of 18.2 birds per m^2 of floor space. The emission rate applied to this stocking density was 0.205ou.m^3 sec^{-1} $bird^{-1}$ and was recommended by the WA DEC, and taken from Jiang & Sands (1998).

Figure 8.3 illustrates modelled emissions based on the Australian Model COP (PRE2001) recommended stocking density of 22.2 birds per m^2 of floor space. The emission rate applied to this stocking density was 0.205ou.m^3 sec^{-1} $bird^{-1}$ and was recommended by the WA DEC, and taken from Jiang & Sands (1998).

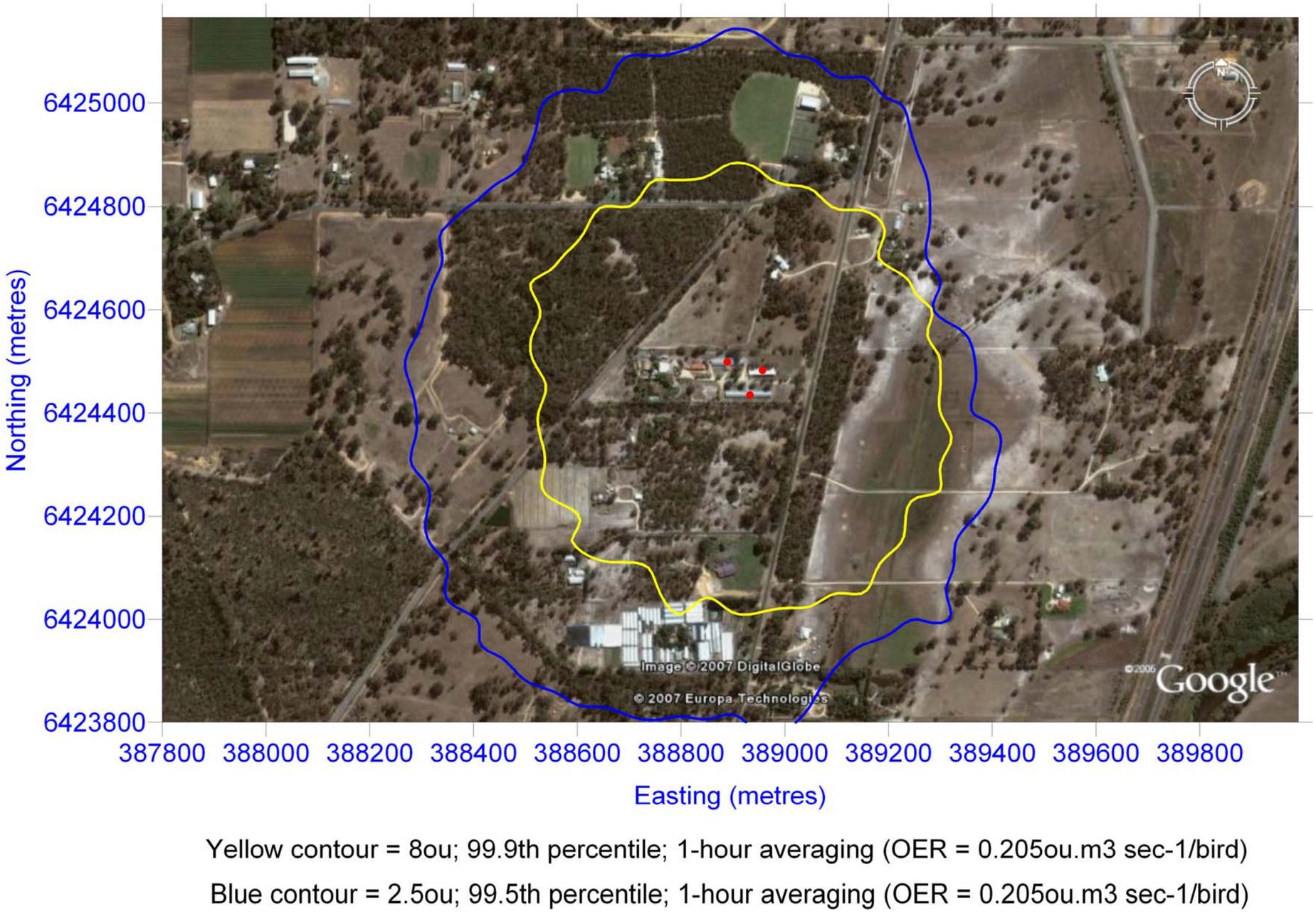


Figure 8.1: Modelling result contours for the WA DEC recommended Emission Rates (refer Section 2.1).

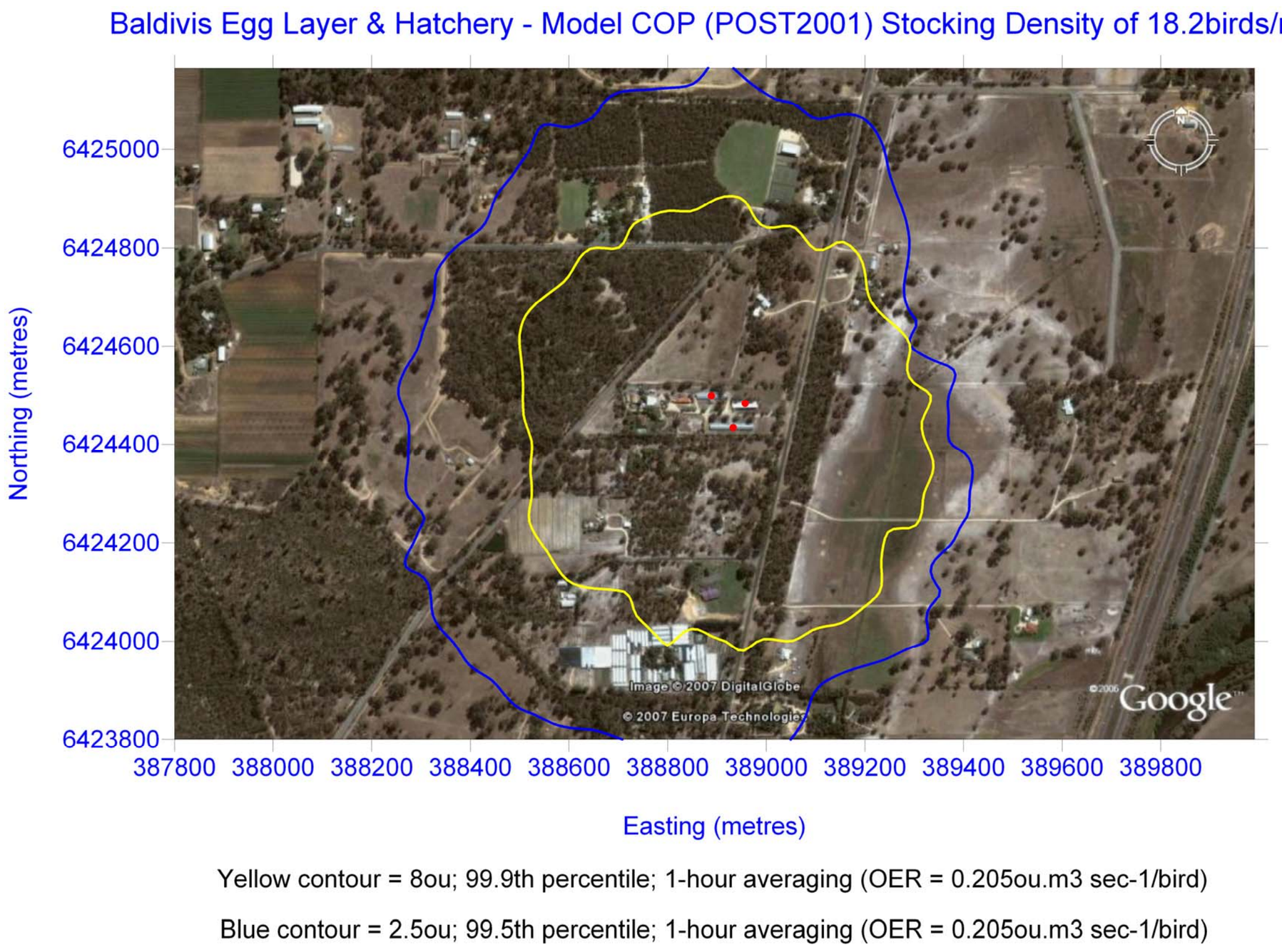


Figure 8.2: Modelling result contours for Emission Rates based on the "Australian Model Code of Practice for the Welfare of Animals – Domestic Poultry (4th Ed.) POST2001 Guidance. (Refer Section 2.2.1).

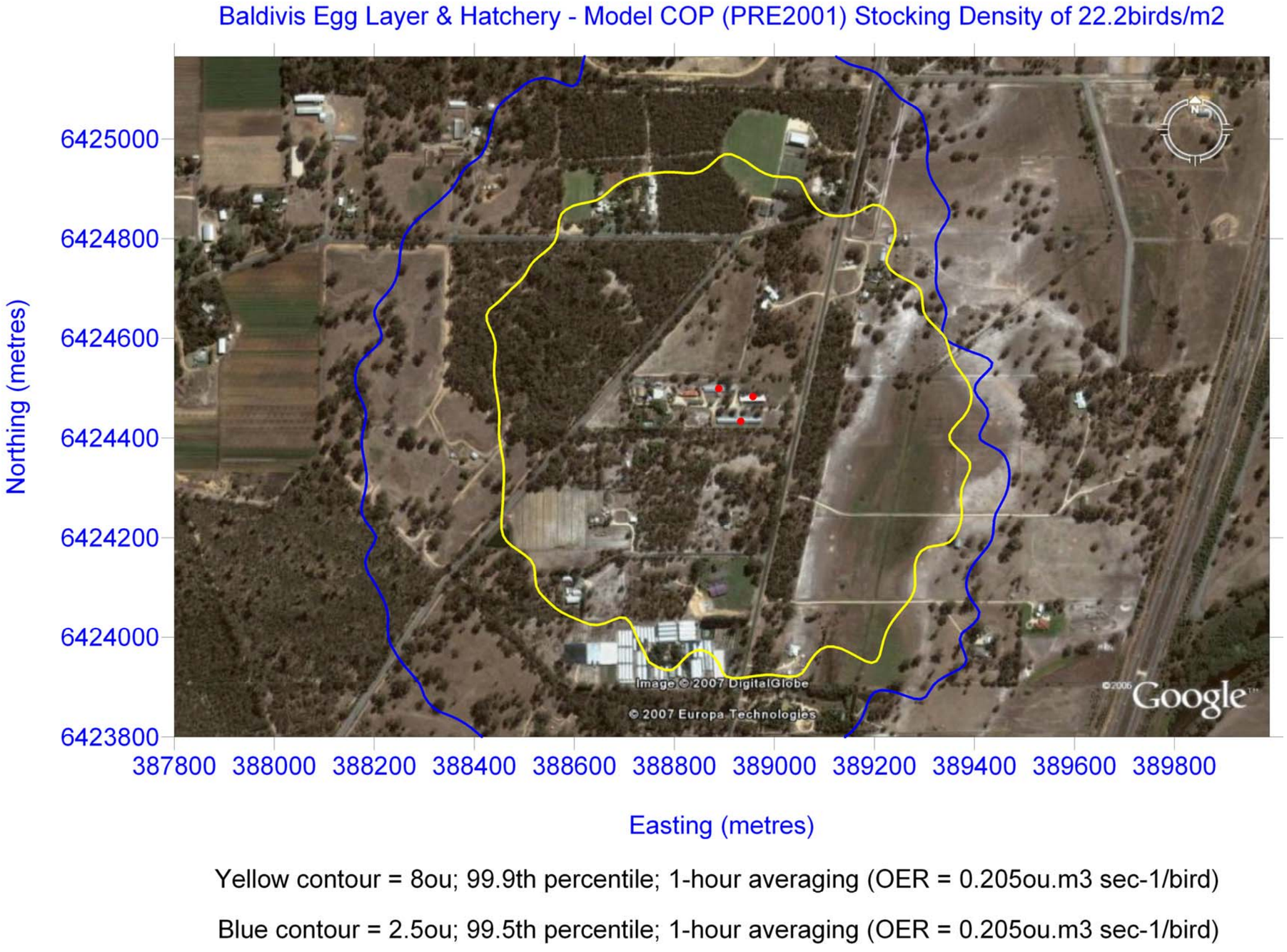


Figure 8.3: Modelling result contours for Emission Rates based on the "Australian Model Code of Practice for the Welfare of Animals – Domestic Poultry (4th Ed.) PRE2001 Guidance. (Refer Section 2.2.1).

9 DISCUSSION OF RESULTS

The Odour Unit Pty Ltd (TOU) conducted an Odour Dispersion Modelling & Field Based Ambient Odour Survey Study of the Layertech Services Poultry (LSP) Facility in Baldivis Western Australia throughout the period of January 2010. The structure for this Odour Impact Study was to assess the potential problematic impacts from the LSP Farm on the adjacent land holding at Lot 61 Eighty Road, Baldivis that has been proposed for redevelopment. Whilst undertaking a 'desktop' Odour Dispersion Modelling Study, TOU also conducted five 'Field Based Ambient Odour Assessments' (FAOA's) to evaluate ground level odorous impacts emanating from the LSP Farm.

The results of the FAOA surveys have concluded that TOU field assessors did not observe problematic odours beyond the boundary of the LSP Farm.

The German VDI 3882 intensity scale is used in FAOA surveys to 'rank' observations of odours. TOU's observations did not exceed an intensity rank of 3, which can be considered problematic. Moreover, TOU field technicians had to 'actively' seek out odour and attempt to define its character during the survey periods. Observations such as this indicate strongly that odours are not problematic, in particular beyond the boundary of the LSP Farm. This result was expected when accounting for the Free Range configuration of the LSP Farm.

TOU is of the belief that these odours observed during the FAOA surveys are non-problematic with respect to Lot 61 Eighty Road, Baldivis. In addition, odour observations were transient and the plume was considered to be narrow. TOU also observed many rural odours that often 'masked' those small intensity odours experienced from/at the LSP Farm boundary. These odours were customary of a typical rural landscape such as grass, fruit and flowering trees.

The Odour Dispersion Modelling 'desktop' study results **(refer section 8)** indicates odour impacts well beyond those observations made during the FAOA's. Again, this result was expected, particularly since the odour emission rate used represents a

poultry broiler (meat) farm. Jiang and Sands suggest that odour emission from free range farms may be at least 2.5 times less than broiler odours. This finding is highly supported by TOU, however, TOU believes that odours from poultry free range farms, in particular egg layer and hatchery configurations such as the LSP Farm, may have odour emission rates much less than indicated by Jiang and Sands.

For comparison, TOU has modelled the Jiang and Sands reported odour emission rate of 0.079ou.m^3 sec^{-1} $bird^{-1}$ for free range configurations and investigated a near-field ground level odour concentration of 5 odour units. TOU modelled the 0.079 OER against an odour criterion of 5ou, 99.5th percentile and 1 hour averaging times. The result of this sensitivity model is illustrated in **Figure 9.1** below.

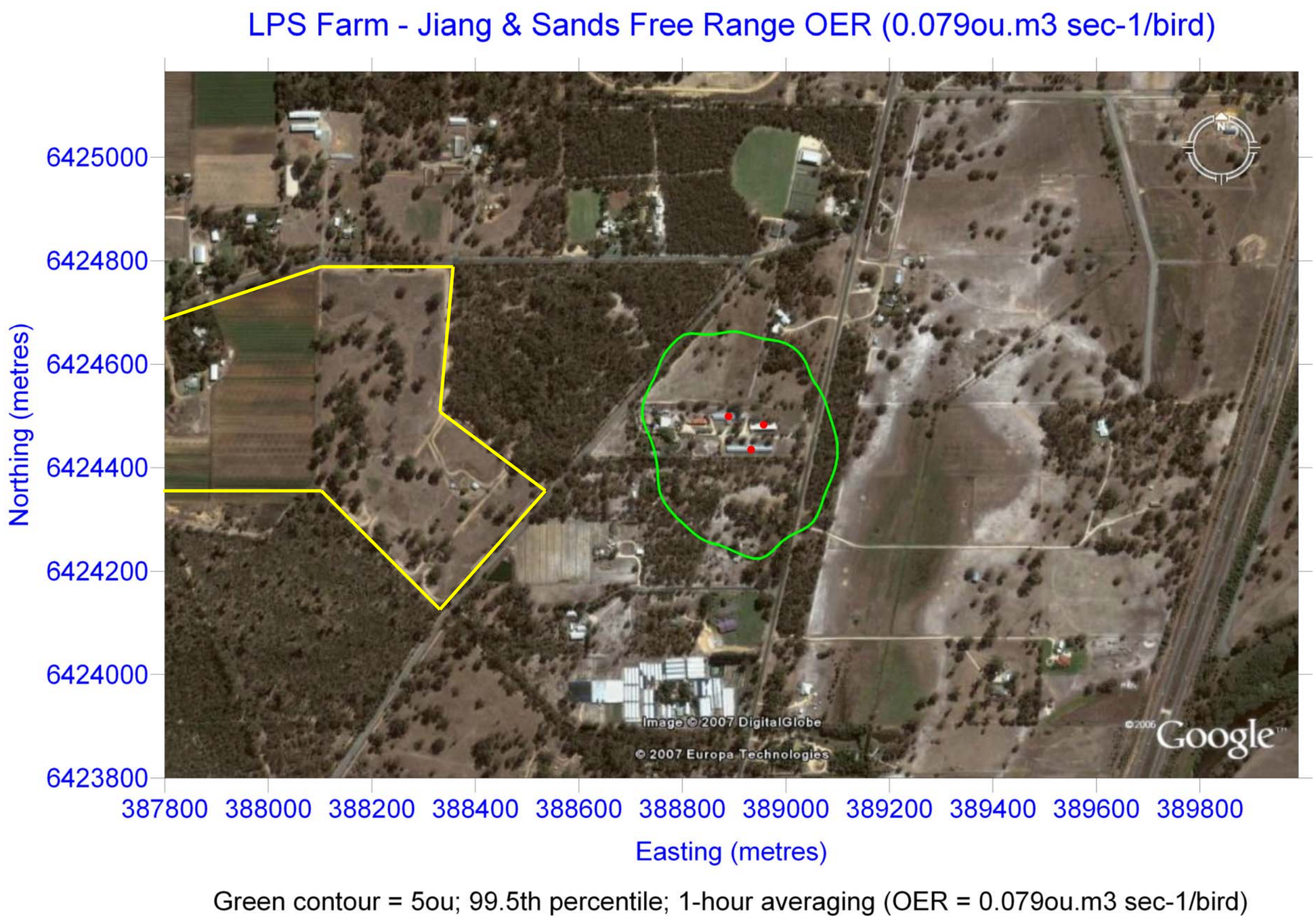


Figure 9.1: Sensitivity Modelling result for an OER of 0.079 at 5ou, 99.5th percentile and 1 hour averaging.

TOU investigated three dispersion modelling scenarios for the LSP Farm based on an Australian Poultry industry literature review, and recommendations from the WA DEC.

TOU has undertaken an odour sensitivity modelling **(Figure 9.1)** exercise to derive what emission rate and odour criteria is relevant to the LSP Farm. The model projection compares well with the FAOA findings. The model projection shows a distance of off-site odour impacts up to approximately 100 metres in any direction from the shed locations at the LSP Farm. This distance is supported by TOU's field observations.

The sensitivity model projection represents a ground level odour impact of 5 odour units at the 99.5th percentile. The stocking density determines the overall odour emission rate and therefore it is likely that the stocking densities at the LSP Farm are less than the 17.4 birds per m^2 investigated. TOU's field observations may represent ground level odours of possibly 1 or 2 odour units at or near the LSP Farm boundary and therefore may support a reduction in the stocking density. These odours were not considered problematic.

The modelling outcomes from the Australian Model Code of Practice and those from the Jiang and Sands data represent highly conservative and overstated emissions for the LSP Farm. The emissions data used represented poultry broiler operations. The LSP Farm is not a broiler producer and has been found to be non-problematic beyond the boundary with respect to odour observations. The model projections in this study also represent constant odour emissions of which the LSP Farm would not produce.

It is the strong viewpoint of TOU that odours from the LSP Egg Layer and Hatchery Farm would not be problematic beyond the Farm boundaries under the current operating conditions.

However, since Lot 61 Eighty Road, Baldivis is in close proximity to the western boundary of the LSP Farm, TOU recommends that the proposed residential land development at Lot 61 Eighty Road, Baldivis retain some public land and/or

recreational areas that border Eighty Road, Baldivis. This recommendation is based on the close proximity of the proposed land development at Lot 61 Eighty Road, Baldivis and the western boundary of the LSP Farm, and therefore it cannot be assumed that transient odour impacts would not occur under the worst conditions for dispersion.

10 REFERENCES

1. Animal Welfare Committee (AWF). 'Australian Model Code of Practice for the Welfare of Animals – Domestic Poultry, 4th Ed. Endorsed by Primary Industries Ministerial Council (PIMC) May 2002.

2. Jiang, J & Sands, J. 'Odour Emissions from Poultry Farms in Western Australia'. Centre for Waste Water Technology NSW, 1998.

3. Queensland Environment Protection Agency. 'Ecoaccess – Guideline: Odour Impact Assessment from Developments', 2004.

4. Western Australian Department of Environmental Protection: 'Guidance for the Assessment of Environmental Factors – Assessment of Odour Impacts from New Proposals' Document No. 47, 2002.

5. Western Australian Department of Environmental Protection. 'Odour Methodology Guideline', March 2002.

Appendix A

Example of the AUSPLUME Model Output File

Concentration or deposition	Concentration
Emission rate units	OUV/second
Concentration units	Odour_Units
Units conversion factor	1.00E+00
Constant background concentration	0.00E+00
Terrain effects	None
Smooth stability class changes?	No
Other stability class adjustments ("urban modes")	None
Ignore building wake effects?	No
Decay coefficient (unless overridden by met. file)	0.000
Anemometer height	10 m
Roughness height at the wind vane site	0.300 m
Use the convective PDF algorithm?	No

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high	Pasquill-Gifford
Vertical dispersion curves for sources <100m high	Pasquill-Gifford
Horizontal dispersion curves for sources >100m high	Briggs Rural
Vertical dispersion curves for sources >100m high	Briggs Rural
Enhance horizontal plume spreads for buoyancy?	Yes
Enhance vertical plume spreads for buoyancy?	Yes
Adjust horizontal P-G formulae for roughness height?	Yes
Adjust vertical P-G formulae for roughness height?	Yes
Roughness height	0.300m
Adjustment for wind directional shear	None

PLUME RISE OPTIONS

Gradual plume rise?	Yes
Stack-tip downwash included?	Yes
Building downwash algorithm:	Huber-Snyder method.
Entrainment coeff. for neutral & stable lapse rates	0.60,0.60
Partial penetration of elevated inversions?	No
Disregard temp. gradients in the hourly met. file?	No

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Rural" values (unless overridden by met. file)

AVERAGING TIMES
1 hour

2.5ou_99.5th_1hr_Jiang&Sands
SOURCE CHARACTERISTICS

VOLUME SOURCE: SHED1

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
388933	6424434	0m	3m	4m	1m

(Constant) emission rate = 4.71E+03 OUV/second
No gravitational settling or scavenging.

VOLUME SOURCE: SHED2

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
388889	6424499	0m	3m	4m	1m

(Constant) emission rate = 3.10E+03 OUV/second
No gravitational settling or scavenging.

VOLUME SOURCE: SHED3

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
388957	6424483	0m	3m	5m	1m

(Constant) emission rate = 3.21E+03 OUV/second
No gravitational settling or scavenging.

1

Layertech_Baldivis_0.205OER_2.5ou's_99.5&ile_1hr_ca94-b

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
387800.m 387850.m 387900.m 387950.m 388000.m 388050.m 388100.m
388150.m 388200.m 388250.m 388300.m 388350.m 388400.m 388450.m
388500.m 388550.m 388600.m 388650.m 388700.m 388750.m 388800.m
388850.m 388900.m 388950.m 389000.m 389050.m 389100.m 389150.m
389200.m 389250.m 389300.m 389350.m 389400.m 389450.m 389500.m
389550.m 389600.m 389650.m 389700.m 389750.m 389800.m 389850.m
389900.m 389950.m

and these y-values (or northings):
6423800.m 6423850.m 6423900.m 6423950.m 6424000.m 6424050.m 6424100.m
6424150.m 6424200.m 6424250.m 6424300.m 6424350.m 6424400.m 6424450.m
6424500.m 6424550.m 6424600.m 6424650.m 6424700.m 6424750.m 6424800.m
6424850.m 6424900.m 6424950.m 6425000.m 6425050.m 6425100.m 6425150.m
6425200.m 6425250.m 6425300.m 6425350.m 6425400.m 6425450.m 6425500.m
6425550.m 6425600.m 6425650.m 6425700.m 6425750.m

METEOROLOGICAL DATA : Caversham 1994 Blockley 271200. Read ca94aus.rea for

Concentration or deposition	Concentration
Emission rate units	OUV/second
Concentration units	Odour_Units
Units conversion factor	1.00E+00
Constant background concentration	0.00E+00
Terrain effects	None
Smooth stability class changes?	No
Other stability class adjustments ("urban modes")	None
Ignore building wake effects?	No
Decay coefficient (unless overridden by met. file)	0.000
Anemometer height	10 m
Roughness height at the wind vane site	0.300 m
Use the convective PDF algorithm?	No

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high	Pasquill-Gifford
Vertical dispersion curves for sources <100m high	Pasquill-Gifford
Horizontal dispersion curves for sources >100m high	Briggs Rural
Vertical dispersion curves for sources >100m high	Briggs Rural
Enhance horizontal plume spreads for buoyancy?	Yes
Enhance vertical plume spreads for buoyancy?	Yes
Adjust horizontal P-G formulae for roughness height?	Yes
Adjust vertical P-G formulae for roughness height?	Yes
Roughness height	0.300m
Adjustment for wind directional shear	None

PLUME RISE OPTIONS

Gradual plume rise?	Yes
Stack-tip downwash included?	Yes
Building downwash algorithm:	Huber-Snyder method.
Entrainment coeff. for neutral & stable lapse rates	0.60,0.60
Partial penetration of elevated inversions?	No
Disregard temp. gradients in the hourly met. file?	No

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Rural" values (unless overridden by met. file)

AVERAGING TIMES
1 hour

8ou_99.9th_1hr_Jiang&Sands
SOURCE CHARACTERISTICS

VOLUME SOURCE: SHED1

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
388933	6424434	0m	3m	4m	1m

(Constant) emission rate = 4.71E+03 OUV/second
No gravitational settling or scavenging.

VOLUME SOURCE: SHED2

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
388889	6424499	0m	3m	4m	1m

(Constant) emission rate = 3.10E+03 OUV/second
No gravitational settling or scavenging.

VOLUME SOURCE: SHED3

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
388957	6424483	0m	3m	5m	1m

(Constant) emission rate = 3.21E+03 OUV/second
No gravitational settling or scavenging.

1

Layertech_Baldivis_0.205OER_8ou's_99.9&ile_1hr_ca94-b

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
387800.m 387850.m 387900.m 387950.m 388000.m 388050.m 388100.m
388150.m 388200.m 388250.m 388300.m 388350.m 388400.m 388450.m
388500.m 388550.m 388600.m 388650.m 388700.m 388750.m 388800.m
388850.m 388900.m 388950.m 389000.m 389050.m 389100.m 389150.m
389200.m 389250.m 389300.m 389350.m 389400.m 389450.m 389500.m
389550.m 389600.m 389650.m 389700.m 389750.m 389800.m 389850.m
389900.m 389950.m

and these y-values (or northings):
6423800.m 6423850.m 6423900.m 6423950.m 6424000.m 6424050.m 6424100.m
6424150.m 6424200.m 6424250.m 6424300.m 6424350.m 6424400.m 6424450.m
6424500.m 6424550.m 6424600.m 6424650.m 6424700.m 6424750.m 6424800.m
6424850.m 6424900.m 6424950.m 6425000.m 6425050.m 6425100.m 6425150.m
6425200.m 6425250.m 6425300.m 6425350.m 6425400.m 6425450.m 6425500.m
6425550.m 6425600.m 6425650.m 6425700.m 6425750.m

METEOROLOGICAL DATA : Caversham 1994 Blockley 271200. Read ca94aus.rea for

Concentration or deposition	Concentration
Emission rate units	OUV/second
Concentration units	Odour_Units
Units conversion factor	1.00E+00
Constant background concentration	0.00E+00
Terrain effects	None
Smooth stability class changes?	No
Other stability class adjustments ("urban modes")	None
Ignore building wake effects?	No
Decay coefficient (unless overridden by met. file)	0.000
Anemometer height	10 m
Roughness height at the wind vane site	0.300 m
Use the convective PDF algorithm?	No

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high	Pasquill-Gifford
Vertical dispersion curves for sources <100m high	Pasquill-Gifford
Horizontal dispersion curves for sources >100m high	Briggs Rural
Vertical dispersion curves for sources >100m high	Briggs Rural
Enhance horizontal plume spreads for buoyancy?	Yes
Enhance vertical plume spreads for buoyancy?	Yes
Adjust horizontal P-G formulae for roughness height?	Yes
Adjust vertical P-G formulae for roughness height?	Yes
Roughness height	0.300m
Adjustment for wind directional shear	None

PLUME RISE OPTIONS

Gradual plume rise?	Yes
Stack-tip downwash included?	Yes
Building downwash algorithm:	Huber-Snyder method.
Entrainment coeff. for neutral & stable lapse rates	0.60,0.60
Partial penetration of elevated inversions?	No
Disregard temp. gradients in the hourly met. file?	No

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Rural" values (unless overridden by met. file)

AVERAGING TIMES
1 hour

5ou_99.5th_1hr_Jiang&Sands_0.079
SOURCE CHARACTERISTICS

VOLUME SOURCE: SHED1

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
388933	6424434	0m	3m	4m	1m

(Constant) emission rate = 1.82E+03 OUV/second
No gravitational settling or scavenging.

VOLUME SOURCE: SHED2

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
388889	6424499	0m	3m	4m	1m

(Constant) emission rate = 1.20E+03 OUV/second
No gravitational settling or scavenging.

VOLUME SOURCE: SHED3

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
388957	6424483	0m	3m	5m	1m

(Constant) emission rate = 1.24E+03 OUV/second
No gravitational settling or scavenging.

1

Layertech_Baldivis_0.079OER_5ou's_99.5&ile_1hr_ca94-b

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
387800.m 387850.m 387900.m 387950.m 388000.m 388050.m 388100.m
388150.m 388200.m 388250.m 388300.m 388350.m 388400.m 388450.m
388500.m 388550.m 388600.m 388650.m 388700.m 388750.m 388800.m
388850.m 388900.m 388950.m 389000.m 389050.m 389100.m 389150.m
389200.m 389250.m 389300.m 389350.m 389400.m 389450.m 389500.m
389550.m 389600.m 389650.m 389700.m 389750.m 389800.m 389850.m
389900.m 389950.m

and these y-values (or northings):
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6424150.m 6424200.m 6424250.m 6424300.m 6424350.m 6424400.m 6424450.m
6424500.m 6424550.m 6424600.m 6424650.m 6424700.m 6424750.m 6424800.m
6424850.m 6424900.m 6424950.m 6425000.m 6425050.m 6425100.m 6425150.m
6425200.m 6425250.m 6425300.m 6425350.m 6425400.m 6425450.m 6425500.m
6425550.m 6425600.m 6425650.m 6425700.m 6425750.m

METEOROLOGICAL DATA : Caversham 1994 Blockley 271200. Read ca94aus.rea for

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Appendix **Two** – Servicing Report

LOTS 312 – 313 FIFTY ROAD AND LOTS 2, 4, 7 AND 8 EIGHTY ROAD, BALDIVIS

ENGINEERING SERVICES REPORT - REF BDVCAN10

1 General

This report has been prepared to outline the servicing proposals and constraints to support the Local Structure Plan on the above land as outlined in the DPS plan.

The investigations in this report has involved consultation with the various service authorities and Council and a desk top study of the available information over the site to establish the opportunities and constraints to development of the area.

2 Executive Summary

The land the subject of this report is located immediately south of Fifty Road between Baldivis road and McDonald Road. The land is sparsely vegetated, mainly hosting residual trees, after being used as market gardens, residential and grazing land for many years. The basic land form is undulating sand hills of free draining sand.

The Environmental Geology map of the Geological Survey of Western Australia classifies this site as being suitable for urbanization.

The land can be connected to all services, either by extension from new neighbouring subdivision developments, or by extension along Baldivis Road. Some upgrading and construction of major water infrastructure will be required to service the development. Sewer services are available either from the neighbouring developments, now that access to the East Rockingham Waste Water treatment Plant (ERWWTP) has been approved for the Water Corporation.

Experience with this land form in developments north of the site shows the soils to be free draining, meaning that all storm water will be retained on site by soakage in swales in line with current best practice as outlined in the "Liveable Neighbourhoods" policy. Ground water levels are a minimum of 3.0 m below the lowest proposed fill levels.

The site is traversed by the Australian Pipeline Trust (APT) high pressure gas pipeline located within a large easement on the west side of the land. The easement land is available for use as POS, drainage and road crossings under strict guidelines as set out in the report below. Road crossings will need special attention to clearances and protection.

3 Site

The land covered by the structure plan is located as shown in Drawing LW-01 in Attachments, being south of Fifty Road in Baldivis and east of Baldivis Road to the APA and Water Corporation Pipeline easement. The land occupies an area of approximately 63.6ha.

The land is undulating, with elevation varying from Baldivis Road at around RL7.0mAHD to a ridge line midway between Eighty Road and Baldivis Road at around RL12.0mAHD down to around RL9.0mAHD at Eighty Road. The land falls further in westerly direction to an isolated low point at around RL3.0m AHD some 250m west of Eighty Road, then rises a to another ridge at around RL14.0mAHD prior to falling to around RL4.0mAHD on the western boundary of the site.

As shown in the Environmental Geology Map (Rockingham part of Sheets 2033II and 2033III, Gozzard J. R) as comprising two soil types:

- Eastern Portion of the site east of Eighty Road and eastern portion abutting Eighty Road: Bassendean Sand, light grey at the surface, yellow at depth of eolian origin.
- Western Portion of Site: Sand derived from Tamala Limestone of residual origin.

Both soil types are described as suitable for urbanization.

The site to the west of Eighty Road comprises of active market gardens and the area east of Eighty Road consists of rural residential land and a hatchery.

Across the eastern half of the land, within an easement, there is the high pressure natural gas pipeline of APT.

Fifty Road, Baldivis Road and Eighty Road and which are located at the northern, eastern and bisect the area respectively are constructed as a good standard rural road with bitumen seal without any formal drainage. Part of Fifty Road has been upgraded as part of the "Baldivis North" development.

4 Development Proposal

It is proposed to develop the land as a residential subdivision of around 750 lots, with all normal services being; wastewater, water, power, roads, gas and telecommunications service. All drainage is proposed to be retained on site using best management practices. One road crossing of the pipeline easement is proposed.

The development will entail substantial earthworks to provide level building blocks from the undulating land form, with all lots having retaining walls to allow this, plus the lower areas west of Eighty Road will need to be filled to facilitate sewerage grades. Ridge lines and locations of substantial trees have been identified and have been incorporated in POS where possible to preserve the existing trees.

5 Earthworks & Retaining Walls

The site requires filling in the southern and western areas to facilitate sewerage into the existing infrastructure. The fill levels vary, depending on the proximity of the site to the pumping station, but in general the western portion of the site will be filled some 2.5 to 3.0m and retained on the boundary where necessary.

Each lot will be finished level, with installation of retaining walls to suit. The retaining wall height is proposed to be restricted to 1.5m (4 blocks) in height on side boundaries, with a maximum of 3m heights to rear boundaries in order to provide the maximum amenity to lots without shading. Retaining walls will be constructed using reconstituted limestone blocks.

Included in Attachments is the proposed sewerage strategy plan which shows the proposed fill levels required to facilitate the sewerage of the land and the approximate levels.

The earthworks are proposed to be designed to be on a "cut to fill" balance, meaning that cut areas will need to be resolved to make up the shortfall of filling required for the filing shown. The future Nairn Drive reserve also passes through the development area. Council has prepared a preliminary design for Nairn Drive which essentially sets the levels. Although this may have to be varied when the detailed design is done, at very least the preliminary design will need to be set at Fifty Road and Eighty Road to coincide with existing road levels.

Where roads join between land holdings with separate ownership, it is likely that the levels on the boundaries will need to be either matched to existing level or co-ordinated to ensure that a staged development approach can be accommodated.

6 Roads

All roads will be constructed to City of Rockingham standards.

Nairn Drive will be constructed where possible although in the interim period it is proposed to be constructed to link into Eighty Road subject to land issues being resolved with adjoining owners.

Baldivis Road and Fifty Road are proposed to be upgraded to a "Boulevard" standard where the road abuts the site. It is envisaged that Baldivis, Fifty and Eighty Roads will be upgraded to urban standard during the development, including reconstruction (or supplementing), kerbing, sheeting and drainage, plus underground services as required for the development.

Where roadways cross the pipeline easement, the profile of the road will be lifted to ensure that the required minimum cover over the pipeline is maintained at 1.2m as required. Previous experience in constructing roads across this easement has given us the background to forecast required levels.

7 Drainage

As outlined in Section 3, the sandy soil characteristics of the site are conducive to soakage. Therefore all stormwater drainage will be retained on the site via soakage swales, including the 1 in 100 year event.

The land falls into a number of drainage catchments that is shown in Attachments in Drawing LW-04.

Catchments have been established based on topography, minimum grades and land ownership to ensure optimization of basin areas and minimization of impact on POS.

Generally the low points in each catchment have been designated as infiltration swales for the 1 in 5 year design storm, with additional capacity either in the swale itself or in the abutting POS to contain the 1 in 100 year ARI storm.

A separate **Local Water Management Strategy (LWMS)** will be provided to Council for the area.

The proposed drainage system for the subdivision will also include accommodating drainage flows from Baldivis Road, Eighty Road and Fifty Road.

All basins will have the maximum depth of water of 1.5m for the 1 in 100 year ARI storm.

8 Groundwater

Extrapolation from the Perth Ground Water Atlas 2004 indicates that the AAMGL for the area is at around RL1.50m AHD at the western side of the site, grading up to around RL2.50mAHD on the eastern boundary of the development. The Groundwater contours are shown in Attachments on Drawing LW04. In the centre of the area there is a soak that has been used for water supply for irrigation, in August of 2011; the water level in the soak was surveyed at around RL1.2m AHD being around 800mm below the AAML levels according to the DoW atlas.

The lowest ground level on the site is approximately RL6.0m AHD at the P.O.S. / drainage swale basin site located in the southern corner of the site. Base of the basin level the same location is at around RL4.0mAHD being which at least 2.0m above AAMGL.

9 Power

It appears that sufficient power supply exists in the area to supply the development. A 22Kv aerial line is located in Baldivis Road, Fifty Road and Eighty Road which serves the area.

All aerial lines along the existing roads will be relocated underground in line with current WAPC approval policy at the cost of the developer. The existing aerial service lines inside the lots will be removed as part of the development.

All internal power reticulation lines and transformer installations will be constructed at the cost of the developer. Transformer sites will be determined at the detailed subdivision design stage.

10 Water Supply

At present there is reticulated water supply past the site in Fifty Rd.

There is an existing 250mm water main along the north verge of Eighty Rd for the whole frontage of the site and beyond to the west, which serves the existing "Baldivis North" and "Chase" developments from the Water Corporation's Tamworth reservoir (which is immediately south of the development area). There is also a 300mm distribution main which is proposed to be extended along Baldivis Road from Ingram Rd to Eighty Rd by other developers in the near future. The 250mm main also links along Fifty Road to Baldivis Road.

Water Corporation Planning requires a future 600mm main to be extended along Baldivis Rd and also along Eighty Road between Tamworth Reservoir and Fifty Road which will boost the capacity and pressures in the area.

It is likely that portions of these mains may need to be constructed as part of this development, although the timing of the various upgrades will depend on the timing of this development relative to others and the proposed staging of this development. For example, if a cross connection was made between Baldivis Road and Eighty Road, the boost from that cross connection may increase the number of lots that can be serviced.

11 Sewer

The site falls within the catchments of three existing wastewater pumping stations (WWPS's) being McDonald Road WWPS to the north, Baldivis Road WWPS to the north east and Tamworth Boulevard WWPS to the south.

The catchment plan, together with the required fill levels is shown in Drawing S100 in Attachments.

At present, the only portion of the catchment that is relatively unconstrained by capacity is the southern catchment into the Tamworth Boulevard WWPS which discharges south to the Rivergums, then west to the Point Peron Waste Water Treatment Plant (WWTP). The existing system has sufficient capacity for the designated catchment.

The Water Corporation has now achieved approval for the linking mains to the ERWWTP, and as a result they are agreeing to new developments in this area.

Connections can be made directly into existing sewers for the north east and southern catchments, and partially for the northern catchment as set out below.

The areas to the north within the McDonald Road and north east within the Baldivis Rd WWPS's are currently limited by capacity as they pump to the Kwinana WWTP via the Baldivis Rd WWPS. Currently McDonald Road Station has been sized for an interim capacity of 15l/s (Equivalent to around 1500lots) and Baldivis Road Pumping Station with an upgrade can cater for a capacity of around 24l/s (Around 2400lots) with significant pressure from developers to connect.

Ultimately the McDonald Road WWPS will accept discharge from the Baldivis Rd WWPS, and will then pump directly to the new East Rockingham WWTP which is anticipated to be operational after 2015.

The western area of the development, being the northern catchment, west of Eighty Rd is separated into two subcatchments, although they both connect ultimately to the McDonald Rd WWPS. The eastern subcatchment area connects to the existing 375mm sewer at the junction of Fifty Rd and Ingerfield Gardens, and as part of the development a 225mm diameter sewer is proposed to be extended from Fifty Rd at Ingerfield Gardens through the subdivision to Eighty Rd to serve the proposed large commercial site. There is a need for fill to be placed on the southern portion of lot 312 adjacent to Eighty Rd he land to allow cover to the sewer.

The western subcatchment area will need a 225mm extension from the McDonald Rd WWPS along McDonald Rd to Fifty Rd. There is a need to fill the southern portion of this subcatchment to allow for the sewer to be constructed over the top of the gas pipeline and the low area along the southern boundary.

12 APT Pipeline Easement

This is a 67 metre wide affected area skewed across the western half of the site, which contains the 375mm Australian Pipeline Trust (APT, originally WANG) natural gas pipeline in its centre, plus the Water Corporation's 1400mm Stirling Trunk Water main located on the eastern side of the gas pipeline.

The development setbacks from the pipeline must be in accord with the requirements of Planning Bulletin 87 – High pressure Gas Transmission Pipelines in the Perth Metropolitan Region (PB 87).

Prior to commencement of subdivision works, the subdivider will prepare and implement a Pipeline Management Plan detailing measures to ensure public safety and the protection of the high pressure natural gas pipeline, including completion of a risk assessment in accordance with AS2885 and implementation of measures required to ensure that the level of risk of future inhabitants of the subdivision is as low as is reasonable practicable.

This risk management assessment has been carried out for other developments in the area and it has been agreed with APT that higher risk land uses such as aged housing, schooling and neighbourhood centres will be removed from the higher risk locations. The planning for this development is cognisant of those requirements.

Although there are no concerns in this development from a planning perspective, at the time of construction the developers and their consultants will need to approach APT to resolve a further pipeline management plan to ensure that the construction of the works in close proximity to the pipeline are properly managed to ensure the safety of the construction personnel. It is at that time that the matter of the road crossing, the levels thereof and the required management measures for the job will be required to be resolved.

13 Telephone

The new area will be served by the NBN or another provider for broadband and telephony. Capacity exists off fifty Road and Baldivis road as part of adjoining developments and will require minor extensions to facilitate connection.

14 Gas

Gas services are located in Fifty Road and Baldivis road and have sufficient capacity to serve the area with minimal augmentation.

15 Attachments

Drawings referred to above are attached as follows;

- Structure Plan – DPS Drawing CarBd060B
- Locality Plan - LW-01.
- Aerial Photograph with Plan – LW-02
- Drainage Strategy Plan – LW-04
- Sewerage Strategy Plan – S100

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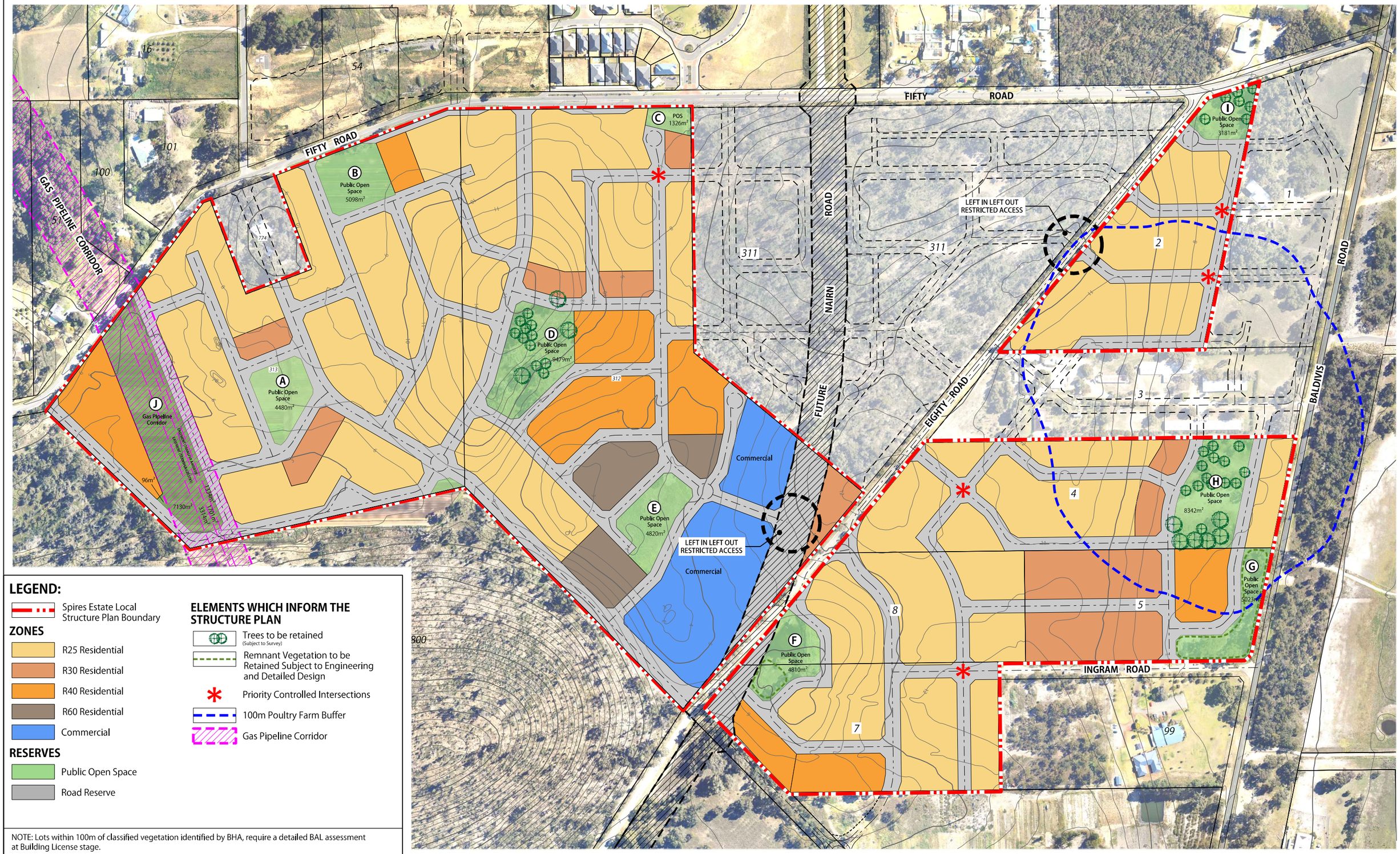
THIS REPORT IS DATED 1ST MAY 2014.



LEGEND:

- Spires Estate Local Structure Plan Boundary

ZONES

- R25 Residential
- R30 Residential
- R40 Residential
- R60 Residential
- Commercial

RESERVES

- Public Open Space
- Road Reserve

ELEMENTS WHICH INFORM THE STRUCTURE PLAN

- Trees to be retained (Subject to Survey)
- Remnant Vegetation to be Retained Subject to Engineering and Detailed Design
- Priority Controlled Intersections
- 100m Poultry Farm Buffer
- Gas Pipeline Corridor

NOTE: Lots within 100m of classified vegetation identified by BHA, require a detailed BAL assessment at Building License stage.

PLAN 1 - Spires Estate Local Structure Plan

Various Lots Fifty and Eighty Road, BALDIVIS

for: Spatial Property Group

SPATIAL Property Group™

NOTES:

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NORTH

Scale 1: 4000 @ A3 | 1:2000 @ A1

0 25 50 75 100 125 150 metres

COMPILED: DPS		DRAWN BY:	RF
DATE:	15/02/2012	REVISED:	19/05/2014
GRID:	MGA 50	DATUM:	AHD
DRAWING NUMBER:	CARBD-2-001e	JOBCODE:	CARBDLSP
FILE ID:	M:\CARBD\Base\Structure Plans\CARBD-2-001e.dgn		

Development Planning Strategies

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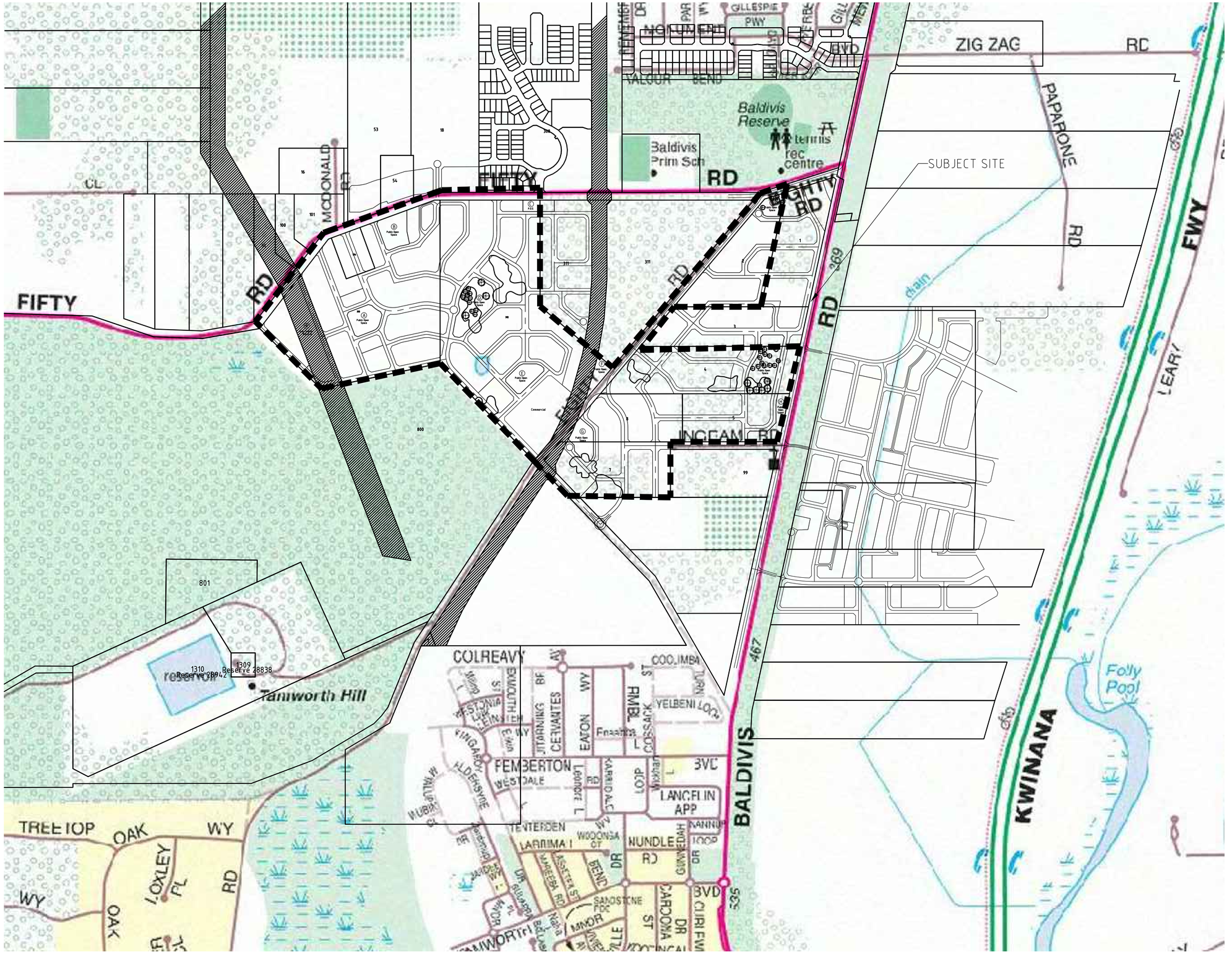

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No.	DATE	BY	REVISION
C	13/5/14	DPH	LOTS 1 & 3 REMOVED FROM CATCHMENT BOUNDARY — SRA
B	24/2/12	JEG	UPDATED STRUCTURE PLAN — SRA
A	27/10/11	JEG	ISSUED FOR APPROVAL/TENDER — SRA

CLIENT:
CARCIONE

DEVELOPMENT ENGINEERING CONSULTANTS
SUITE 3, 123A COLIN ST, WEST PERTH, 6005 WESTERN AUSTRALIA
Ph: (08) 9481 1900
Fax: (08) 9481 1700

PROJECT:
LOTS 312-313 FIFTY ROAD & LOTS 2, 4, 7 & 8 EIGHTY ROAD BALDIVIS
W.A.P.C. No. - 141490

DRAWING:
BALDIVIS LOCALITY PLAN
CAD DRAWING DO NOT MANUALLY ALTER

SCALE	DRAWN	CHECK	REV No.
1:5000	JEG	SRA	C
DATE 27/10/11	DESIGNED JEG	APPROVED SRA	

PROJECT NUMBER
BDVCAN01 LW01
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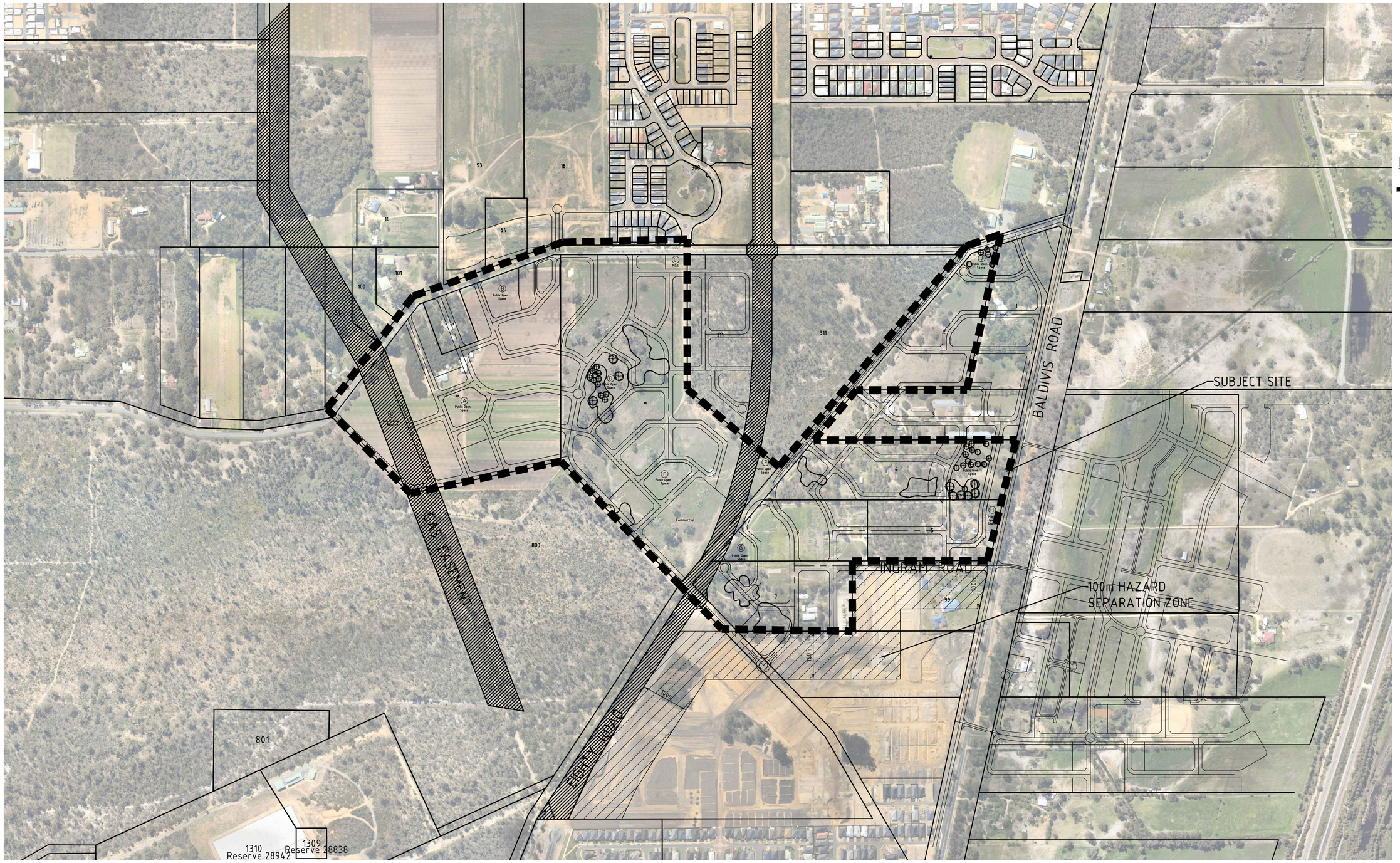

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No.	DATE	BY	REVISION	
D	13/5/14	DPH	LOTS 1 & 3 REMOVED FROM CATCHMENT BOUNDARY	SRA
C	1/5/12	JEG	BUFFER ZONE ADDED	SRA
B	24/2/12	JEG	UPDATED STRUCTURE PLAN	SRA
A	7/12/19	JEG	ISSUED FOR APPROVAL	SRA

CLIENT: **CARCIONE NOMINEES PTY LTD**

DEVELOPMENT ENGINEERING CONSULTANTS
SUITE 3, 123A COLIN ST, WEST PERTH, 6005 WESTERN AUSTRALIA
Ph: (08) 9481 1900
Fax: (08) 9481 1700

PROJECT: **LOT 400 BALDIVIS ROAD BALDIVIS**
W.A.P.C. No. -

DRAWING: **AERIAL PHOTO**
CAD DRAWING DO NOT MANUALLY ALTER

SCALE	DRAWN	CHECK	REV No.
1:2500	JEG	SRA	D
DATE 7/12/09	DESIGNED SRA	APPROVED SRA	

PROJECT NUMBER **BDVCAN01 LW02**
S:\CAN\BDVCAN01\DRAWINGS\LWMS\BDVCAN01_LW02.dwg 13/05/2014

CATCHMENT 10B BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.99ha
100yr STORAGE REQUIRED	2157m³
AREA AT TWL (100yr)	2392m²
RL (TWL) (100yr)	5.60m AHD
5yr STORAGE REQUIRED	982m³
AREA AT TWL (5yr)	1607m²
RL (TWL) (5yr)	5.01m AHD
1yr STORAGE REQUIRED	494m³
AREA AT TWL (1yr)	1188m²
RL (TWL) (1yr)	4.66m AHD
PEAK OUTFLOW (100yr)	25 l/s
LWL	4.10m AHD

CATCHMENT 9 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.40ha
100yr STORAGE REQUIRED	1511m³
AREA AT TWL (100yr)	1682m²
RL (TWL) (100yr)	8.50m AHD
5yr STORAGE REQUIRED	668m³
AREA AT TWL (5yr)	1099m²
RL (TWL) (5yr)	7.89m AHD
1yr STORAGE REQUIRED	334m³
AREA AT TWL (1yr)	812m²
RL (TWL) (1yr)	7.54m AHD
PEAK OUTFLOW (100yr)	31 l/s
LWL	7.00m AHD

CATCHMENT 8 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.07ha
100yr STORAGE REQUIRED	1181m³
AREA AT TWL (100yr)	1372m²
RL (TWL) (100yr)	6.50m AHD
5yr STORAGE REQUIRED	531m³
AREA AT TWL (5yr)	885m²
RL (TWL) (5yr)	5.92m AHD
1yr STORAGE REQUIRED	266m³
AREA AT TWL (1yr)	637m²
RL (TWL) (1yr)	5.57m AHD
PEAK OUTFLOW (100yr)	11 l/s
LWL	5.00m AHD

CATCHMENT 11 BASIN DETAILS

TOTAL IMPERVIOUS AREA	0.58ha
100yr STORAGE REQUIRED	725m³
AREA AT TWL (100yr)	924m²
RL (TWL) (100yr)	6.50m AHD
5yr STORAGE REQUIRED	302m³
AREA AT TWL (5yr)	548m²
RL (TWL) (5yr)	5.92m AHD
1yr STORAGE REQUIRED	151m³
AREA AT TWL (1yr)	377m²
RL (TWL) (1yr)	5.59m AHD
PEAK OUTFLOW (100yr)	6 l/s
LWL	5.00m AHD

LEGEND

- DRAINAGE CATCHMENT BOUNDARY
- TREES
- INDICATIVE LOCATION OF COMPENSATING BASIN (SHOWING ~ 1 IN 5 YEAR FLOOD AREA)
- 2.50 AAMGL CONTOURS PER 2003 PERTH GROUNDWATER LEVEL ATLAS
- MONITORING BORES
- STORAGE - 1 IN 100 YEAR LEVEL
- STORAGE - 1 IN 10 YEAR LEVEL
- STORAGE - 1 IN 5 YEAR LEVEL
- STORAGE - 1 IN 1 YEAR LEVEL

CATCHMENT 2 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.50ha
100yr STORAGE REQUIRED	1562m³
AREA AT TWL (100yr)	1680m²
RL (TWL) (100yr)	6.60m AHD
5yr STORAGE REQUIRED	689m³
AREA AT TWL (5yr)	1110m²
RL (TWL) (5yr)	5.97m AHD
1yr STORAGE REQUIRED	348m³
AREA AT TWL (1yr)	842m²
RL (TWL) (1yr)	5.62m AHD
PEAK OUTFLOW (100yr)	34 l/s
LWL	5.10m AHD

CATCHMENT 1 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.95ha
100yr STORAGE REQUIRED	2009m³
AREA AT TWL (100yr)	2050m²
RL (TWL) (100yr)	6.00m AHD
5yr STORAGE REQUIRED	838m³
AREA AT TWL (5yr)	1365m²
RL (TWL) (5yr)	5.31m AHD
1yr STORAGE REQUIRED	424m³
AREA AT TWL (1yr)	1078m²
RL (TWL) (1yr)	4.97m AHD
PEAK OUTFLOW (100yr)	44 l/s
LWL	4.50m AHD

CATCHMENT 3 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.18ha
100yr STORAGE REQUIRED	1341m³
AREA AT TWL (100yr)	1560m²
RL (TWL) (100yr)	7.00m AHD
5yr STORAGE REQUIRED	590m³
AREA AT TWL (5yr)	1001m²
RL (TWL) (5yr)	6.41m AHD
1yr STORAGE REQUIRED	298m³
AREA AT TWL (1yr)	725m²
RL (TWL) (1yr)	6.07m AHD
PEAK OUTFLOW (100yr)	12 l/s
LWL	5.50m AHD

CATCHMENT 4 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.40ha
100yr STORAGE REQUIRED	1466m³
AREA AT TWL (100yr)	1598m²
RL (TWL) (100yr)	7.20m AHD
5yr STORAGE REQUIRED	650m³
AREA AT TWL (5yr)	1051m²
RL (TWL) (5yr)	6.58m AHD
1yr STORAGE REQUIRED	329m³
AREA AT TWL (1yr)	791m²
RL (TWL) (1yr)	6.23m AHD
PEAK OUTFLOW (100yr)	31 l/s
LWL	5.70m AHD

CATCHMENT 5 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.46ha
100yr STORAGE REQUIRED	1529m³
AREA AT TWL (100yr)	1640m²
RL (TWL) (100yr)	6.50m AHD
5yr STORAGE REQUIRED	655m³
AREA AT TWL (5yr)	1069m²
RL (TWL) (5yr)	5.85m AHD
1yr STORAGE REQUIRED	335m³
AREA AT TWL (1yr)	819m²
RL (TWL) (1yr)	5.51m AHD
PEAK OUTFLOW (100yr)	33 l/s
LWL	5.00m AHD

CATCHMENT 6 BASIN DETAILS

TOTAL IMPERVIOUS AREA	2.52ha
100yr STORAGE REQUIRED	2549m³
AREA AT TWL (100yr)	2491m²
RL (TWL) (100yr)	4.50m AHD
5yr STORAGE REQUIRED	1048m³
AREA AT TWL (5yr)	1702m²
RL (TWL) (5yr)	3.78m AHD
1yr STORAGE REQUIRED	525m³
AREA AT TWL (1yr)	1381m²
RL (TWL) (1yr)	3.55m AHD
PEAK OUTFLOW (100yr)	57 l/s
LWL	3.00m AHD

CATCHMENT 7 BASIN DETAILS

TOTAL IMPERVIOUS AREA	3.34ha
100yr STORAGE REQUIRED	3284m³
AREA AT TWL (100yr)	3080m²
RL (TWL) (100yr)	5.80m AHD
5yr STORAGE REQUIRED	1328m³
AREA AT TWL (5yr)	2162m²
RL (TWL) (5yr)	5.05m AHD
1yr STORAGE REQUIRED	673m³
AREA AT TWL (1yr)	1809m²
RL (TWL) (1yr)	4.72m AHD
PEAK OUTFLOW (100yr)	75 l/s
LWL	4.30m AHD

CATCHMENT 10A BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.34ha
100yr STORAGE REQUIRED	1437m³
AREA AT TWL (100yr)	1624m²
RL (TWL) (100yr)	6.80m AHD
5yr STORAGE REQUIRED	659m³
AREA AT TWL (5yr)	1074m²
RL (TWL) (5yr)	6.22m AHD
1yr STORAGE REQUIRED	327m³
AREA AT TWL (1yr)	781m²
RL (TWL) (1yr)	5.86m AHD
PEAK OUTFLOW (100yr)	14 l/s
LWL	5.30m AHD

CATCHMENT AREA INFORMATION

CATCHMENT	TOTAL AREA	LOT AREA	ROAD RESERVE AREA	POS AREA
1	50853m²	23589m²	22700m²	4564m²
2	49038m²	28547m²	17538m²	2953m²
3	43314m²	27871m²	13660m²	1783m²
4	58750m²	34098m²	16305m²	8347m²
5	61892m²	39916m²	16951m²	5025m²
6	72129m²	26016m²	40522m²	5591m²
7	139854m²	88911m²	39101m²	11842m²
8	40310m²	23754m²	12386m²	4170m²
9	61149m²	38787m²	16315m²	6047m²
10A	53842m²	31822m²	15558m²	6462m²
10B	71824m²	36328m²	23141m²	12355m²
11	23374m²	15502m²	6742m²	1130m²

CATCHMENT 10B
CATCHMENT 10A
CATCHMENT 9
CATCHMENT 8
CATCHMENT 11
CATCHMENT 7
CATCHMENT 6
CATCHMENT 2
CATCHMENT 1
CATCHMENT 3
CATCHMENT 4
CATCHMENT 5
Public Open Space
Gas Pipeline Reserve
Commercial
FILL TO R.L.6.00m AHD
DRAINS TO U/G STORAGE
CATCHMENT DETERMINED IN PREVIOUS LWMS
CATCHMENT DETERMINED IN PREVIOUS LWMS
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No.	DATE	BY	REVISION	
C	21/2/12	JEG	CATCHMENTS 2, 3, 4, 5, 7, 8, & 9 REVISED	SRA
B	30/11/11	JEG	CATCHMENTS REVISED, ADDITIONAL CATCHMENT INFORMATION ADDED	SRA
A	21/11/11	JEG	ISSUED FOR INFORMATION	SRA

CLIENT: CARCIONE NOMINEES PTY LTD

DEVELOPMENT ENGINEERING CONSULTANTS
SUITE 3, 123A COLIN ST, WEST PERTH, 6005 WESTERN AUSTRALIA
Ph: (08) 9481 1900
Fax: (08) 9481 1700

PROJECT: LOTS 312-313 FIFTY ROAD & LOTS 2, 4, 7 & 8 EIGHTY ROAD BALDIVIS
W.A.P.C. No. -

DRAWING: CATCHMENT PLAN POST-DEVELOPMENT
CAD DRAWING DO NOT MANUALLY ALTER

SCALE	DRAWN	CHECK	REV No.
1:2000 (A1)	JEG	SRA	C
DATE	DESIGNED	APPROVED	
21/10/11	DMN	SRA	

PROJECT NUMBER: BDVCAN10 LW04
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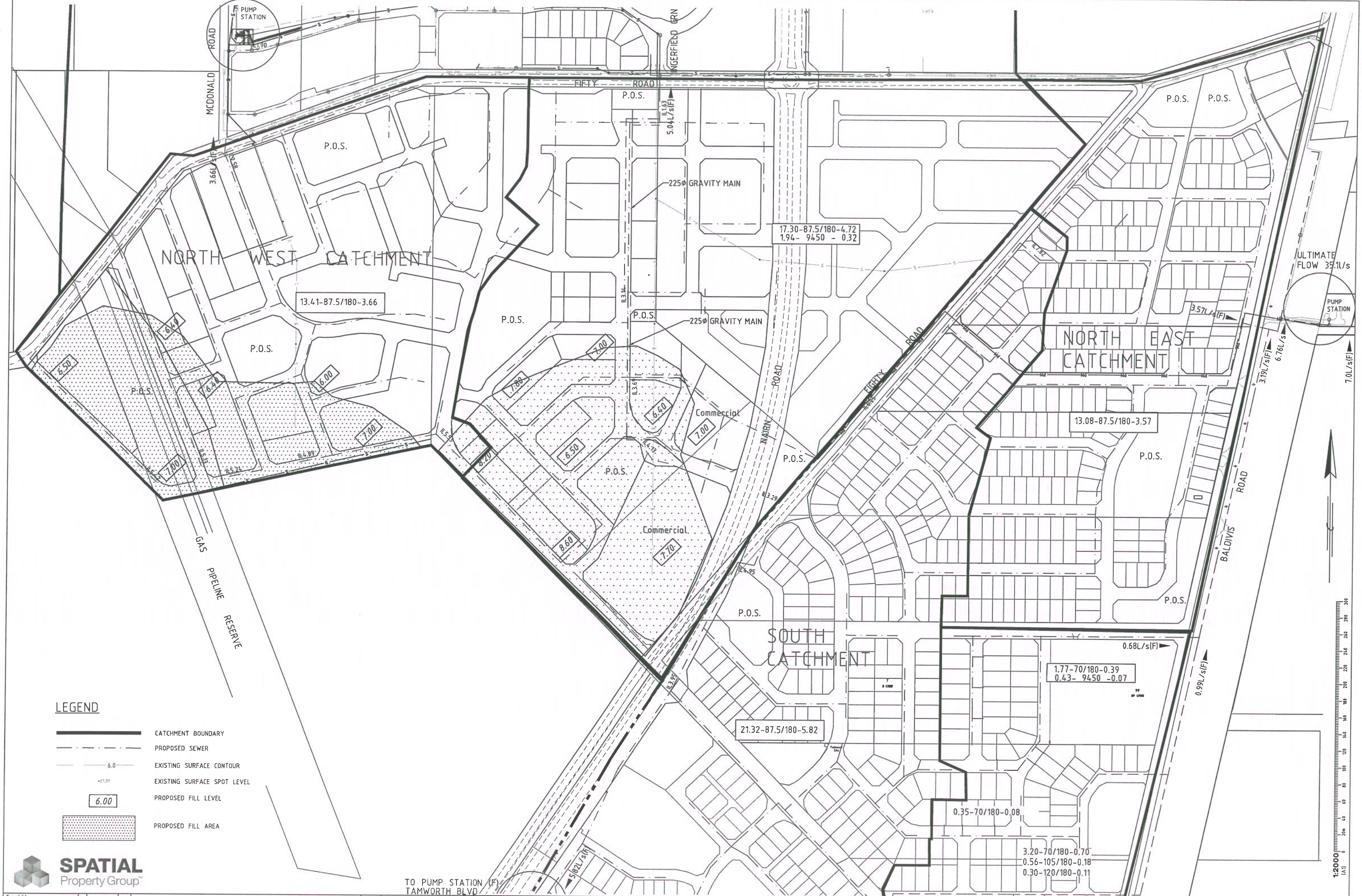

LEGEND

- CATCHMENT BOUNDARY
- PROPOSED SEWER
- 6.0 — EXISTING SURFACE CONTOUR
- +27.99 — EXISTING SURFACE SPOT LEVEL
- 6.00 — PROPOSED FILL LEVEL
- PROPOSED FILL AREA

SPATIAL Property Group

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No.	DATE	BY	REVISION	
F	2/5/14	HJW	CATCHMENT AREAS ADDED	DNW
E	11/4/13	HJW	SEWER REDUCED TO 225, PM DELETED	SRA
D	20/3/13	HJW	SEWER ADJUSTED TO SUIT STRUCTURE & FSL PLAN	SRA
C	21/3/12	HJW	ADJUSTED SEWER TO MATCH	SRA
B	24/2/12	JEG	UPDATED STRUCTURE PLAN	SRA
A	21/11/11	HJW	ISSUED FOR APPROVAL	SRA

CLIENT: CARCIONE NOMINEES PTY LTD

DEVELOPMENT ENGINEERING CONSULTANTS
SUITE 3, 123A COLIN ST, WEST PERTH, 6005 WESTERN AUSTRALIA
Ph: (08) 9481 1900
Fax: (08) 9481 1700

PROJECT: LOTS 311,312,313 FIFTY RD LOTS 1,3,4,5,400 BALDIVIS RD LOTS.2,7,8 EIGHTY RD, BALDIVIS
W.A.P.C. No. -

DRAWING: SEWER STRATEGY PLAN

CAD DRAWING DO NOT MANUALLY ALTER

SCALE	DRAWN	CHECK	REV No.
1:2000	HJW	SRA	F
DATE 9/11/11	DESIGNED HJW	APPROVED SRA	

PROJECT NUMBER: BDVCAN10 S100

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Appendix **Three** – Landowner Agreement

Commercial Zoned Land

Baldivis North
where home is!
www.baldivisnorth.com.au

P16/03/13/D001

7 March 2012

Bruce Young
Spatial Property Group
Unit 1, 896 Canning Hwy
Applecross WA 6153

Dear Bruce,

Agreement re Zoning Change within Baldivis North Local Structure Plan (Lots 30, 31 Kerosene Land and Lot 308 Fifty Road Baldivis)

Lot 191 (1.5Ha) and lot 270 (0.526Ha) are currently zoned 'Commercial' under the approved Baldivis North Local Structure Plan - Lots 30, 31 Kerosene Land and Lot 308 Fifty Road Baldivis (BN LSP). As part of this approval, a maximum of 0.85Ha of the total commercial area of 2.026Ha) can be used for residential purposes.

It is my understanding that Spatial Property Group - Spires Estate is currently seeking approval for a new Local Structure Plan (LSP) for land located to the south of the Baldivis North development and that the LSP application includes an area of commercial zoning on the basis of the agreement in this letter.

This letter serves to confirm that Baldivis North Pty Ltd and Spatial Property Group – Spires Estate have agreed to an arrangement whereby the commercial zoning currently applicable to lots 191 and lot 270 in the approved BN LSP can be relocated to within the Spires Estate LSP, provided that;

1. The entire area of Lots 191 and 270 can be zoned as R40;

2. The change to the zoning can be achieved via an amendment to the BN LSP before the approval of the Spires LSP.

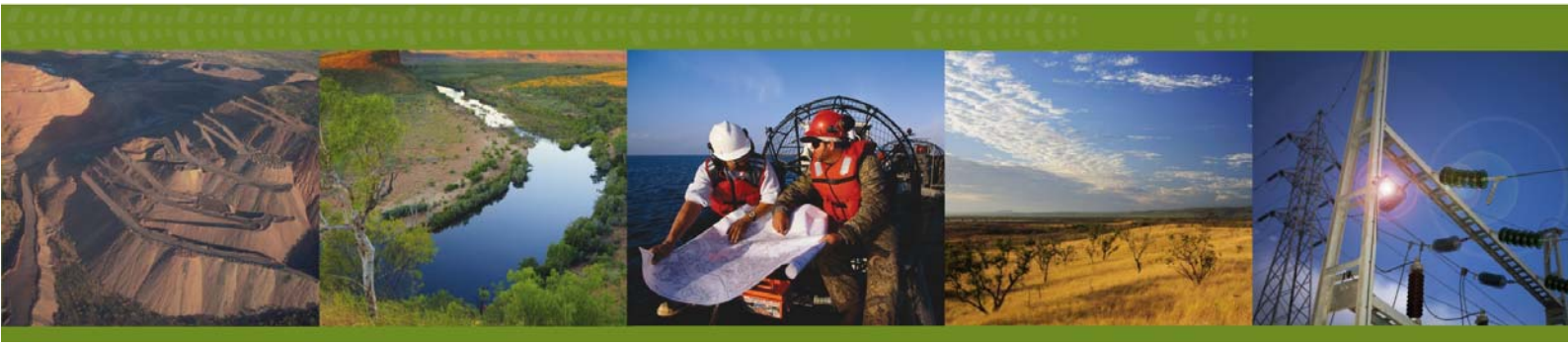
We would be pleased to meet with yourself and the City of Rockingham in order to facilitate the swap of land uses.

Yours sincerely

Rob Penfold

Baldivis North Pty Ltd

Appendix **Four** – Fire Management Plan



Fire Management Plan

Spires Estate Local Structure Plan

Prepared for
Spatial Property Group
by Strategen

March 2014

STRATEGEN
environmental consultants

Fire Management Plan

Spires Estate Local Structure Plan

Strategen is a trading name of
Strategen Environmental Consultants Pty Ltd
Level 2, 322 Hay Street Subiaco WA
ACN: 056 190 419

March 2014

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In particular, it should be noted that this report is a qualitative assessment only, based on the scope of services defined by the Client, budgetary and time constraints imposed by the Client, the information supplied by the Client (and its agents), and the method consistent with the preceding.

Strategen has not attempted to verify the accuracy or completeness of the information supplied by the Client.

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Client: Spatial Property Group

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Draft Report	Rev A	For review by client	Z Cockerill / T Bowra	Electronic	30/08/2013
Draft Report	Rev 0	For review by key stakeholders	Z Cockerill / R Banks	Electronic	2/09/2013
Draft Report	Rev 1	For review by key stakeholders	Z Cockerill / R Banks	Electronic	19/12/2013
Draft report	Rev 2	For consideration by CoR, DFES and DoP	Z Cockerill / R Banks	Electronic	12/02/2014
Draft report	Rev 3	To address final CoR and DoP comments	Z Cockerill	Electronic	24/02/2014
Final Report	Rev 4	Issued for use: to address Schedule of Modifications and for lodgement with final LSP	Z Cockerill	Electronic	26/03/2014

Filename: SPP13167_01 R001 Rev 4 - 26 March 2014

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1. Introduction

1.1 Background

Spatial Property Group (SPG) is proposing to implement the Spires Estate Local Structure Plan (LSP), which outlines proposed development of seven lots situated between Fifty Road and Baldivis Road in the City of Rockingham (the project area). The development is predominantly for residential purposes. Development Planning Strategies has prepared the LSP on behalf of SPG, as presented in Figure 1.

There is an inherent bush fire risk to proposed life and property assets of the development, particularly due to the extent of vegetation on adjoining properties. A bush fire hazard assessment was undertaken across the project area and surrounds by Bushfire Safety Consulting (2012), as outlined in Appendix 1. The assessment identified the project area and surrounding land as containing a range of bush fire hazard levels, some classified as 'Extreme'. Consequently, a Fire Management Plan (FMP) was recommended to be prepared for each future stage of subdivision application.

In response to the above recommendation, SPG has commissioned Strategen to prepare an FMP to support the Spires Estate LSP in accordance with *Planning for Bush Fire Protection Guidelines (Edition 2)* (PFBFP Guidelines) (WAPC et al. 2010). A completed FMP compliance checklist is contained in Appendix 2.

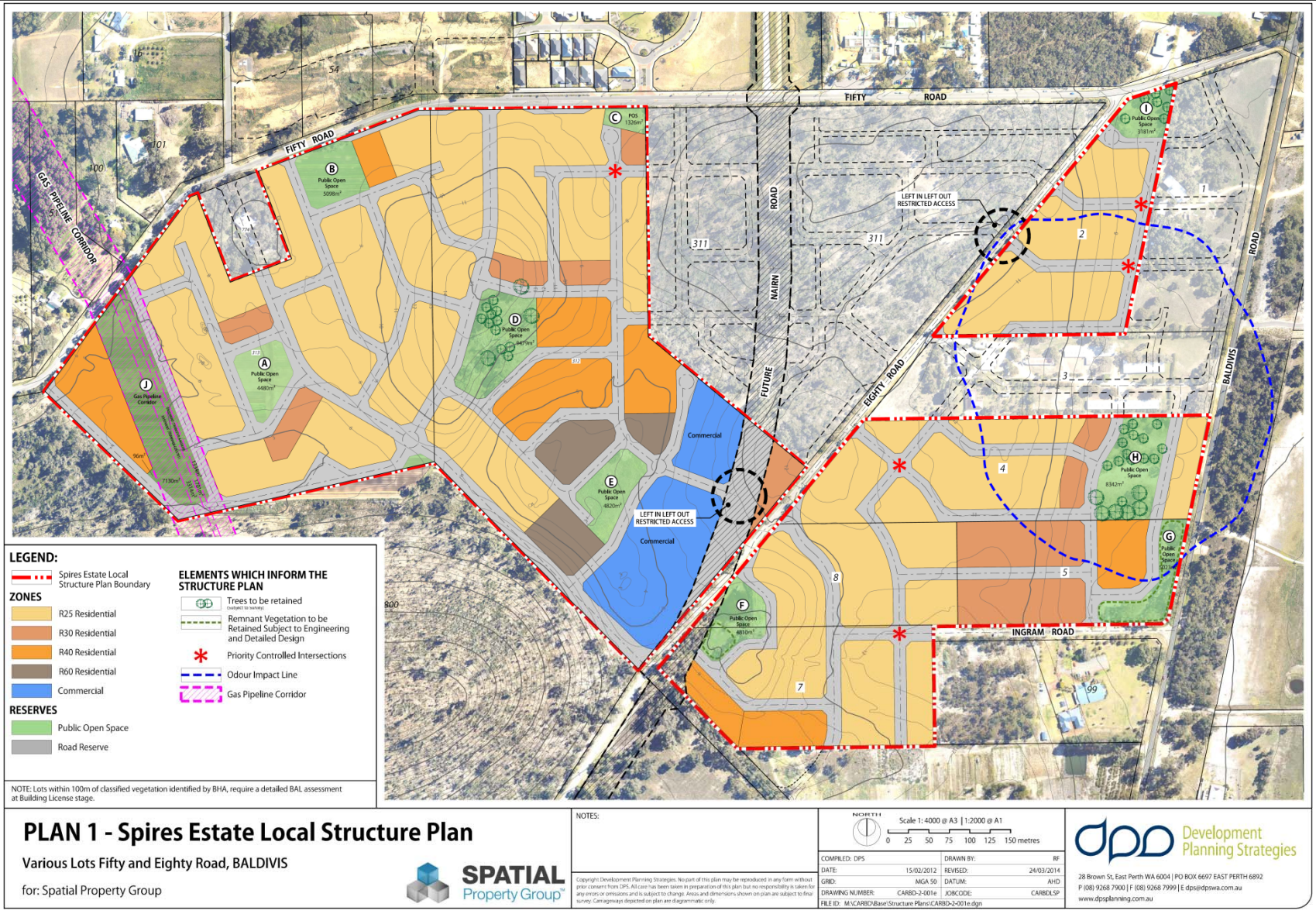
1.2 Purpose and application of the plan

The purpose of the FMP is to provide guidance on how to plan for and manage the bush fire risk to the project area through implementation of a range of bush fire risk mitigation measures in accordance with requirements of PFBFP Guidelines. The FMP outlines how future on-site assets can be protected during the summer months when the risk of bush fire is at its peak. This is particularly relevant when existing fire appliances in the area may be unable to offer an adequate emergency suppression response. Therefore, the developer should aim to ensure on-site assets are self-protecting from bush fire.

Implementation of the FMP is a shared responsibility between the developer, City of Rockingham (CoR) and prospective landowners to ensure bush fire risk treatment and mitigation measures are adopted and implemented on an ongoing basis to achieve bush fire management objectives.

1.3 Stakeholder consultation

Strategen has undertaken consultation with the developer, CoR, Department of Fire and Emergency Services (DFES) and Department of Planning (DoP) to ensure aims and objectives of the FMP are in accordance with stakeholder expectations and the FMP maintains compliance with PFBFP Guidelines.



Source: Development Planning Strategies 2014

2. Aim and objectives

2.1 Aim

The FMP aims to achieve a reduction in the occurrence of uncontrolled bush fires and minimise potential impacts on life and property of the proposed development. The following tasks have been undertaken to achieve this, as documented in this FMP:

- quantify the bush fire hazard and assess the bush fire risk to the project area
- document bush fire prevention requirements of the project area to provide ongoing protection to future residents, visitors and built assets of the subject land
- identify bush fire protection issues, appropriate strategies and those persons and/or organisations who have a responsibility to implement the FMP
- comply with PFBFP Guidelines and bush fire management on neighbouring subdivisions
- provide guidance for the developer, CoR and prospective landowners to protect the subject land and on-site assets in the event that fire appliances may not be available to offer a prompt bush fire suppression response.

2.2 Objectives

Key objectives of the FMP and the relevant section/s of this document in which they are addressed are outlined in Table 1.

Table 1 Key objectives of the FMP

Objective	Section
Define areas where values are located (i.e. location of assets)	Section 3.7
Define and rank fire hazard areas	Section 4.2
Nominate individuals and organisations responsible for fire management and associated works within the project area	Section 5.7
Propose fire management measures for the project area, with due regard for life, property and the environment	Section 5
Provide performance criteria and acceptable solutions for all fire management works in accordance with PFBFP Guidelines	Section 4.2.5

3. Description of the area

3.1 General overview

The project area is located approximately 40 km south of the Perth Central Business District, 6 km east of Rockingham City Centre and 2 km north of Baldivis District Centre (Figure 2). The project area is approximately 54.5 ha and comprises seven lots situated between Fifty Road and Baldivis Road in the City of Rockingham (Figure 3). Individual lot details are provided in Table 2.

The project area is bound by Fifty Road to the north and Baldivis Road to the east, and occurs on either side of Eighty Road and private vegetated Lot 311. Predominant land uses comprise a market garden, rural residential lifestyle properties and vacant landholdings.

Table 2 Lots contained within the project area

Lot number	Predominant land use	Area (ha)
Lot 312 Fifty Road	Vacant landholding	18.6
Lot 313 Fifty Road	Market garden	15.0
Lot 2 Eighty Road	Vacant landholding	4.0
Lot 4 Baldivis Road	Rural residential lifestyle property	5.8
Lot 5 Baldivis Road	Vacant landholding	3.4
Lot 7 Baldivis Road	Rural residential lifestyle property	4.3
Lot 8 Ingram Road	Rural residential lifestyle property	3.4
Total area		**54.5**

3.1.1 Overview of predominant areas of vegetation, bush fire hazard and risk

The majority of the project area consists of cleared land, with only small remnants of degraded or modified vegetation remaining in some areas. Furthermore, the proposed development will result in a predominantly cleared, built environment, with only minor retention of individual overstorey trees proposed throughout selected Public Open Space (POS) areas subject to annual management. Therefore, the long term bush fire risk on-site will be low due to the lack of predominant vegetation and bush fire hazards.

The predominant vegetation considered to pose a permanent bush fire risk to the project area occurs within the following adjacent properties, as illustrated in Figure 3:

- Rockingham Lakes Regional Park to the southwest (Bush Forever Site 356)
- Baldivis Nature Reserve to the northeast
- Tramway Reserve to the east
- rural-zoned land to the northwest.

The project area adjoins private vegetated properties subject to future urban development as indicated by the Metropolitan Region Scheme (MRS), City of Rockingham Town Planning Scheme No. 2 (TPS No. 2) and Baldivis North District Structure Plan (BNDSP). These properties include:

- private vegetated Lot 311 in the central-north
- private vegetated Lot 774 to the northwest
- private vegetated Lot 1 to the northeast.

These adjacent properties will pose a temporary bush fire risk to the project area until such time that the vegetation and bush fire hazards are removed through proposed urban development or by other means of fuel hazard reduction. Both the permanent and temporary bush fire risks posed by the abovementioned properties will need to be addressed as part of ongoing planning and design of the Spires Estate LSP.

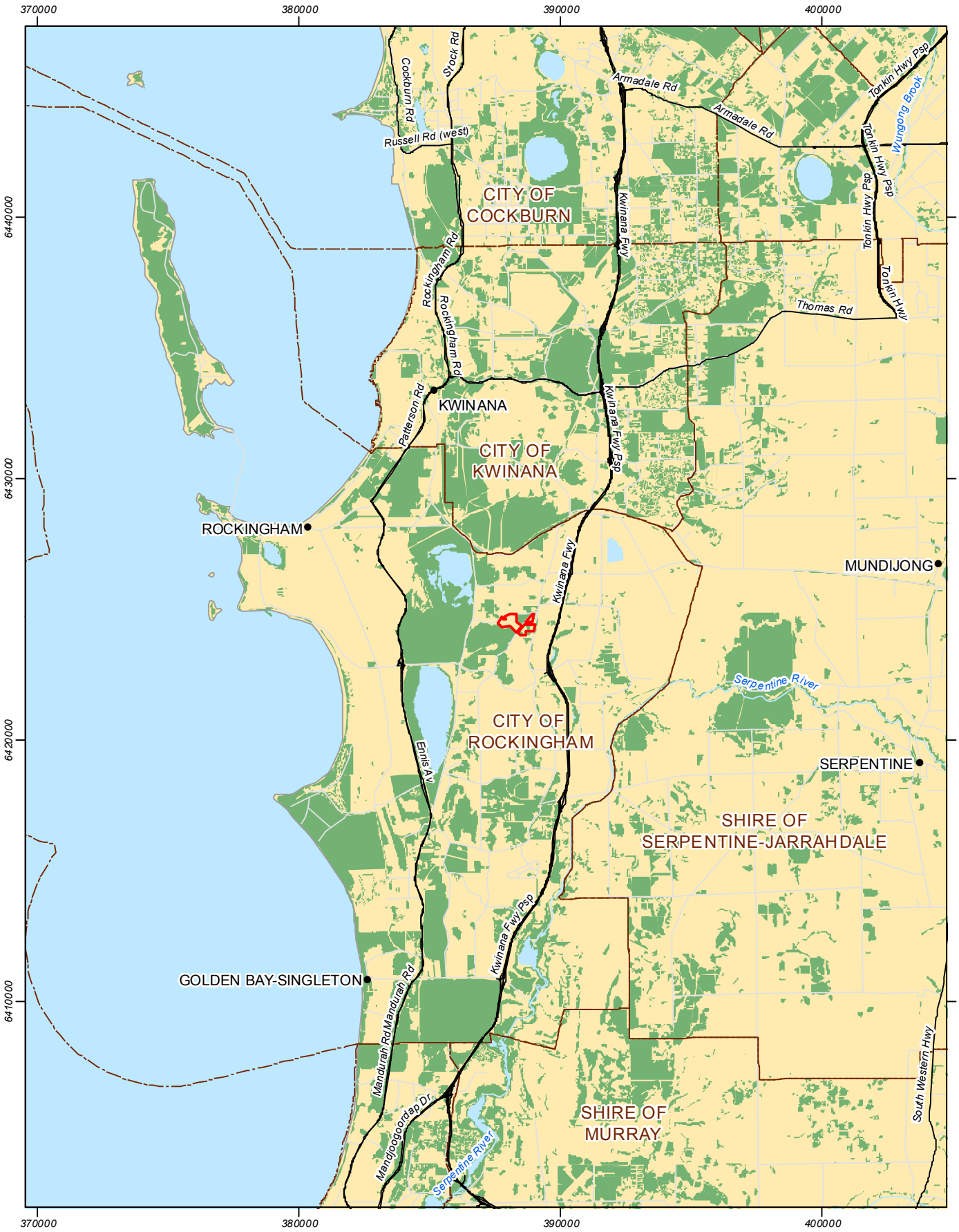


Figure 2 Regional location

Scale 1:200,000 at A4

0 1 2 3 4 5 km

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 28/08/2013
Author: JCrute
Source: Topography: Geoscience Australia 2011.

Legend

- Town
- Major road
- Minor road
- Major river
- Lakes
- Local government boundary
- Spires Estate LSP boundary
- Native vegetation

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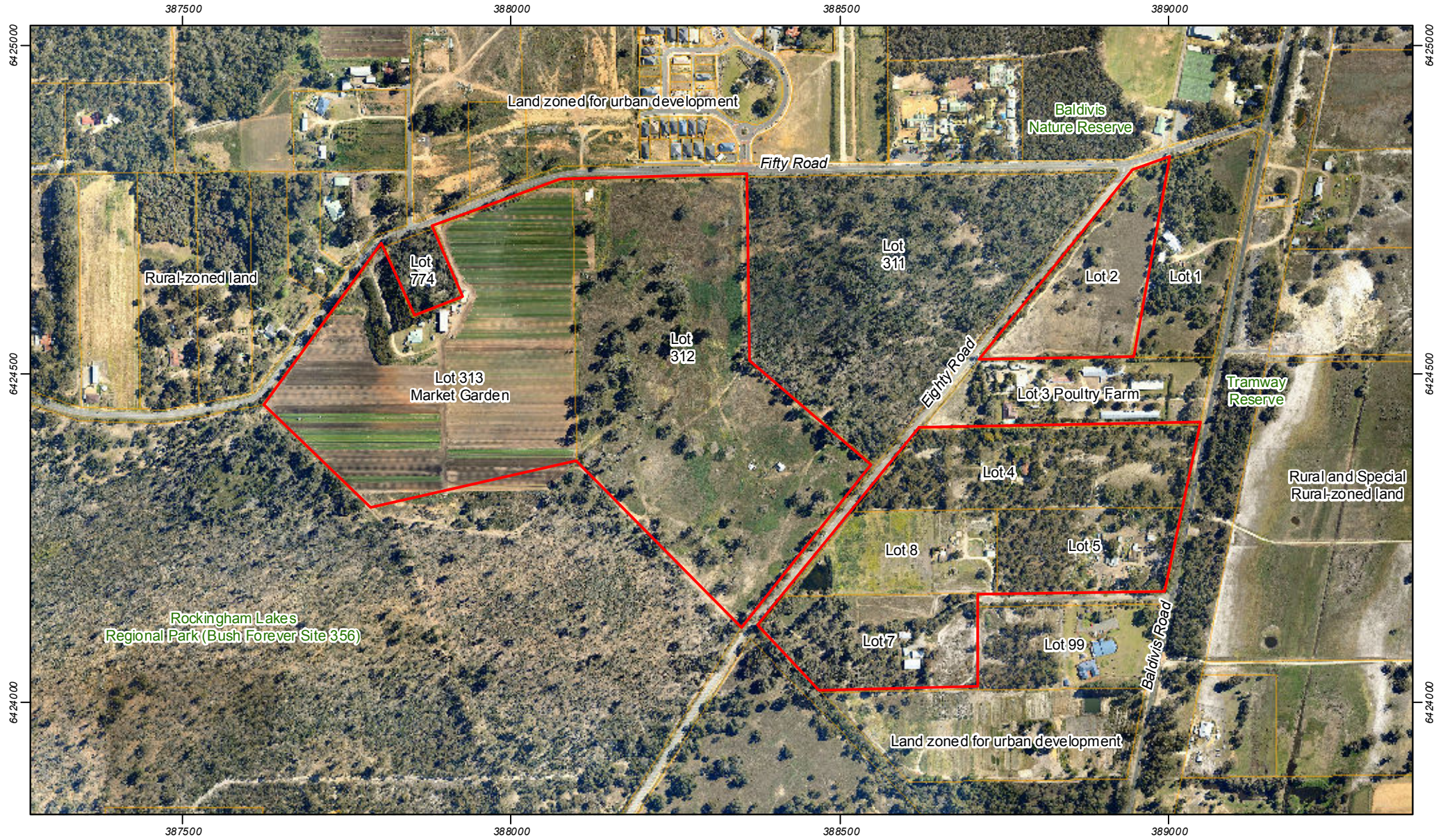

Figure 3 Site overview

Scale 1:8,000 at A4

0 50 100 150 200 250 m

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 28/08/2013

Author: JCrute
Source: Client 2013.

Legend

- Spires Estate LSP boundary
- Existing cadastral boundaries

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3.2 Local climate

The Baldivis locality experiences a Mediterranean-type climate characterised by mild, wet winters and warm to hot, dry summers. The Bureau of Meteorology (BoM) weather station at Medina Research Centre (Station No. 9194) provides mean monthly climate statistics for the Baldivis locality (Table 3). Mean annual rainfall since 1983 for Medina Research Centre is 765.6 mm (BoM 2012). Rainfall may occur at any time of year; however, most occurs in winter in association with cold fronts from the southwest. Highest temperatures are generally recorded from December to March, with mean monthly maximums ranging from 28°C in December to 31.4°C in February.

Table 3 Mean monthly climate statistics for Medina Research Centre

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean maximum temperature (°C)	30.6	31.4	29.4	25.6	22.1	19.3	18.3	18.8	20.2	22.5	25.9	28.0	24.3
Mean minimum temperature (°C)	17.0	17.5	15.9	13.3	10.5	9.1	8.2	8.0	9.1	10.3	13.4	15.0	12.3
Mean rainfall (mm)	12.2	20.1	18.3	40.3	97.5	148.3	147.9	114.2	76.3	40.2	32.1	10.6	765.6

Source: BoM 2012

3.2.1 Fire weather

Southwest Western Australia generally experiences a cool to mild growing season in the months of August through to November of each year, followed by four months of summer drought conditions, which is when the potential for bush fire occurrence is at its peak. The worst fire weather conditions occur during this dry period when a low pressure trough forms off the west coast and strong winds develop from the north or northeast. These conditions are sometimes associated with 'Extreme' or 'Catastrophic' fire dangers, which are consistent with very high temperatures, low relative humidity and strong winds. On average, based on the predominant summer climatic conditions of the local area, these high fire risk fire weather conditions are considered to occur less than 5% of the time during the designated bush fire season, which equates to around 6 days between December and March.

Average 9:00 am and 3:00 pm January wind profiles for Medina Research Centre are contained in Appendix 3, which illustrate that the predominant winds during this high risk period are from the east and southeast in the morning averaging around 13 km/h; and from the southwest in the afternoon averaging around 20 km/h (BoM 2012). Mean 9:00 am and 3:00 pm relative humidity in January for Medina Research Centre is 53% and 42% respectively and the average maximum summer temperature in January for the area is 30.6°C. These predominant fire weather conditions correlate with an average fire danger index of 'High', as determined using the Commonwealth Science and Industrial Research Organisation (CSIRO) Fire Danger and Fire Spread Calculator (CSIRO 1999). These dominant fire weather conditions are considered to occur more than 95% of the time during the designated bush fire season.

3.3 Landform and topography

The project area is located on the Swan Coastal Plain, which is characterised by a low-lying coastal plain, mainly covered with woodlands. Banksia and Jarrah-banksia woodlands are the usual vegetation contained within the dune systems (McKenzie et al. 2003).

Site topography of the project area and adjacent properties is generally undulating due to the presence of dune systems, with slopes not exceeding 10 degrees (BSC 2012). The project area consists of several small rises and depressions, with on-site elevation ranging from 3 mAHD (Australian Height Datum) in the depressions, to 15 mAHD in the rises (Figure 4). On-site slope is not considered to be a significant factor of bush fire risk due to the lack of on-site vegetation under slope and proposed establishment of a built footprint across the site in association with managed POS areas. The surrounding vegetation extent is generally located on flat land or up-slope from the project area. This is particularly apparent in Rockingham Lakes Regional Park to the southwest and vegetated Lot 311 in the central-north (Figure 4).

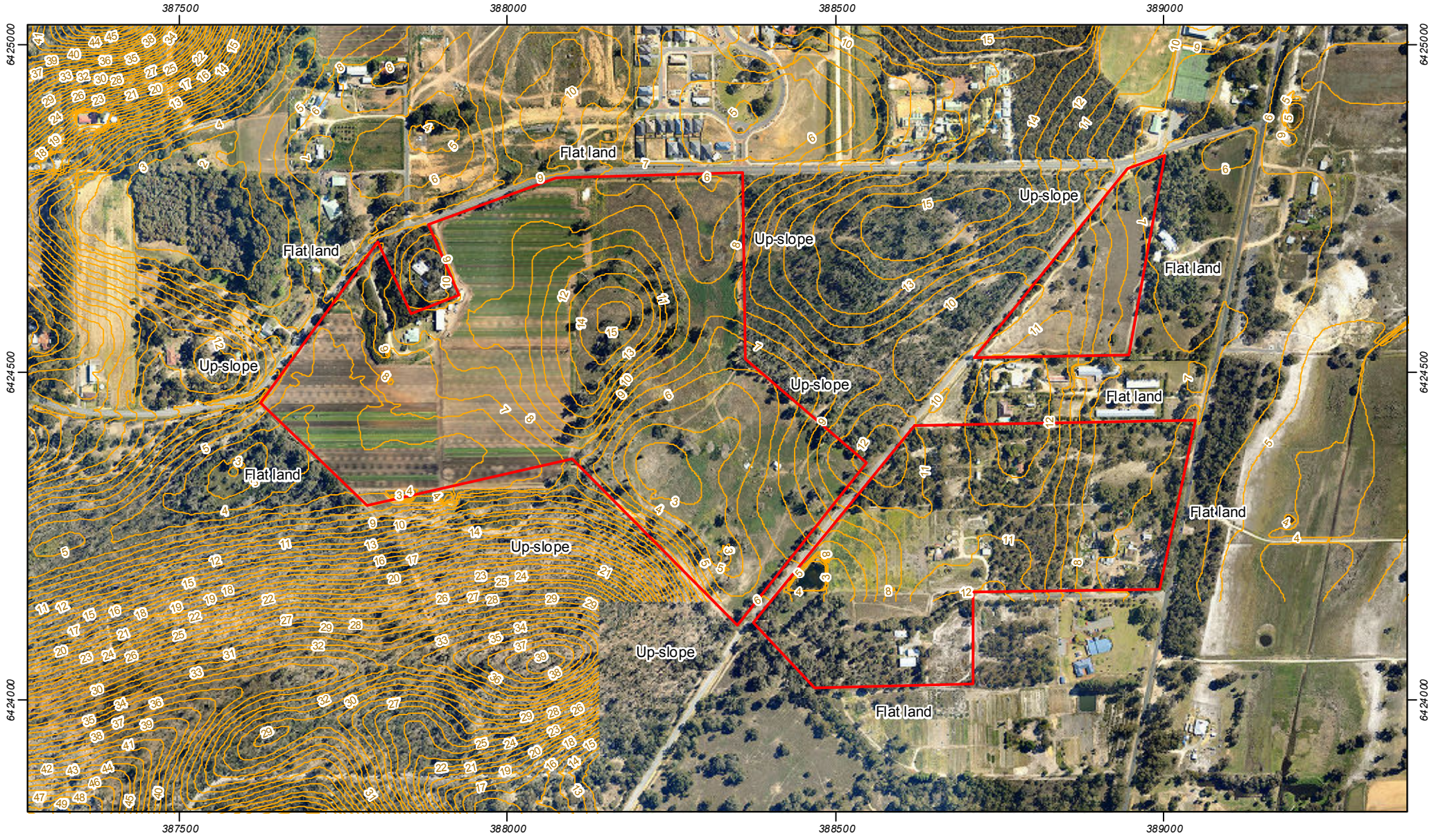

Figure 4 Site topography

Scale 1:8,000 at A4

0 50 100 150 200 250 m

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 18/12/2013

Author: JCrute
Source: Client 2013.

Legend

- Surface elevation (mAHD)
- Spires Estate LSP boundary

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3.4 Predominant soil types

The project area contains three natural soil types of the Spearwood and Tamala soil systems, as described in DPS (2013):

- Sand (S8): very light grey at the surface, yellow at depth, fine to medium grained, sub-rounded quartz, moderately well sorted, of eolian origin as relatively thin veneer over C2 (clay), M4 (silt) and Mc2
- Sand (S7): pale yellowish brown, medium to coarse grained, sub-angular to well-rounded quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin
- Limestone (LS1): pale yellowish brown, fine to coarse grained, sub-angular to well-rounded quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin.

3.5 Vegetation and flora

3.5.1 On-site vegetation extent

Current land use across the project area has resulted in a highly modified environment compared to the pre-clearing vegetation extent. Rural-residential pursuits have resulted in large portions of the project area being completely cleared of native vegetation, with only small pockets of degraded or modified vegetation remaining in some areas. Consequently, the on-site vegetation extent currently consists of:

1. A cleared grassland/pasture understorey with scattered individual *Eucalyptus gomphocephala* (Tuart), *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri) trees. This parkland landscape is particularly evident in the western portion of the site adjacent to the market garden.
2. A degraded woodland of eucalypts and scattered banksias, with limited mid and understorey species. This vegetation is particularly evident in the eastern portion of the site.
3. A small area of open eucalypt forest containing more intact over, mid and understorey stratums confined to the southeast portion of the site.
4. A small area of dense closed scrub vegetation abutting the market garden in the western portion of the site.

The proposed development will result in a predominantly cleared, built environment. This will remove the majority of on-site vegetation and bush fire hazard. There will be minor retention of overstorey trees in selected POS areas, as stated in Section 3.6.1.

Numerous flora and vegetation surveys were undertaken across the project area in 2011 and these confirmed that no Threatened Ecological Communities, Declared Rare Flora or any other significant flora or vegetation values were encountered within the site (DPS 2013). On-site vegetation condition ranged from ‘Completely Degraded’ to ‘Good’ (DPS 2013).

3.5.2 Adjacent vegetation extent

The predominant vegetation extent situated on properties adjoining the project area is representative of the Cottesloe (Central and South) and Karrakatta (Central and South) vegetation complexes (Figure 5), which are outlined in DPS (2013) as follows:

- Cottesloe Complex (Central and South): a mosaic of woodland of Tuart and open forest of Tuart-Jarrah-Marri with closed heath on the limestone outcrops
- Karrakatta Complex (Central and South): predominantly an open forest of Tuart-Jarrah-Marri and woodland of Jarrah-*Banksia spp*.

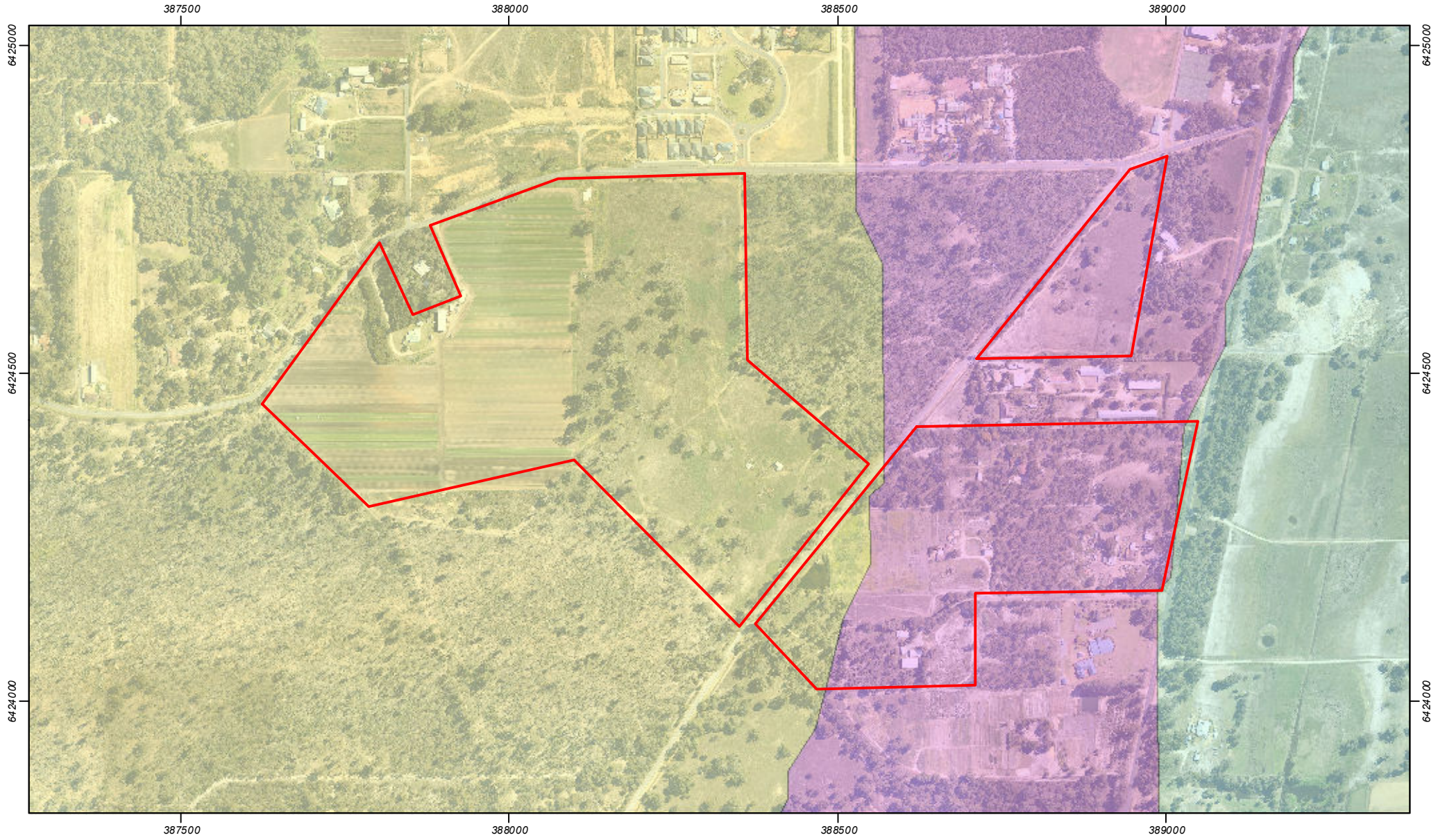

Figure 5 Vegetation complexes

Scale 1:8,000 at A4

0 50 100 150 200 250 m

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 28/08/2013

Author: JCrute
Source: Client 2013.

Legend

Spires Estate LSP boundary

Vegetation complex

Cottesloe complex - central and south

Karrakatta complex - central and south

Serpentine River complex

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3.6 Land use

Baldivis was historically a farming settlement, which has evolved over time into a semi-rural residential suburb of Perth. Land in the western portion of Baldivis was zoned for urban development in the 1990s under the MRS, and since has been progressively developed as residential land.

As is the case with many properties in the local vicinity, the project area is currently zoned 'Development' under the provisions of TPS No. 2 (DoP 2013). Predominant land uses currently comprise a market garden, rural residential lifestyle properties and vacant landholdings, as indicated in Table 2.

Eighty Road and future Nairn Road traverse the project area generally in a north-south direction, with Parmelia high pressure natural gas pipeline traversing Lot 313 in a northwest-southeast alignment in the western portion of the site.

3.6.1 Proposed land use

The proposed development, as depicted in Figure 1, will create large residential zones for medium and high density living, a commercial precinct and 10 POS areas (including a gas pipeline reserve). In addition, road, water, sewerage, power, gas and communications infrastructure will be provided throughout the project area to service the proposed development.

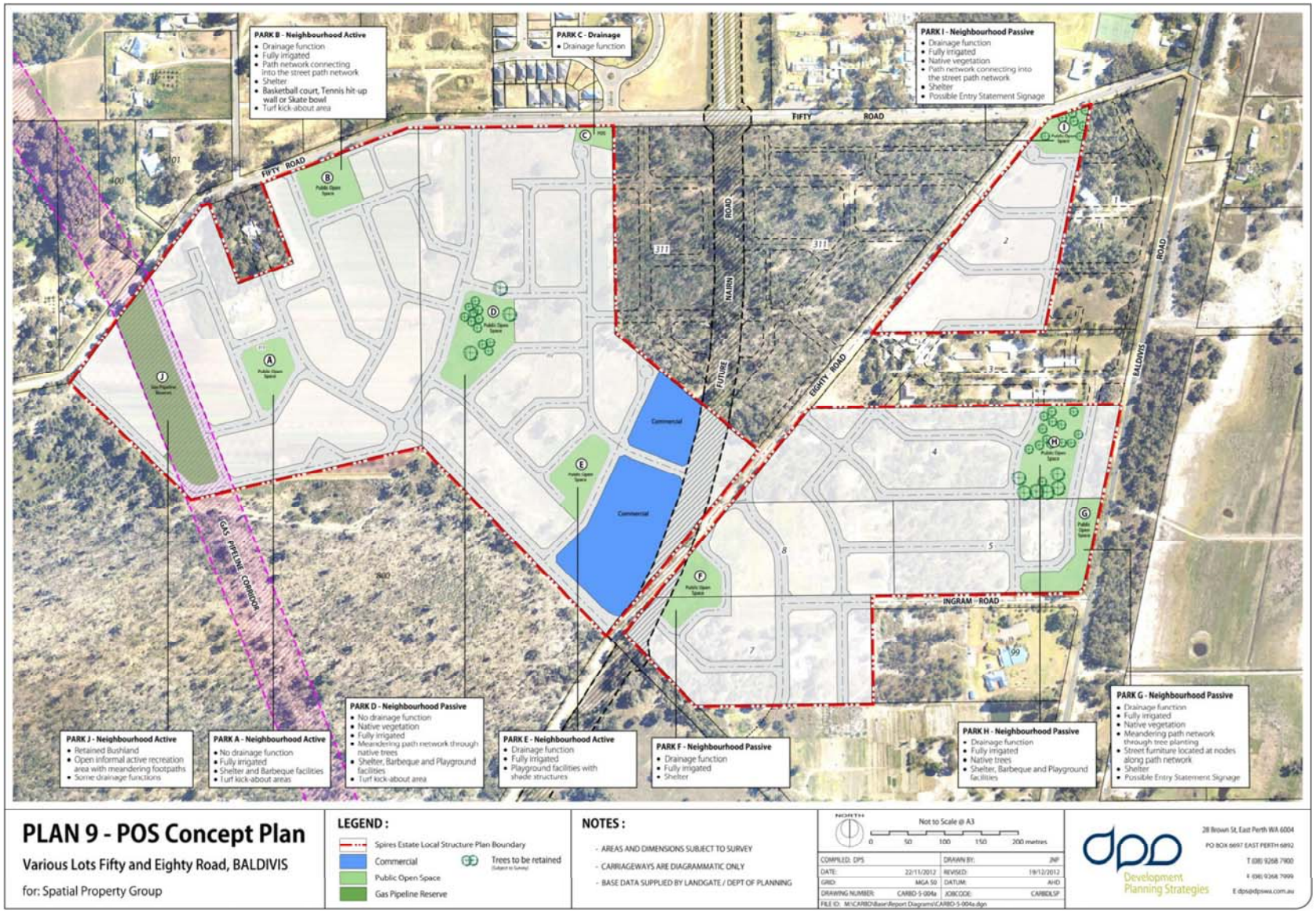
The POS concept is provided in Figure 6, which indicates that POS areas D, H and I will retain individual overstorey trees. All POS (including areas D, H and I) will have understoreys managed on an ongoing basis within 2 t/ha, so will not adversely contribute to the bush fire risk to life and property assets of the development.

3.6.2 Surrounding land use

Surrounding land uses comprise the following:

- market gardens and rural land to the northwest
- residential subdivision to the north (currently being developed)
- residential subdivision to the southeast (currently being developed)
- Baldivis Primary School and Baldivis Nature Reserve to the northeast
- private vegetated Lot 1 to the northeast, which contains a single dwelling and outbuilding
- private vegetated Lot 774 to the northwest, which contains a single dwelling and outbuilding
- private Lot 3 in the central-east, which is currently a poultry farm
- private vegetated Lot 311 in the central-north, which is undeveloped and fully vegetated
- Tramway Reserve to the far east, which is predominantly vegetated
- Rockingham Lakes Regional Park and Bush Forever Site 356 to the southwest, which is fully vegetated.

Much of the land surrounding the project area, in particular private lots 311, 1 and 774, is subject to future urban development in accordance with regional and local development planning directions under the MRS, TPS No. 2 and BNDSP.



Source: Development Planning Strategies 2013

3.7 Site assets

The project area does not currently contain an extensive range of on-site life, property or environmental assets. However, critical assets are still currently maintained throughout the project area through scattered dwellings/outbuildings and a small number of residents and visitors. Current life and property assets will be removed on development of the project area.

There project area contains limited on-site environmental assets due to the level of vegetation disturbance associated with current on-site land uses.

3.7.1 Proposed assets

Implementation of the Spires Estate LSP development will result in significant intensification of life and property assets. A dwelling yield projection outlined in DPS (2013) determined that approximately 950 dwellings should be achieved on implementation of the LSP, in addition to a commercial precinct and services. These will comprise the majority of future life and property assets within the project area, consisting of a combination of built assets, residents and visitors.

POS areas D, H and I will maintain environmental assets on implementation of the LSP through retention of individual overstorey trees. These POS areas will be managed to ensure the retained environmental assets do not adversely contribute to the bush fire risk.

3.8 Water supply

At present, there is no reticulated water supply to the site. This will be resolved through extension of the existing reticulated water supply from the development area to the southeast, which is currently under construction. In addition, the proposed water supply will be augmented through a link with the Tamworth Reservoir located immediately south of the site.

3.9 Power supply

Sufficient power supply exists in the vicinity of the project area in the form of a 22 KV aerial line, located along Baldivis Road, Fifty Road and Eighty Road. Existing aerial powerlines are proposed to be relocated underground on development of the project area.

3.10 Site access

Individual lots of the project area are currently accessed via driveways off Fifty Road, Eighty Road, Baldivis Road and Ingram Road.

A comprehensive internal public road network will be provided throughout the project area to service the proposed development, as outlined in Figure 1. The proposed road network provides numerous links to the surrounding public road network in Fifty Road, Eighty Road, future Nairn Road and Baldivis Road. The proposed road network also provides buffers to adjacent bushland areas and is sufficient for the provision of access for emergency fire service vehicles.

4. Fire problem

4.1 Bush fire history

The most recent bush fire in the vicinity of the project area occurred in 2012, which was a prescribed burn undertaken by CoR staff to reduce fuel loads within Baldivis Nature Reserve adjacent to Baldivis Primary School (Edwards H [CoR Chief Bush Fire Control Officer] 2013, pers. comm. 28 August).

Uncontrolled bush fires occur relatively frequently in the City of Rockingham during the bush fire season. The most recent of which (located near the project area) are outlined as follows (taken from BSC [2012]):

- 13 December 2010: a fire ignited at 1.12pm between Baldivis Road and Kwinana Freeway north of Safety Bay Road and burnt 20 ha of bushland. Fire crews saved four homes and several sheds. Part of the woodland vegetation in the Tramway Reserve was burnt.
- 12 April 2009: a fire ignited near Eighty and Fifty Road and DFES warned residents to close all doors and windows and turn off evaporative coolers. Fifty Road was closed between Baldivis Road and Safety Bay Road. This fire affected most of the project area and a total of 780 ha was burnt. The woodland vegetation to the west and southwest of the project area shows extensive evidence of this event.

In general, City of Rockingham is subject to a range of potential ignition sources, most notably suspected arson and accidental causes such as vehicle accidents, sparks from industrial work, pole-top fires, etc.

There are numerous emergency service resources in City of Rockingham that could provide a suppression response to the project area within 15 minutes, including local and career bush fire brigades at Baldivis, Rockingham, Secret Harbour and Singleton.

4.2 Bush fire hazards

A bush fire hazard assessment aims to classify the bush fire hazard at both the strategic and local level, which leads to an assessment of the Bushfire Attack Level (BAL). A preliminary bush fire hazard assessment was undertaken across the project area and adjacent land by Bushfire Safety Consulting (BSC 2012) in accordance with procedures outlined in PFBFP Guidelines (as outlined in Appendix 1). An additional, comprehensive bush fire hazard assessment, including assessment of the predominant vegetation types and available fuel loads, was undertaken by Strategen on 12 August 2013 across the full project area and adjoining properties. Results were compiled for both assessments, which are discussed in the following subsections.

4.2.1 On-site vegetation type, class and fuel hazards

On-site vegetation is restricted to isolated degraded remnants and individual scattered trees due to the level of vegetation clearance and disturbance associated with current on-site land uses. This has resulted in creation of large grassland and market garden areas, lesser areas of degraded eucalyptus woodland and small areas of open eucalypt forest and closed scrub.

Available fuel loads range from 0–2 t/ha (tonnes per hectare) in cleared grassland areas and market garden land; 2–5 t/ha in degraded eucalyptus woodland; and 5–8 t/ha in small areas of open eucalypt forest and closed scrub. The majority of these areas have been subject to various degrees of disturbance and fuel hazard reduction (e.g. clearing, rural use, prescribed burning and uncontrolled fire).

A summary of the on-site vegetation and fuel hazards is provided in Table 4, as well as a description of vegetation class and type in accordance with PFBFP Guidelines, supported by a series of photographs.

Table 4 On-site vegetation and fuel hazards

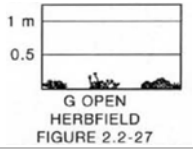
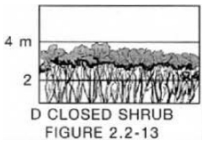
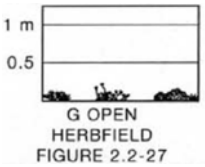
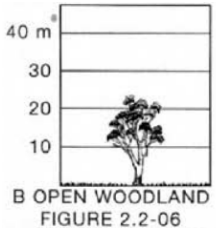
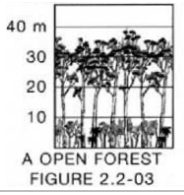
Lot number	Predominant vegetation and estimated available fuel load	Refer to plate number	Vegetation class	Vegetation type	Figure (as per PFBFP Guidelines)	Figure description
Lot 312	Grassland with scattered remnant Tuart trees (0–2 t/ha)	1	(G) Grassland	Open herbfield		All forms including situations with shrubs and trees if the overstorey foliage cover is less than 10%.
Lot 313	Market garden land (0–2 t/ha)	2	Not applicable for market garden land (unclassified vegetation type).			
	Small area of closed scrub (5–8 t/ha)	Not available	(D) Scrub	Closed scrub		Found in areas wet enough to support eucalypts trees; affected by poor soil fertility or shallow soils; greater than 30% foliage cover; dry heaths occur in rocky areas; shrubs 1–2 metres high; often coastal wetlands.
Lot 2	Grassland with scattered remnant Tuart trees (0–2 t/ha)	1	(G) Grassland	Open herbfield		All forms including situations with shrubs and trees if the overstorey foliage cover is less than 10%.
Lot 4	Eucalyptus woodland of Tuart, Jarrah and Marri with degraded mid and understoreys (2–5 t/ha)	3	(B) Woodland	Open woodland		Trees 10–30 m high; 10-30% foliage cover dominated by eucalypts; understorey low trees to tall shrubs typically dominated by Acacia, Callitris or Casuarina.
Lot 5	Eucalyptus woodland of Tuart, Jarrah and Marri with degraded mid and understoreys (2–5 t/ha)					
Lot 7	Eucalyptus woodland of Tuart, Jarrah and Marri with degraded mid and understoreys (2–5 t/ha)					
	Open eucalypt forest (5–8 t/ha)	4	(A) Forest	Open forest		Trees 10–30 m high; 30-70% foliage cover; (may include understorey of sclerophyllous low trees and tall scrubs or grass); typically dominated by eucalypts.
Lot 8	Market garden land (0–2 t/ha)	2	Not applicable for market garden land (unclassified vegetation type).			

Plate 1 Grassland adjacent to Fifty Road (0–2 t/ha)

Plate 2 Market garden land adjacent to Fifty Road (0–2 t/ha)

Plate 3 Eucalyptus woodland with degraded mid and understorey adjacent to Eighty Road (2–5 t/ha)

Plate 4 Open eucalypt forest adjacent to Eighty Road (5–8 t/ha)

4.2.2 Adjacent vegetation type, class and fuel hazards

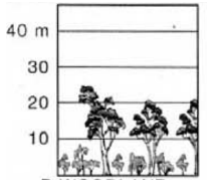
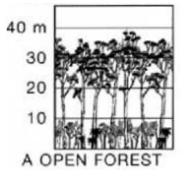
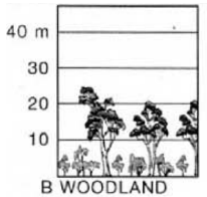
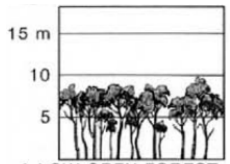
The vegetation extent situated adjacent to the project area consists of larger, more intact stands of woodland and forest vegetation. The adjacent vegetation extent has been allocated into two specific groups (refer to Section 3.1.1 for further information):

1. Vegetation considered to pose a permanent bush fire risk to the project area:
   (a) Rockingham Lakes Regional Park to the southwest (Bush Forever Site 356)
   (b) Baldivis Nature Reserve to the northeast
   (c) Tramway Reserve to the east
   (d) rural-zoned land to the northwest.
2. Vegetation considered to pose a temporary bush fire risk to the project area:
   (a) private vegetated Lot 311 in the central-north
   (b) private vegetated Lot 774 to the northwest
   (c) private vegetated Lot 1 to the northeast.

The abovementioned vegetated areas have been affected to varying degrees by three known bush fire events within the last five years, which have significantly reduced the available fuel loads.

A summary of the vegetation types and fuel hazards on land situated adjacent to the project area is provided in Table 5, as well as a description of vegetation class and type in accordance with PFBFP Guidelines, supported by a series of photographs.

Table 5 Adjacent vegetation and fuel hazards

Location of predominant vegetation	Predominant vegetation and estimated available fuel load	Refer to plate number	Vegetation class	Vegetation type	Figure (as per PFBFP Guidelines)	Figure description
Rockingham Lakes Regional Park (Bush Forever Site 356) to the southwest	Large area of eucalyptus woodland containing Tuart, Jarrah and Marri with intact midstorey of banksia and understorey shrubs and grasses (5–8 t/ha)	5 and 6	(B) Woodland	Woodland	 B WOODLAND FIGURE 2.2-05	Trees 10–30 m high; 10-30% foliage cover dominated by eucalypts; understorey low trees to tall shrubs typically dominated by Acacia, Callitris or Casuarina.
	Small area of open forest containing Tuart, Jarrah and Marri, with intact midstorey of banksia and understorey shrubs and grasses (5–8 t/ha)	Not available	(A) Forest	Open forest	 A OPEN FOREST FIGURE 2.2-03	Trees 10–30 m high; 30-70% foliage cover; (may include understorey of sclerophyllous low trees and tall scrubs or grass); typically dominated by eucalypts.
Vegetated private Lot 311 in the central-north	Large area of eucalyptus woodland containing Tuart, Jarrah and Marri with intact midstorey of banksia and understorey shrubs and grasses (5–8 t/ha)	7	(B) Woodland	Woodland	 B WOODLAND FIGURE 2.2-05	Trees 10–30 m high; 10-30% foliage cover dominated by eucalypts; understorey low trees to tall shrubs typically dominated by Acacia, Callitris or Casuarina.
Baldivis Nature Reserve to the north	Small area of low open eucalypt forest with a Jarrah-Marri overstorey, banksia midstorey and understorey of low shrubs (5 t/ha)	8	(A) Forest	Low open forest	 A LOW OPEN FOREST FIGURE 2.2-04	Trees 10–30 m high; 30-70% foliage cover; (may include understorey of sclerophyllous low trees and tall scrubs or grass); typically dominated by eucalypts.
Tramway Reserve to the east	Narrow strip of vegetation containing a combination of eucalyptus woodland and open forest vegetation (5–8 t/ha)	Not available	(B) Woodland and (A) Forest	Woodland and Open forest	As above	As above.

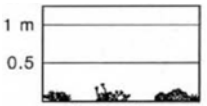
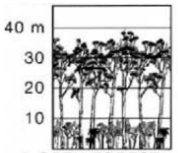
Location of predominant vegetation	Predominant vegetation and estimated available fuel load	Refer to plate number	Vegetation class	Vegetation type	Figure (as per PFBFP Guidelines)	Figure description
Rural land to the northwest and far east	Grassland with scattered remnant Tuart trees (0–2 t/ha)	Not available	(G) Grassland	Open herbfield	 G OPEN HERBFIELD FIGURE 2.2-27	All forms including situations with shrubs and trees if the overstorey foliage cover is less than 10%.
Vegetated private Lot 774 to the northwest	Small area of open forest containing Tuart, Jarrah and Marri, with intact midstorey of banksia and understorey shrubs and grasses (5–8 t/ha)	Not available	(A) Forest	Open forest	 A OPEN FOREST FIGURE 2.2-03	Trees 10–30 m high; 30-70% foliage cover; (may include understorey of sclerophyllous low trees and tall scrubs or grass); typically dominated by eucalypts.
Vegetated private Lot 1 to the northeast	Small area of vegetation containing a combination of eucalyptus open forest (5–8 t/ha) and grassland vegetation (0–2 t/ha)	Not available	(A) Forest and (G) Grassland	Open forest and Open herbfield	As above	As above.
Remaining cleared, undeveloped land to the north and southeast	Disturbed environment with weeds and sandy areas only (0–2 t/ha)	Not available	Not applicable for cleared land currently under development (unclassified vegetation type).			

Plate 5 Rockingham Lakes Regional Park (Bush Forever Site 356) to the southwest (5–8 t/ha)

Plate 6 Rockingham Lakes Regional Park (Bush Forever Site 356) to the southwest (5–8 t/ha)

Plate 7 Private vegetated Lot 311 in the central-north (5–8 t/ha)

Plate 8 Baldivis Nature Reserve to the northeast (5 t/ha)

4.2.3 Location of bush fire hazards

The location of existing bush fire hazard areas is outlined in the vegetation class map (Figure 7), as prepared by BSC (2012). This map has been created using the abovementioned vegetation class and type descriptions.

4.2.4 Bush fire hazard levels

Bush fire hazard levels of the predominant vegetation are displayed in the bush fire hazard assessment map (Figure 8), as prepared by BSC (2012). Classifying the bush fire hazard by assessing the predominant vegetation is a key to the initial determination of site suitability for development. This also leads to determination of the potential level of construction standard by the application of AS 3959–2009 *Construction of buildings in bushfire prone areas* (SA 2009) for any proposed development.

The project area and adjacent properties contain bush fire hazard levels ranging from 'Low' to 'Extreme':

- 'Low' bush fire hazards levels occur within market garden land, managed grasslands and areas currently subject to development
- 'Moderate' bush fire hazard levels occur in all areas of unmanaged grasslands, as well as managed or disturbed areas of open woodlands
- 'Extreme' bush fire hazard levels occur in all areas classified as woodland or forest.

According to PFBFP Guidelines, land with an assessed 'Moderate' to 'Extreme' bush fire hazard level is classified as bush fire prone land, which triggers implementation of AS 3959–2009 for any proposed development within 100 m.

Once developed, the project area will maintain a 'Low' bush fire hazard level. Therefore, the bush fire hazards on adjacent land will pose the predominant bush fire risk to the project area.

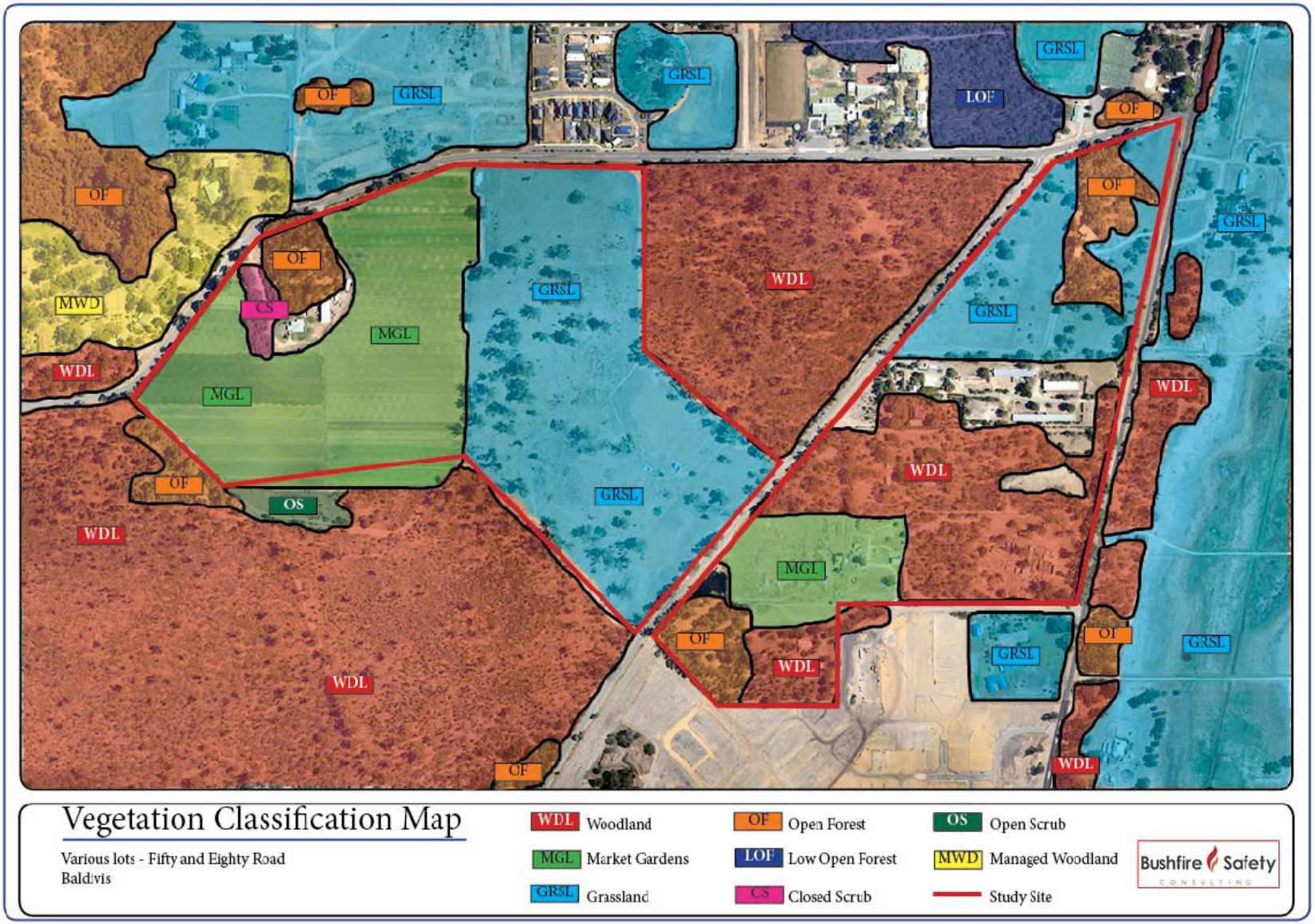
Permanent bush fire hazards are situated within the following areas:

- Rockingham Lakes Regional Park to the southwest ('Extreme')
- Baldivis Nature Reserve to the northeast ('Extreme')
- Tramway Reserve to the east (combination of 'Moderate' and 'Extreme')
- rural-zoned land to the northwest (combination of 'Moderate' and 'Extreme').

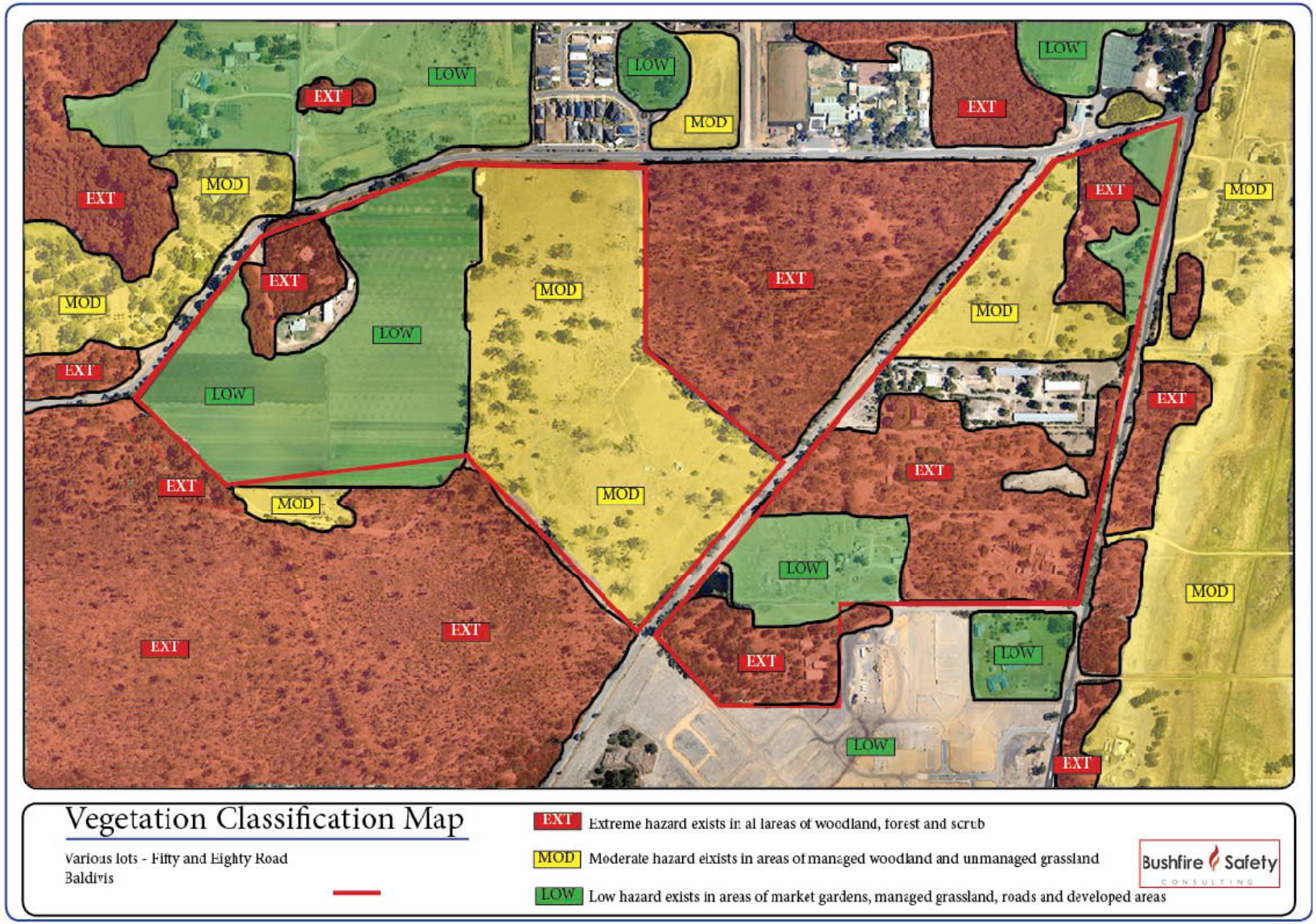
Temporary bush fire hazards are situated within the following areas:

- private vegetated Lot 311 in the central-north ('Extreme')
- private vegetated Lot 774 to the northwest ('Extreme')
- private vegetated Lot 1 to the northeast (combination of 'Low' and 'Extreme').

The abovementioned permanent and temporary areas of adjacent 'Moderate' and 'Extreme' bush fire hazard will need to be managed through ongoing planning and design of the Spires Estate LSP.



Source: Bushfire Safety Consulting 2012



Source: Bushfire Safety Consulting 2012

STRATEGEN	Fire Management Plan: Spires Estate Local Structure Plan Bush fire hazard assessment map	Figure 8

4.2.5 Bush fire hazard performance criteria

The relationship between various bush fire hazard levels and development performance criteria is set out in Table 6. The project area contains, and is situated adjacent to, areas with an 'Extreme' bush fire hazard level. In general, new developments are not permitted in areas with an 'Extreme' bush fire hazard level (WAPC et al. 2010). Therefore, a comprehensive suite of bush fire risk mitigation measures will need to be implemented to reduce and maintain the bush fire hazard to a 'Moderate' level or lower. This is expected to be achieved through implementation of numerous bush fire risk mitigation measures to compliment the extent of on-site vegetation clearance.

Compliance with performance criteria for a 'Moderate' bush fire hazard level will be achieved, focussing on the key areas of development location, vehicular access, water supply, siting of development and design of development. Performance criteria will be achieved through adoption of recommended acceptable solutions outlined in PFBFP Guidelines.

Table 6 Bush fire hazard levels and performance criteria

Bush fire hazard level	Bush fire protection performance criteria required
Low hazard	Development does not require special bush fire planning controls. Despite this, DFES strongly recommends that ember protection features be incorporated in design where practicable.
Moderate hazard	Performance criteria for: • location (Element 1) • vehicular access (Element 2) • water (Element 3) • siting of development (Element 4) • design of development (Element 5).
Extreme hazard	Development is to be avoided in areas with these hazard levels.

Source: WAPC et al. 2010

Compliance of the Spires Estate LSP development with bush fire protection performance criteria and associated acceptable solutions is documented in the compliance checklist (Appendix 2).

4.2.6 Classifying the Bushfire Attack Level (BAL)

This procedure, as outlined in PFBFP Guidelines and AS 3959–2009, uses a combination of the state-adopted Fire Danger Index rating of FDI 80, vegetation type, slope under classified vegetation and the distance maintained between proposed development areas and the classified vegetation to specify the Bushfire Attack Level (BAL). Based on the specified BAL, construction requirements for proposed buildings can then be assigned.

Once developed, the project area will maintain a 'Low' bush fire hazard level, with the full extent of surrounding classified vegetation located either up-slope or on flat land from proposed development areas.

On the basis of the above, Strategen considers that the predominant bush fire risk to the project area will be from adjacent 'Moderate' and 'Extreme' bush fire hazard areas. Some of these hazards are considered permanent (i.e. not currently subject to future urban development) and some are considered temporary (i.e. subject to future urban development), as outlined in Section 4.2.4.

Application of AS 3959–2009 to address permanent bush fire risk

All proposed lots situated within the 100 m Hazard Separation Zone (HSZ) to permanent 'Moderate' or 'Extreme' bush fire hazard areas (as depicted in Figure 9a) will require implementation of AS 3959–2009 and application of increased building construction standards and associated Building Protection Zones (BPZs), in accordance with the BALs and minimum separation distances highlighted in Table 7. The specified BALs and accompanying BPZs are illustrated in Figure 9a, which have been defined on the basis of the following parameters:

- FDI 80
- a combination of woodland and forest vegetation types
- no classified vegetation under slope located down-slope from proposed lots (i.e. the location of proposed lots is on flat land or down-slope from the adjacent vegetation)
- achievable separation distances provided by existing/proposed road reserves, footpaths, building setbacks, cleared areas and developed areas.

Table 7 Determination of Bushfire Attack Levels to address permanent bush fire hazards

Vegetation class	Bush fire attack level (BAL)				
	BAL FZ	BAL 40	BAL 29	BAL 19	BAL 12.5
	Distance (m) of the site from the predominant vegetation class				
	Vegetation is up-slope and flat land (0 degrees)				
(A) Forest	<16 (not appropriate)	16–<21 (not appropriate)	21–<31	31–<42	42–<100
(B) Woodland	<10 (not appropriate)	10–<14 (not appropriate)	14–<20	20–<29	29–<100

Application of AS 3959–2009 to address temporary bush fire risk

A 100 m wide HSZ and associated BALs and BPZs to adjacent temporary bush fire hazards is depicted in Figure 9b. This level of mitigation will be implemented should development within the 100 m wide buffer precede development of the adjoining vegetated private property (i.e. in Lot 311, Lot 774 and Lot 1). In this case, those areas within the 100 m wide buffer currently subject to BAL FZ and BAL 40 will remain undeveloped until such time as adjacent vegetation is cleared, consistent with the provisions of AS 3959–2009.

It should be noted that Figure 9b depicts preliminary BAL ratings for lots within the 100 m wide buffer of adjacent temporary bush fire risk. The preliminary BAL ratings may be updated by provision of more detailed BAL assessments.

In the event that the temporary bush fire risk is removed prior to development of the land within the 100 m wide buffer, then the above land use/development response will be redundant.

Measures will be incorporated to manage the temporary bush fire risk from on-site vegetation during internal staging, such as maintenance of a 100 m wide low fuel HSZ between stages undergoing development and future undeveloped stages that have a 'Moderate' to 'Extreme' bush fire hazard level (this is discussed further in Section 5.4.4).

4.2.7 Construction standards

A brief description of BAL 12.5, BAL 19 and BAL 29, associated heat flux exposure thresholds, predicted bush fire attack, levels of exposure and the relevant sections of AS 3959–2009 is provided in Table 8. Specific construction standards for BAL 12.5, BAL 19 and BAL 29 are fully explained in Appendix 4.

Table 8 Construction standards

Bush fire attack level (BAL)	Classified vegetation within 100m of the site and heat flux exposure thresholds	Description of predicted bush fire attack and levels of exposure	Section as per AS 3959–2009
BAL 12.5	≤12.5 kW/m^2	Ember attack	3 and 5
BAL 19	>12.5 kW/m^2 ≤19 kW/m^2	Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing heat flux.	3 and 6
BAL 29	>19 kW/m^2 ≤29 kW/m^2	Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing heat flux.	3 and 7

Source: SA 2009

4.3 Inherent bush fire risk

An inherent bush fire risk assessment has been undertaken for the project area, which quantifies the level of risk of loss or damage to current assets within the project area from uncontrolled bush fire, prior to the implementation of the Spires Estate LSP development and associated bush fire risk mitigation measures.

The risk assessment is derived from *Rural Urban Bush Fire Threat Analysis* (Smith 2003) and Australian Standard/New Zealand Standard *AS/NZS ISO 31000:2009 Risk management – Principles and guidelines* (SA & SNZ 2009). Risks are evaluated through determining likelihood of ignition and consequence of bush fire occurrence, as well as a scoring system based on the parameters outlined in Table 9.

Results of the risk assessment are outlined in Table 9. The assessment revealed that the inherent risk of loss or damage to current site assets from uncontrolled bush fire is high on the basis of the following:

1. The project area contains or is in direct proximity to extreme bush fire hazard areas, derived mainly from the extent of eucalyptus woodland and forest located on adjoining properties.
2. The project area currently contains critical life and property assets.
3. The project area and surrounding vegetation has been subject to recent, frequent occurrences of uncontrolled bush fire.
4. The project area does not currently maintain a high level of bush fire management.

Table 9 Inherent bush fire risk assessment for the project area

Parameter	Risk to site assets
On-site fuel hazard rating (highest rating)	Extreme
Are assets located up-slope from vegetation?	No
Are assets located in the flame zone?	Yes
Resident/visitor presence (low, moderate, high)	Moderate
Values or assets (low, moderate, high)	High
Fire unit access risk (low, moderate, high)	Moderate
Fire suppression response time (minutes)	<15
Likelihood of ignition and bush fire occurrence (low, moderate, high)	High
Current level of bush fire management (low, moderate, high)	Low
Overall inherent ris	**High**

4.4 Summary of key bush fire issues

The following is a summary of key bush fire issues that should be considered as part of ongoing planning and design of the Spires Estate LSP and development of specified bush fire risk mitigation measures:

- the locality has had recent, frequent occurrences of uncontrolled bush fire
- the average response time in the event that the project area is threatened by bush fire is 15 minutes from local volunteer and career bush fire brigades
- the project area and surrounding land contains a range of vegetation types and available fuel loads, including grassland, woodland and forest fuels, the majority of which have been subject to various degrees of disturbance and fuel hazard reduction (e.g. clearing, rural use, prescribed burning and uncontrolled fire)
- a bush fire hazard assessment determined the project area and adjacent land to contain bush fire hazard levels of 'Low', 'Moderate' and 'Extreme'
- once developed, the project area will maintain a 'Low' bush fire hazard level; therefore, the bush fire hazards within adjoining properties will pose the predominant bush fire risk to the project area
- permanent bush fire hazards are situated within the following areas:
    - Rockingham Lakes Regional Park to the southwest ('Extreme')
    - Baldivis Nature Reserve to the northeast ('Extreme')
    - Tramway Reserve to the east (combination of 'Moderate' and 'Extreme')
    - rural-zoned land to the northwest (combination of 'Moderate' and 'Extreme')
- temporary bush fire hazards are situated within the following areas:
    - private vegetated Lot 311 in the central-north ('Extreme')
    - private vegetated Lot 774 to the northwest ('Extreme')
    - private vegetated Lot 1 to the northeast (combination of 'Low' and 'Extreme')
- permanent bush fire risks will be addressed through implementation of a combination of the following within a designated 100 m wide HSZ (refer to Figure 9a):
    - BAL 29 (with a minimum 21 m wide BPZ comprising a 14 m wide road reserve and 7 m building setback), BAL 19 and BAL 12.5 adjacent to forest
    - BAL 29 (with a minimum 14 m wide BPZ contained wholly within the adjacent road reserve), BAL 19 and BAL 12.5 adjacent to woodland
    - BAL 19 (with a minimum 20 m wide BPZ contained wholly within the adjacent road reserve) and BAL 12.5 adjacent to woodland
- temporary bush fire risk will be addressed through provision of a temporary 100 m wide HSZ, with BALs and BPZs (refer to Figure 9b) to be implemented should development within the 100 m wide HSZ precede development of the adjoining vegetated private property (i.e. in Lot 311, Lot 774 and Lot 1)
- those areas within the temporary 100 m wide buffer currently subject to BAL FZ and BAL 40 will remain undeveloped until such time as adjacent vegetation is cleared, consistent with the provisions of AS 3959–2009
- in the event that the temporary bush fire risk is removed prior to development of the land within the 100 m wide buffer, then the above land use/development response will be redundant
- measures will be incorporated to manage the temporary bush fire risk from on-site vegetation during internal staging, such as maintenance of a 100 m wide low fuel HSZ between stages undergoing development and future undeveloped stages that have a 'Moderate' to 'Extreme' bush fire hazard level
- performance criteria and acceptable solutions will be achieved for a moderate bush fire hazard level, focussing on the key areas of development location, vehicular access, water supply, siting of development and design of development
- the pre-development, inherent bush fire risk to the project area is high.

5. Bush fire risk mitigation

The following subsections outline how the proposed Spires Estate LSP development will mitigate the inherent bush fire risk to life, property and the environment and achieve a suitable and effective bush fire management outcome for the site. This will be achieved by meeting performance criteria and associated acceptable solutions in accordance with PFBFP Guidelines. Where applicable, these measures are illustrated on an aerial image of the project area to assist with implementation of the FMP, as depicted in Figure 9a (to address the permanent bush fire risk) and Figure 9b (to address the temporary bush fire risk).

5.1 Development location

Strategic location, layout and management of future development at the planning stage can reduce future fire threat and risk to critical life and property assets.

5.1.1 Proposed lots

Once developed, the project area will consist of a significant built footprint, with only minor retention of individual overstorey trees proposed throughout selected POS areas subject to annual management. This will result in creation of a 'Low' bush fire hazard area, which will incorporate all proposed lots.

5.1.2 Public Open Space

POS areas D, H and I will retain some individual overstorey trees. However, all POS areas will have managed understoreys, so will not adversely contribute to the bush fire risk to life and property assets of the development. Annual management of POS understoreys will achieve creation of a 'Low' bush fire hazard level across all POS areas, with available fuel loads maintained annually within 2 t/ha through mechanical slashing (i.e. mowing) of understorey grasses, trash and litter fuels prior to the onset of the designated bush fire season.

The above measures will ensure the development is not located on land subject to either an extreme bush fire hazard level or construction standards applicable to BAL 40 or BAL FZ. This meets performance criteria for development location (Element 1) by adopting acceptable solution A1.1.

5.2 Vehicular access

The Spires Estate LSP development will result in provision of a comprehensive internal road network. The proposed road network will provide up to 11 links to the surrounding public road network in Fifty Road, Eighty Road, future Nairn Road and Baldivis Road (Figure 9a). This measure adopts acceptable solution A2.1 by ensuring all residents and visitors of the development are provided with at least two vehicular access routes connecting to the surrounding public road network at all times.

All public roads, cul-de-sacs (including a small number of short, dead-end roads) and private driveways will be constructed to specifications in accordance with Main Roads WA and DFES requirements to align with acceptable solutions A2.2, A2.3 and A2.5.

Other acceptable solutions for vehicular access including emergency access ways, fire service access routes, gates, firebreaks and signage are not considered necessary as part of the development, due to the adequate level of vehicular access proposed and the lack of on-site bush fire hazards to warrant higher level access requirements. The external road network, which follows the LSP boundary, is sufficient to provide access for emergency fire service vehicles in the event that uncontrolled bush fire threatens the project area from adjoining bushland areas.

The above measures will ensure the development meets performance criteria for vehicular access (Element 2).

5.3 Water supply

A reticulated water supply will be provided for the proposed LSP development through extension of the existing reticulated water supply from the development area to the southeast, which is currently under construction. In addition, the proposed water supply will be augmented through a link with the Tamworth Reservoir located immediately south of the site.

A network of hydrants will also be provided along the internal road network at locations which meet relevant water supply authority and DFES requirements.

The above measures will ensure the development meets performance criteria for water supply (Element 3) by adopting acceptable solution A3.1.

5.4 Siting of development

When considering the overall bush fire management of the project area, protection should be provided to critical life and property assets (i.e. residents, visitors and built assets) as a minimum requirement. Low fuel buffers between fire hazard areas and critical assets, as well as application of AS 3959–2009 can be implemented to achieve this.

5.4.1 Hazard separation zones

The project area adjoins numerous properties designated as 'Moderate' or 'Extreme' bush fire hazard. These areas have been allocated as follows (refer to Section 3.1.1 for further information):

1. Permanent bush fire hazards are situated within:
   (a) Rockingham Lakes Regional Park to the southwest ('Extreme')
   (b) Baldivis Nature Reserve to the northeast ('Extreme')
   (c) Tramway Reserve to the east (combination of 'Moderate' and 'Extreme')
   (d) rural-zoned land to the northwest (combination of 'Moderate' and 'Extreme').
2. Temporary bush fire hazards are situated within:
   (a) private vegetated Lot 311 in the central-north ('Extreme')
   (b) private vegetated Lot 774 to the northwest ('Extreme')
   (c) private vegetated Lot 1 to the northeast (combination of 'Low' and 'Extreme').

100 m wide HSZs have been depicted around both permanent and temporary bush fire hazard areas rated as 'Moderate' or 'Extreme' to inform implementation of AS 3959–2009 and application of increased building construction standards and associated BPZs (see Figure 9a and Figure 9b respectively).

5.4.2 Application of AS 3959–2009 to address the permanent bush fire risk

All proposed lots situated within the permanent 100 m wide HSZ will be subject to Detailed Area Plan (DAP) requirements and require implementation of AS 3959–2009 and application of building construction standards applicable to either BAL 29, BAL 19 and BAL 12.5 (refer to Figure 9a for specified BAL ratings).

BAL 29 lots adjacent to forest vegetation, located along the southern boundary and west of POS area J, will be subject to a minimum BPZ of 21 m, which will impose building setbacks of 7 m on these lots since the proposed 14 m wide road reserve (which abuts POS area J) is not wide enough to accommodate the full 21 m wide BPZ.

BAL 29 lots adjacent to woodland vegetation will be subject to a minimum BPZ of 14 m, which is not expected to impose building setbacks since the full 14 m can be accommodated within the adjoining road reserve to the south.

BAL 19 lots adjacent to woodland vegetation will be subject to a minimum BPZ of 20 m, which is not expected to impose building setbacks since the full 20 m can be accommodated within the adjoining road reserves in Baldivis Road, Fifty Road and Eighty Road.

BAL 12.5 lots will not require individual BPZs since these lots are 'set back' further into the built footprint and have adequate hazard separation in accordance with AS 3959–2009 (refer to Table 7). The developer will provide an overlay of all BPZs on the subdivision layout to accompany subdivision. The BPZs will be maintained within 2 t/ha on an ongoing basis, consisting of existing/proposed road reserves, footpaths, building setbacks (where required), cleared areas and developed areas. Irrigated lawns, landscaped gardens and road-side verges can also be included within the BPZ, provided they are maintained annually within 2 t/ha.

5.4.3 Application of AS 3959–2009 to address temporary bush fire risk

All proposed lots within the temporary 100 m wide HSZ will potentially be subject to BAL and BPZ requirements, as depicted in Figure 9b. This level of mitigation will be implemented should development within the 100 m wide buffer precede development of the adjoining vegetated private property (i.e. in Lot 311, Lot 774 and Lot 1). In this case, land within the temporary 100 m HSZ currently subject to BAL FZ and BAL 40 (i.e. land directly adjoining the vegetated private property) will remain undeveloped as BPZs (either a 14 m wide BPZ if adjacent to woodland or a 21 m wide BPZ if adjacent to forest) until such time as the adjacent bush fire risk is removed, consistent with the provisions of AS 3959–2009. The developer will provide an overlay of all BPZs on the subdivision layout to accompany subdivision.

Figure 9b depicts preliminary BAL ratings for lots within the 100 m wide buffer of adjacent temporary bush fire risk. Should development of this land precede removal of the adjacent temporary bush fire risk, the preliminary BAL ratings may be updated by provision of more detailed BAL assessments.

In the event that the temporary bush fire risk is removed prior to development of the land within the 100 m wide buffer, then the above land use/development response will be redundant.

All lots within the 100 m HSZ will be subject to DAP requirements.

5.4.4 Development staging

Measures will be incorporated to manage the temporary bush fire risk from on-site vegetation during internal staging, such as maintenance of a 100 m wide low fuel Hazard Separation Zone (HSZ) between stages undergoing development and future undeveloped stages that have a 'Moderate' to 'Extreme' bush fire hazard level.

The range of measures outlined in Section 5.4 will ensure the development meets performance criteria for siting of development (Element 4) by adopting acceptable solution A4.1, A4.2, A4.3, A4.4 and A4.5. Strategen considers that these measures adequately address the permanent and temporary bush fire risk posed by on-site and adjoining vegetated land.

5.5 Design of development

Development design, as indicated in Figure 1, is expected to reduce the vulnerability of life and property from the affects of bush fire and greatly assist bush fire prevention and suppression operations. Given the proposed development is considered to comply with acceptable solutions A4.1, A4.2, A4.3, A4.4 and A4.5, there are no special design requirements.

5.6 Additional bush fire risk mitigation

The following measures will be considered in addition to those outlined previously to provide a more thorough level of bush fire protection to the project area:

1. Annual fuel inspections: inspections are undertaken by CoR staff and failure to comply with this FMP and the specified requirements of the current CoR fire control notice may result in the issuing of fines of up to $250 (refer to Appendix 5 for the current CoR fire control notice).
2. Landowner education and awareness: prospective landowners are required to be provided a copy of local government and DFES bush fire information booklets that are currently available. In addition, attendance by prospective landowners at annual DFES bush fire awareness briefings would be advantageous.

5.7 Summary of bush fire risk mitigation and works program

A summary of the bush fire risk mitigation measures described in Section 5 and a works program is provided in Table 10. These measures will be implemented to ensure ongoing protection of on-site assets is achieved. Additional optional techniques are also provided and can be adopted by residents to further mitigate their risk to life and property from uncontrolled bush fires. Responsibilities are also defined to assist with implementation of each management measure.

Table 10 Summary of bush fire risk mitigation measures and works program

Bush fire risk mitigation	Recommended works	Mandatory	Optional	Timing	Responsibility
Development location	Undertake clearing and development in accordance with the Spires Estate LSP to ensure the site maintains a 'Low' bush fire hazard level. Refer to FMP Section 5.1.1.	Yes	No	On implementation of Spires Estate LSP development	Developer
	Manage all POS understoreys within 2 t/ha via mechanical slashing of understorey grasses, trash and litter fuels. Refer to FMP Section 5.1.2.	Yes	No	Annually prior to the onset of the designated bush fire season	Developer during development, CoR thereafter
Vehicular access	Construct an internal public road network in accordance with the Spires Estate LSP, which provides up to 11 links to the surrounding public road network. Refer to FMP Section 5.2.	Yes	No	On implementation of Spires Estate LSP development	Developer
	Construct all public roads, cul-de-sacs (including a small number of short, dead-end roads) and private driveways in accordance with Main Roads WA and DFES requirements. Refer to FMP Section 5.2.	Yes	No	On implementation of Spires Estate LSP development	Developer
	Provide an external perimeter road network sufficient for access by emergency fire service vehicles. Refer to FMP Section 5.2.	Yes	No	On implementation of Spires Estate LSP development	Developer
Water supply	Provide a reticulated water supply through extension of the existing reticulated water supply from the development area to the southeast. Refer to FMP Section 5.3.	Yes	No	On implementation of Spires Estate LSP development	Developer
	Provide a network of hydrants along the internal road network at locations which meet relevant water supply authority and DFES requirements. Refer to FMP Section 5.3.	Yes	No	On implementation of Spires Estate LSP development	Developer
Siting of development	For those lots within the permanent 100 m wide HSZ, implement AS 3959–2009 and associated construction standards and BPZs in accordance with Figure 9a, based on the assessment outlined in Section 4.2.6 and summarised in Section 5.4.2.	Yes	No	On construction of individual buildings	Developer and prospective landowners
	Manage all BPZs within 2 t/ha on an ongoing basis, including irrigated lawns, landscaped gardens and road-side verges. Refer to FMP Section 5.4.2.	Yes	No	On implementation of Spires Estate LSP development	Developer during development, CoR and prospective landowners thereafter

Bush fire risk mitigation	Recommended works	Mandatory	Optional	Timing	Responsibility
	For those lots within the temporary 100 m wide HSZ, implement AS 3959–2009 and associated construction standards and BPZs in accordance with Figure 9b, should development within the temporary 100 m HSZ precede development of the adjoining vegetated private property (i.e. in Lot 311, Lot 774 and Lot 1). Refer to FMP Section 5.4.3.	Yes	No	On implementation of Spires Estate LSP development	Developer
	Should the temporary bush fire risk remain, then land within the 100 m wide buffer currently subject to BAL FZ and BAL 40 will remain undeveloped as BPZs until such time as the adjacent bush fire risk is removed, consistent with the provisions of AS 3959–2009. Refer to FMP Section 5.4.3.	Yes	No	On implementation of Spires Estate LSP development	Developer
	Maintain a 100 m wide low fuel HSZ between stages undergoing development and future undeveloped stages that have a 'Moderate' to 'Extreme' bush fire hazard level. Refer to FMP Section 0.	Yes	No	On implementation of Spires Estate LSP development	Developer
	Provide an overlay of all BPZs on the subdivision layout to accompany subdivision. Refer to FMP Sections 5.4.2 and 5.4.3.	Yes	No	On application of subdivision.	Developer
	Lots within the 100 m HSZ (permanent and temporary) are to be subject to DAP requirements. Refer to FMP Section 5.4.2.	Yes	No	Prior to subdivision of proposed lots	Developer
Design of development	Comply with all acceptable solutions A4.1, A4.2 and A4.3, A4.4 and A4.5. Refer to FMP Section 5.5.	Yes	No	On implementation of Spires Estate LSP development	Developer
Annual fuel inspections	Comply with the current CoR fire control notice. Refer to Appendix 5.	Yes	No	Annually prior to the onset of the designated bush fire season	Developer, CoR and prospective landowners
	Undertake an inspection of fuel hazards across individual lots to assess compliance with the FMP and annual fire control notice. Refer to FMP Section 5.6.	Yes	No	Annually prior to the onset of the designated bush fire season	CoR staff
	Issue work orders or fines where compliance with the *Bush Fires Act 1954*, the FMP or the annual fire control notice has been compromised. Refer to FMP Section 5.6.	Yes	No	Annually prior to the onset of the designated bush fire season	CoR staff
Landowner education and awareness	Distribution of bush fire information booklets. Refer to FMP Section 5.6.	Yes	No	Annually	CoR staff, DFES
	Attendance at annual DFES bush fire awareness briefings. Refer to FMP Section 5.6.	No	Yes	Annually	Prospective landowners
Optional building requirements	Restriction on the installation of evaporative air-conditioners, mesh screens and shutters. Installation of residential building sprinkler systems.	No	Yes	On construction of individual buildings	Prospective landowners
Restricted and prohibited burning times	Comply with the annual fire control notice and DFES/CoR-determined burning periods. Refer to Appendix 5.	Yes	No	As specified by DFES/CoR	CoR, prospective landowners

6. Implementation of the Fire Management Plan

6.1 Implementation of bush fire risk mitigation measures

The full range of bush fire risk mitigation measures and location of implementation as specified in this FMP is provided in Figure 9a (addressing the permanent bush fire risk) and Figure 9b (addressing the temporary bush fire risk), which are overlain on an aerial image of the project area to assist with implementation.

6.2 Residual bush fire risk

The residual bush fire risk is the level of risk remaining after the Spires Estate LSP development and associated bush fire risk mitigation measures have been implemented. A residual bush fire risk assessment for the project area is provided in Table 11.

The residual bush fire risk to life and property assets was assessed as 'Low', due to the increased level of bush fire management proposed across the site and the subsequent expected reduction in on-site fuel loads, access risk and likelihood of ignition and bush fire occurrence.

Table 11 Residual bush fire risk assessment for the project area

Parameter	Risk to site assets
On-site fuel hazard rating (highest rating)	Low
Are assets located up-slope from vegetation?	No
Are assets located in the flame zone?	No
Resident/visitor presence (low, moderate, high)	High
Values or assets (low, moderate, high)	High
Fire unit access risk (low, moderate, high)	Low
Fire suppression response time (minutes)	<15
Likelihood of ignition and bush fire occurrence (low, moderate, high)	Low
Level of bush fire management (low, moderate, high)	High
Overall residual ris	**Low**

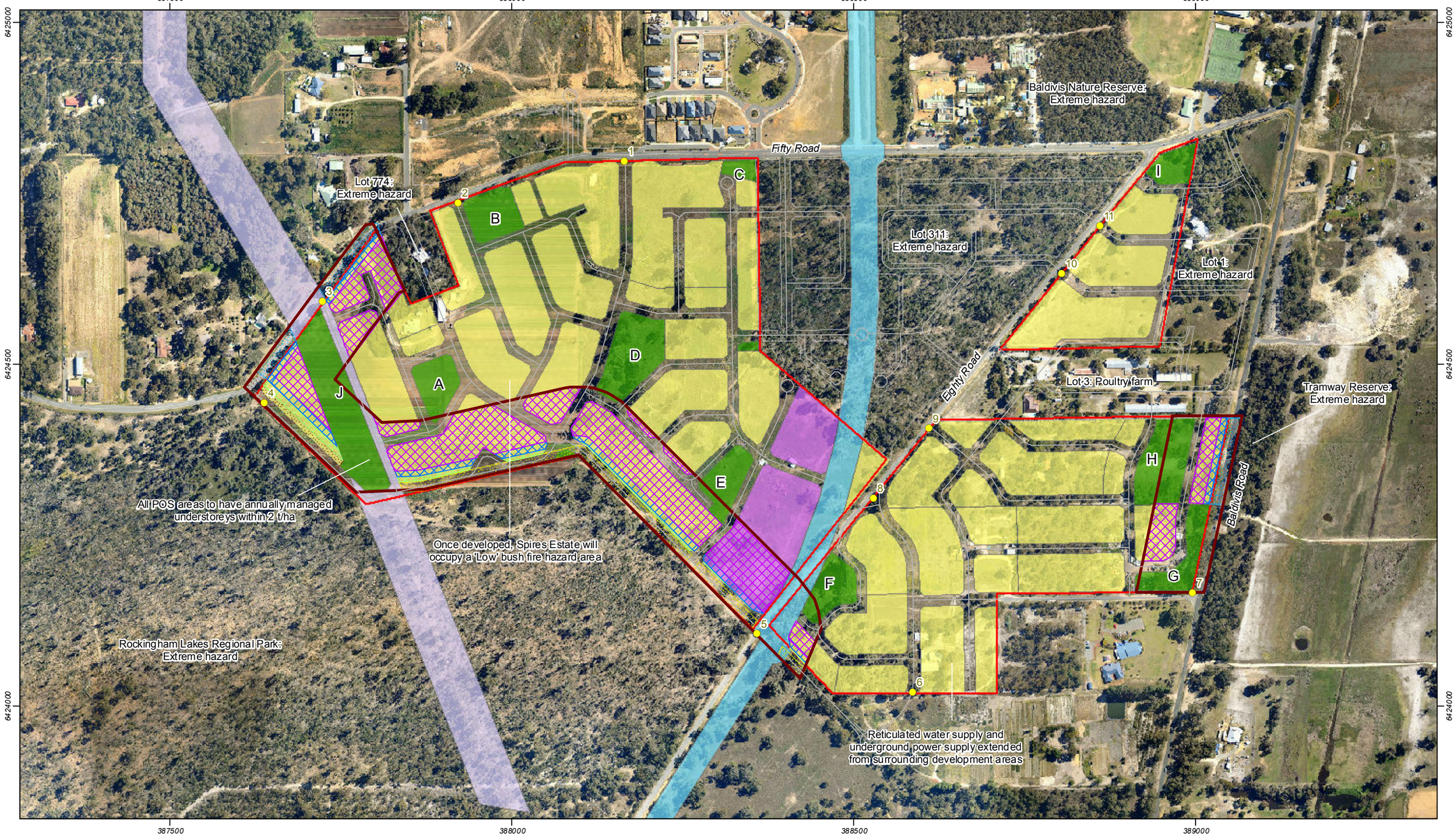


Figure 9a Fire Management Plan (to address permanent bush fire risk): Spires Estate Local Structure Plan

Scale 1:5,500 at A3

0 50 100 150 200 250 m

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 12/02/2014
Author: JCrute
Source: Client 2013.

Legend

- Public vehicular access routes
- Proposed local roads
- 100 m HSZ to address permanent bush fire risk
- BAL 12.5
- BAL 19
- BAL 29
- 14 m wide BPZ
- 20 m wide BPZ
- 21 m wide BPZ
- Spires Estate LSP boundary
- Existing adjoining landholdings
- Proposed commercial areas
- Proposed POS areas (A-J)
- Proposed residential lots
- Proposed gas pipeline corridor
- Proposed Nairn Road alignment

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Figure 9b Fire Management Plan (to address temporary bush fire risk): Spires Estate Local Structure Plan

Scale 1:5,500 at A3

0 50 100 150 200 250 m

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 12/02/2014
Author: JCrute
Source: Client 2013.

Legend

- Proposed local roads
- 100 m wide HSZ to address temporary bush fire risk
- BAL FZ and BAL 40 (undevelopable buffer)
- BAL 12.5
- BAL 19
- BAL 29
- Spires Estate LSP boundary
- Existing cadastral boundaries
- Existing adjoining landholdings
- Proposed commercial areas
- Proposed POS areas (A-J)
- Proposed residential lots
- Proposed gas pipeline corridor
- Proposed Nairn Road alignment

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6.3 Legislative requirements, specifications and standards

The legislative requirements, specifications and standards applicable to implementation of this FMP are referenced in Section 7 and Appendix 6 and pertain to the following:

- *Bush Fires Act 1954*
- *Planning and Development Act 2005*
- *Environment Protection and Biodiversity Conservation Act 1999*
- *Environmental Protection Act 1986*
- *Wildlife Conservation Act 1950*
- Building Code of Australia
- Planning for Bush Fire Protection Guidelines (Edition 2)
- Australian Standard AS 3959–2009 Construction of Buildings in Bushfire Prone Areas
- City of Rockingham annual fire prevention notice 2013–2014.

7. References

Bureau of Meteorology (BoM) 2012, *Climate statistics for Australian locations: Monthly climate statistics for Medina Research Centre*, [Online], Commonwealth of Australia, available from: *http://www.bom.gov.au/climate/averages/tables/cw_009194.shtml*, [13 November 2012].

Bushfire Safety Consulting (BSC) 2012, *Bushfire Hazard Assessment: Local Structure Plan Various Lots Fifty and Eighty Road, Baldivis*, report prepared for Spatial Property Group, June 2012.

Commonwealth Science and Industrial Research Organisation (CSIRO) 1999, *Fire Danger and Fire Spread Calculator*, Commonwealth Science and Industrial Research Organisation, Perth.

Department of Planning (DoP) 2013, *City of Rockingham Town Planning Scheme No. 2*, originally gazetted 19 November 2004, Department of Planning, Perth.

Development Planning Strategies (DPS) 2013, *Spires Estate Local Structure Plan*, report prepared for Spatial Property Group, July 2013.

McKenzie NL, May JE and McKenna S 2003, *Bioregional Summary of the 2002 Biodiversity Audit of Western Australia*, Department of Conservation and Land Management, Perth.

Smith R 2003, *Rural Urban Bush Fire Threat Analysis (RUBTA)*, Fire and Emergency Services Authority of Western Australia, Perth.

Standards Australia (SA) 2009, *Australian Standard AS 3959–2009 Construction of Buildings in Bushfire-Prone Areas*, Standards Australia, Sydney.

Standards Australia & Standards New Zealand (SA & SNZ) 2009, *Australian Standard/New Zealand Standard AS/NZS ISO 31000:2009 Risk management – Principles and guidelines*, Standards Australia/Standards New Zealand, Sydney/Wellington.

Western Australian Planning Commission, Department of Planning and Fire and Emergency Services Authority (WAPC et al.) 2010, *Planning for Bush Fire Protection Guidelines (Edition 2)*, Western Australian Planning Commission and Fire and Emergency Services Authority, Perth.

Appendix 1
Bushfire Hazard Assessment: Various Lots Fifty and Eighty Road, Baldivis (Bushfire Safety Consulting 2012)

Bushfire Safety
CONSULTING

Bushfire Hazard Assessment

Spatial Property Group

Local Structure Plan
Various Lots Fifty and Eighty Road,
Baldivis

City of Rockingham
June 2012

Local Structure Plan
Various Lots Fifty and Eighty Roads
Baldivis
CITY OF ROCKINGHAM

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Executive Summary

This Bushfire Hazard Assessment has been prepared following the survey of the site that is various Lots on Fifty and Eighty Road, Baldivis in the City of Rockingham.

The development site has been assessed for bushfire hazard levels. Bushfire attack level assessments have been undertaken to ensure the development will fall within the acceptable level of risk, i.e. dwellings exposed to BAL-29 and lower.

Currently, the site's bushfire hazard levels are rated as low, moderate and extreme but as the development progresses the hazard will be greatly reduced as the majority of the vegetation will be removed from within the site. Residual bushfire hazard will remain in some adjoining lots such as the Rockingham Lakes Regional Park.

Neighbouring sites to the north and east have been identified and zoned for future urban development, so bushfire hazards along these boundaries will be removed over time.

An assessment of the subdivision concept plan confirms that access and egress from all the proposed lots will adequately service residents and fire fighters within the development. The development design has several access options on to surrounding public roads.

Water will be adequate for residential needs and for a water supply during fire suppression operations.

This plan provides preliminary advice consistent with the fact that a Local Structure Plan is a guide only. Details in this report are consistent with the Planning for Bushfire Protection guidelines and will establish a framework for more detailed planning to occur at subdivision application stage.

This plan demonstrates the site is suitable for residential development. It outlines building siting criteria that establishes an acceptable solution is possible by installing a building protection zone to separate bushfire hazard from buildings. Predicted radiant heat flux exposure levels on buildings will be mitigated with implementation of bushfire construction standards consistent with AS3959-2009 Construction of buildings in bushfire-prone areas.

A Fire Management Plan is required at each future subdivision application stage.

1. Introduction

The site contains various lots on Fifty and Eighty Road, Baldivis in the City of Rockingham. It is bounded by Fifty Road in the west, and Baldivis Road in the east. It is a condition on the Local Structure Plan that a Bushfire Hazard Assessment (BHA) be prepared to examine the bushfire planning constraints on the proposed development. The BHA is to be prepared to the satisfaction of Local Government and the Fire and Emergency Services Authority (FESA).

The site is located 45 kms south of the Perth CBD and 10 kms east of Rockingham (Appendix A). The site currently contains some market gardens and rural residential lots. Most of the site is clear of remnant vegetation and areas remaining are mostly disturbed or modified. Surrounding lots contain substantial areas of woodland which is extreme bushfire hazard.

The site is held in multiple ownership by a number of different parties. It is zoned "Development" under the City of Rockingham's Town Planning Scheme No. 2.

This report provides broad advice consistent with the understanding that the Local Structure Plan is a guide. A detailed analysis of building siting is outlined to determine the correct setback distances that are required between bushfire hazard and dwellings. Vehicular access and water supply are discussed in broad terms. There are opportunities at subdivision application stage to revisit all bushfire hazard issues and provide specific mitigation strategies in greater detail in accordance with the key principles in this report.

1.1 The Proposal

The proposal includes the creation of large residential zones for medium and high density living, a commercial precinct and 11 Public Open Space (POS) areas.

At this early stage in planning a preliminary subdivision design is all that is available (Appendix B), it represents an indicative concept of what may occur once and if appropriate approvals are in place. The proposed development fits within a broader context of facilities, infrastructure and residential development in surrounding areas particularly north of Fifty Road (Appendix C).

1.2 Objectives

The purpose of this report is to:

- Assess the subject land and immediate surrounding area to determine the level of bushfire hazard.
- Assess the level of risk against the specific mitigation strategy siting of development.
- Assess the level of risk against broad mitigation strategies such as water supply and vehicular access consistent with the Planning for Bushfire Protection Guidelines (edition 2).
- Provide preliminary advice in relation to how bushfire hazards can be appropriately mitigated and managed as part of a local structure planning process.

This document demonstrates that the bushfire hazards are manageable in terms of intended land use change that includes residential development.

2. Statutory and Policy Framework

Relevant key legislation, policy and guidelines include the following:

2.1 Bush Fires Act

The Act sets out provision to diminish the dangers resulting from bushfires, prevent, control and extinguish bushfires and for other purposes. The Act addresses various matters including prohibited burning times, enabling Local Government to require land owners/occupiers to plough or clear firebreaks, to control and extinguish bushfires and establish and maintain Bush Fire Brigades.

The Act also applies to land throughout Western Australia that is managed by the Department of Environment and Conservation (DEC). Sections 39 and 45 provide authorised CALM Act officers with powers to suppress fires in and near forests and Crown Land. Other sections provide for authorised CALM Act officers to enforce the provisions of the Bush Fires Act. The Bush Fires Act does not affect the provisions of the CALM Act and the Bush Fires Act does not generally bind the DEC.

The provisions of the Bush Fires Act can be enforced in addition to this FMP.

2.2 State Planning Policy No. 3.4 Natural Hazards and Disasters

The objectives of this Policy are to:

- Include planning for natural disasters as a fundamental element when preparing all statutory and non-statutory planning documents, specifically town planning schemes and amendments, and local planning strategies, and
- Use these planning instruments to minimise the adverse effects of natural disasters on communities, the economy and the environment.

The Policy determines those areas that are most vulnerable to bushfire and where development is appropriate and not appropriate. The provisions and requirements contained in Planning for Bush Fire Protection Guidelines - Edition 2 (WAPC et al. 2010) were used in this determination.

2.3 Planning for Bush Fire Protection Guidelines (2010)

These Guidelines were prepared by FESA, the Western Australian Planning Commission (WAPC) and the Department of Planning. The document is the foundation for fire risk management planning on private land in Western Australia.

The document addresses important fire risk management and planning issues and sets out performance criteria and acceptable solutions to minimise the risk of bushfires in new subdivisions and developments. It addresses management issues including the location, design and siting of the development, vehicular access and water.

3. Bushfire Impacts

Reliable records began in 1900 and since then there have been 729 civilian fatalities from bushfires in Australia, of those 21 (or 3 per cent of the national total) have occurred in Western Australia. Bushfires have killed more people in Australia than any other natural disaster.

3.1 Building Survival

Buildings survive bushfires due to a number of factors; some relate to the way a bushfire behaves at a site, others relate to the design and construction materials in the building and siting of surrounding elements. Infrastructure, utilities and human behaviour are also factors. Leonard (2009) identified the following factors:

- Terrain (slope)
- Vegetation - overall fuel load, steady state litter load, bark fuels, etc.
- Weather (temperature, relative humidity and wind speed)
- Distance of building from unmanaged vegetation
- Individual elements surrounding the building that are either a shield or an additional fuel source
- Proximity to surrounding infrastructure
- Building design and maintenance
- Human behaviour - ability to be present and capacity to fight the fire
- Access to the building and how that influences human behaviour
- Water supply for active and/or passive defence, and
- Power supply.

It is likely that buildings are lost because of their vulnerability to the mechanisms of bushfire attack. Buildings constructed to Australian Standard (AS 3959) are more likely to survive a bushfire compared to buildings with no construction standards.

Buildings constructed to AS3959 standards do not guarantee their survival. Building survival depends on the way vegetation is managed, the unpredictable nature and behaviour of fire, and extreme weather conditions (Standards Australia 2009).

3.2 Human Fatalities

The final report from the Victorian Bushfires Royal Commission (VBRC) into the Black Saturday bushfires handed down on 31 July 2010 is the most comprehensive evidence ever assembled about the circumstances surrounding fatalities in an Australian bushfire.

Where people died on Black Saturday contrasts strikingly with studies from previous bushfire fatalities (VBRC 2010). Historically about 32 per cent of people have died in late evacuations (Risk Frontiers et al. 2008); however, on Black Saturday the majority of people (113 out of 173) died inside or close to structures. In a “Black Saturday” type of bushfire, safety can only be assured if people leave early, well before any fire arrives. When the Fire Danger rating is “Catastrophic” most buildings cannot be defended.

Most people die in bushfires from being exposed to radiant heat. Protection is provided by wearing long sleeved natural fibre clothing, having solid barriers and maintaining a long distance between people and the fire (i.e. source of radiant heat).

Bushfires also generate enormous amounts of smoke and wind, and when these factors are combined with the fire, they usually cause many trees to come down. If people evacuate late, then road conditions become extremely hazardous and emergency vehicles are also using the roads.

4. Description of the Area

Baldivis is a semi-rural residential suburb 45 kilometres south of the Perth CBD and 10 kms east of the centre of Rockingham. Development of the area dates from the 1920s, spurred by the Government's settlement scheme. Land was used mainly for farming. Significant development did not occur until the 1950s. Rapid growth took place from the mid 1990s, with the population more than trebling between 1996 and 2006, a result of new dwellings being added to the area. Growth has been mainly in the western section of Baldivis (http://www.rockingham.wa.gov.au/City-and-community/About-Rockingham/Profile-and-statistics.aspx).

Land parallel to the eastern side of Baldivis Road was set aside for a tramway between Jandakot in the north and Karnup to the south. Only part of the tramway was constructed but not in the Baldivis area. The Tramway Reserve is now retained for open space.

Land in the western portion of Baldivis was zoned for urban development in the 1990s, and the suburb has been progressively developed as residential land. Australian Bureau Statistics Census data from 2006 indicate that there were 5,952 people residing in Baldivis in 2128 dwellings. Of the 5,952 people, 877 (or 14 %) were aged over 55 years (see http://www.abs.gov.au/).

4.1 Description of the Subject Land

There are various lots that make up the site. Land use is currently a mixture of market gardens, pasture and lifestyle blocks.

This BHA focuses on the subject land and immediate surrounding area (Appendix B). In summary this land is:

- Used for a mixture of land uses including vegetable production and rural residential living.
- Generally undulating with slopes not exceeding 10 degrees
- Adjoining the Rockingham Regional Lakes Park that contains a woodland and small areas of open forest vegetation
- Intersected by Eighty Road with Fifty and Baldivis Roads as west and east perimeter roads respectively
- Adjacent to extreme bushfire hazard in the form of woodland vegetation in the Tramway Reserve, on Lot 311 and north of Fifty Road adjacent to the Baldivis Primary School.

4.2 Fire Climate

The behaviour of bushfires is significantly affected by weather conditions and they burn more aggressively when high temperatures combine with low humidity and strong winds.

In Perth and surrounding areas, the fire risk is greatest from summer through autumn, when the moisture content in vegetation is low. Summer and autumn days with high temperatures, low humidity and strong winds are particularly conducive to the spread of fire. This threat is enhanced if thunderstorms develop accompanied by lightning and little or no rain.

Research indicates that virtually all house losses occur during severe, extreme or catastrophic conditions (i.e when the Fire Danger Index is over 50) (Blanchi et al. 2010).

The Bureau of Meteorology website (www.bom.gov.au/weather/wa/sevwx/perth/bushfires.shtml) states that extreme fire weather conditions in the Perth region typically occur with strong easterlies or north easterly winds associated with a strong high to the south of the state and a trough offshore. Easterly winds represent about

60 per cent of extreme fire weather days (events) compared to less than 5 per cent associated with southerly winds. About 15 per cent of Perth events occurred in a westerly flow following the passage of a trough. Very dangerous fire weather conditions often follow a sequence of hot days and easterly winds that culminate when the trough deepens near the coast and moves inland. Winds can change from easterly to northerly and then to westerly during this sequence of climatic events.

Data from the Bureau of Meteorology research station at Medina (5 km north west of the study site) indicate the area experiences warm dry summers and cool wet winters (Figure 1), and is classified as a Mediterranean climate. Mean maximum temperatures vary from 31 degrees Celsius in February to 18 degrees Celsius in July.

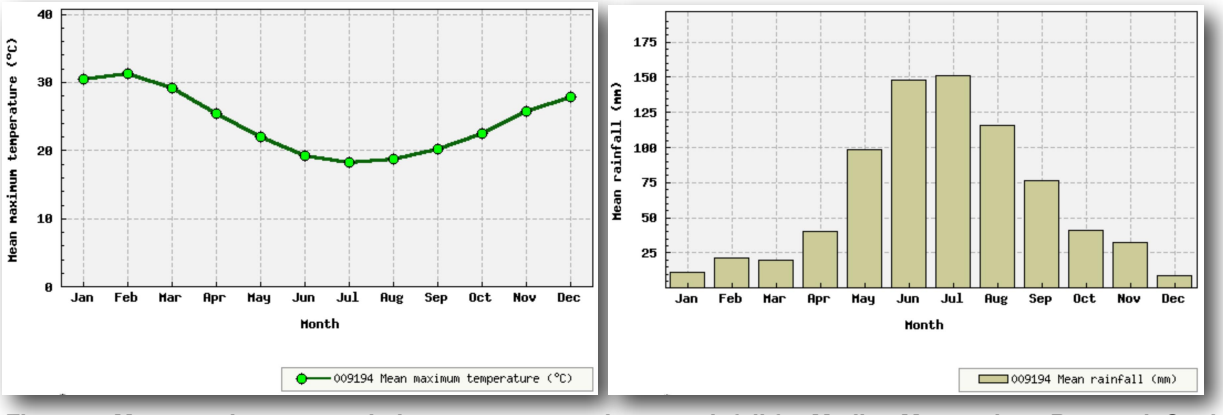


Figure 1: Mean maximum recorded temperatures and mean rainfall for Medina Meteorology Research Station between 1983 and 2010

The site is 7 km from the coast and is significantly influenced by land and sea breezes. These are created by the daily heating and cooling of the land surface next to the ocean. The sea breeze occurs when the air over the land heats up and becomes more buoyant and rises, denser moist air over the ocean then flows inland. Sea breezes can strengthen prevailing wind, reduce it or even reverse it, depending on the strength and direction of the two airstreams (Cheney and Sullivan 2008).

Data from the Bureau of Meteorology weather station at Medina indicate that the predominant winds in the summer months at 3 pm near the study site are south-westerlies (Figure 2). Wind strength, direction and frequency of the south-west wind is clearly dominant and occurs 40-60 per cent of the time. Winds from the west and south occur < 10 per cent of the time.

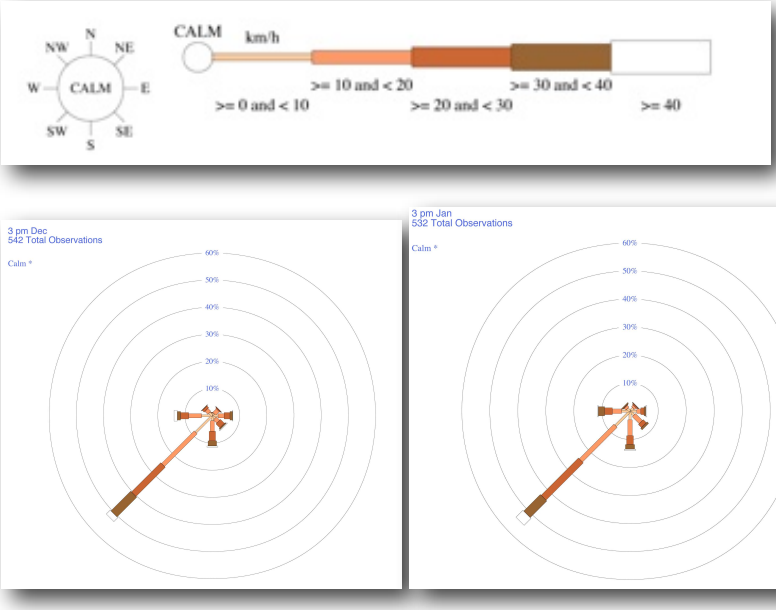


Figure 2: Rose of wind direction and wind speed in km/hr for December, January and February between 1983 and 2010 at the Medina Bureau of Meteorology Research Station

Interpreting Figure 2 - Wind speed Vs Direction Plot

Wind roses summarise the occurrence of winds at a location, showing their strength, direction and frequency. The percentage of calm conditions is represented by the size of the centre circle - the bigger the circle, the higher is the frequency of calm conditions. Each branch of the rose represents wind coming from that direction, with north to the top of the diagram. Eight directions are used. The branches are divided into segments of different thickness and colour, which represent wind speed ranges in that direction. Speed ranges of 10 km/hr are used. The length of each segment within a branch is proportional to the frequency of winds blowing within corresponding range of speeds from that direction (BOM 2010).

5 Bushfire History

A recent study has concluded that bushfires may have been in the Australian Landscape for 50 million years longer than previously thought. The adaption of eucalypts that allows them to recover from bushfires has been traced back more than 60 million years (Crisp et al. 2011), indicating fire has been in the Australian landscape since that time.

Anthropological and historical evidence suggests that much of the Swan Coastal Plain was regularly burnt by the Aborigines until the middle of the nineteenth century (Hallam 1975, Abbott 2003).

Bushfires are common in the City of Rockingham. Recent bushfire history includes:

- 13 December 2010, a fire started at 1.12pm between Baldivis Road and Kwinana Freeway north of Safety Bay Road and burn't through 20 hectares of bush. Fire Crews saved four homes and several sheds. Part of the woodland vegetation in the Tramway Reserve was burnt.
- 12 April 2009, (Easter Sunday) a bushfire began near Eighty and Fifty Road and FESA warned residents to close all doors and windows and turn off evaporative coolers. Fifty Road was closed between Baldivis Road and Safety Bay Road. Thjsi fire impacted on most of the study site and 780 ha in total were burnt. The woodland vegetation shows extensive signs of this event.

Areas of native vegetation surrounded by residential estates are susceptible to frequent bushfires due to the high risk of arson and great potential for accidental ignitions (Walker 1981, Burrows and Abbott 2003).

6. Bushfire Hazard Assessment

Assessing bushfire hazards at a strategic level takes into account the predominant class of vegetation on the site and surrounding area for a minimum of 100 metres. The vegetation class map for the site and surrounding area for a minimum of 100 m is shown in Appendix D. Fuel layers in a typical forest environment can be broken down into 5 obvious segments (Figure 3). These defined fuel layers are used in the following descriptions regarding vegetation types, fuel structure and bushfire hazard levels.

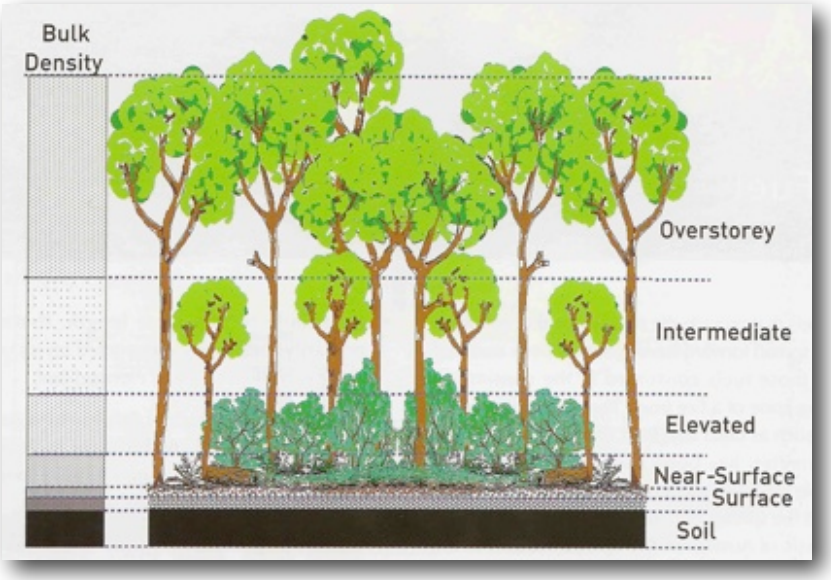


Figure 3 : The five obvious fuel layers in a forest environment that could be associated with fire behaviour (Gould et al. 2007)

6.1 Vegetation Type and Class

Native vegetation has been largely modified on the site particularly between Fifty and Eighty Road. In this area pasture grasses dominate over 60% of the site and the remaining is managed as a market garden. The pasture grasses appeared to be unmanaged and not currently grazed by livestock or horses. An open woodland of remnant Tuart trees (*Eucalyptus gomphocephala*) occur in the grassland but canopy foliage cover was assessed as being near and below 10% foliage cover overall. In tjis condition it is classified according to its understorey which is grassland.

Between Eighty and Baldivis Road, the site was vegetated in a mixture of uncultivated market garden land, Eucalypt woodland, grassland and three small areas of open forest. The Eucalypt woodland vegetation is dominant and contains a mixture of Tuart (*Eucalyptsu gomphocephala*), Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*). In some areas the woodland appeared relatively undisturbed, while in others there was significant modification of fuel layers including the absence of intermediate and elevated fuels. This left a canopy of woodland foliage and a near surface fuel layer of grasses only.

The more natural undisturbed areas of vegetation occur external to the site. South of site between Fifty and Eighty Road is the Rockingham Lakes Regional Park. This area experienced a large bushfire in April 2009 and a thick shrub layer has regenerated as has significant Eucalypt regrowth. The mature Tuart eucalypt trees have poor canopy health and reduced foliage cover. There is a grassy near surface fuel layer with seed heads up to 1 m in height. In some areas the overstorey canopy is below 10% foliage cover and would strictly mean the vegetation should be classified according to intermediate or elevated fuel layers. However, the site is assessed considering the overstorey foliage cover will increase as regeneration of tree species occurs. For this reason it is classified as Woodland vegetation.

The wedge of woodland vegetation north of the development site where Fifty and Eighty Roads intersect was also burnt in the April 2009 bushfire. It is similarly recovering and regenerating from this event and a thick elevated shrub layer has regenerated under the 20 metre high woodland canopy. Canopy foliage appears low with trees in poor condition.

North of Eighty Road on the eastern side of Baldivis Primary School, high fuel loads exist in the Low Open Forest. This vegetation type is characterised by banksia trees and some Jarrah and Marri overstorey trees. It appears to be relatively undisturbed and all fuel layers are present.

East of Baldivis Road, the Tramway Reserve contains woodland and open forest vegetation. A recent bushfire has also disturbed areas within this site. Elsewhere surrounding the site there are disturbed environments including other land being developed and residential areas.

The vegetation class map for the site and surrounding area for a minimum of 100 m is shown in Appendix D.

6.2 Slope

The landscape is undulating, the woodland vegetation south of the site has an effective upslope relative to the development site. The woodland area located south of Fifty Road between the two development areas is also predominantly positioned with an effective upslope however some downslope does exist.

6.3 The Bushfire Hazard Assessment Levels

The vegetation class map (Appendix D) outlines the dominant vegetation types on the study site and surrounding area for a minimum of 100 m. Descriptions of the vegetation class structure and dominant species are outlined in section 6.1 Vegetation Type and Class. The bushfire hazard assessment levels were determined using Appendix 1 of the Planning for Bushfire Protection Guidelines - Edition 2 (WAPC et al. 2010).

The study site has bushfire hazard ratings of low, moderate and extreme. Low bushfire hazards (Figures 4 and 5) occur in areas of market gardens, managed grasslands and areas undergoing development. Moderate bushfire hazards occur is all areas of unmanaged grasslands, and managed or disturbed woodland or open forest (Figures 6 and 7). Extreme bushfire hazards occur in all areas of undisturbed Woodland and Open Forest (Figures 8 and 9).

As the site develops and vegetation is removed, the bushfire hazard will reduce. Permanent hazard will remain around the perimeter of the site in the woodland and forest vegetation in the Rockingham Lakes Regional Reserve, the Tramway Reserve and in the wedge of vegetation south of Fifty Road.

The bushfire hazard rating map for the site and surrounding areas is shown in Appendix E. The following representative photos provide a picture of fuel quantity and structure on and surrounding the site. There is low (Figures 4 and 5) and

moderate (Figures 6 and 7) and extreme bushfire hazard rated vegetation (Figures 8 and 9).

Low bushfire hazard rating

Figures 4 and 5: Managed grassland (left) occurs on the site and a large market garden (right) occupies a large area on Fifty Road

Moderate bushfire hazard rating

Figures 6 and 7: Unmanaged grassland (left) covers significant areas, while some small areas of disturbed open forest without intermediate and elevated fuel exists (right)

Extreme bushfire hazard rating

Figures 8 and 9: Open forest occurs in the small areas where canopy health and foliage cover exceeds 30% (left), while woodland exists over many adjacent lots but it is still recovering from the 2009 bushfire (right)

7. Fire Mitigation Strategies

This report adopts a detailed acceptable solution approach for the bushfire management issue of building siting. The bushfire management issues of water and vehicular access are broadly analysed to ensure more specific mitigation strategies are dealt with and consistent during subdivision application stages. It is envisaged that a full Fire Management Plan (FMP) will be required at all future subdivision application stages. This is usually when more detailed assessment is completed.

All mitigation strategies are consistent with Appendix 2 in Planning for Bushfire Protection guidelines (WAPC et.al 2010).

7.1 Element: Siting of Development

Vegetation and bushfire hazard will be largely removed from within the site as development stages are completed. Some vegetation within POS areas may be retained and be a long term bushfire hazard for dwellings. However, the vast majority of bushfire hazard on the structure plan area will be from residual vegetation external to the site.

Based on this understanding, all dwellings within 100 metres of classified vegetation are exposed to predicted bushfire attack mechanisms that will warrant increased bushfire construction standards (Standards Australia 2009).

The mitigation strategy outlined in this report focusses on the provision of a low fuel Building Protection Zone (BPZ) which can include as roads, road reserves, irrigated lawns, landscaped gardens and setbacks on private lots. The key to the setback distance is that it must be sufficient to reduce the Bushfire Attack Level (BAL) to BAL-29 or lower. This will comply with the Planning for Bushfire Protection Guidelines (BPBG) and any exposed buildings will have construction standards aligned with AS3959-2009 Construction of buildings in bushfire prone areas.

Acceptable Solution: Building Protection Zone (BPZ)

One of the most important fire protection measures influencing the safety of people and property is to create a BPZ around buildings.

World first research into land management and house loss during the Black Saturday Victorian bushfires concluded that the action of private landholders, who managed fuel loads close to their houses, was the single most important factor to determine house survival when compared with other land management practices, such as broad scale fuel reduction burning remote from residential areas (Gibbons et al. 2012).

The creation of a BPZ around the perimeter of the built development between buildings and the residual bushfire hazard will ensure the predicted radiant heat flux exposure levels remain below Bushfire Attack Level BAL-29 or below predicted 29 kW/m^2. A minimum 20 metre BPZ must be achieved between all buildings and bushfire hazard. Some areas within the development boundary such as POS areas also could retain remnant native vegetation. Depending on the size, dimensions and location of these areas of internal remnant vegetation, they may also require provision of a BPZ to separate buildings from the hazard.

Creating and managing vegetation in the BPZ has two main purposes:

- To reduce direct flame contact and radiant heat from igniting the building during the passage of a fire front, and
- To reduce ember attack and provide a safer space for people to defend (if required) before, during and after a fire front.

A permanent BPZ will be established surrounding the development between buildings and bushfire hazard.

The location and dimensions of the BPZ is outlined in the plan shown in Appendix F.

The BPZ must be established and maintained to the following standards:

- Width: 20 m surrounding the area of development containing structures and bushfire hazard as indicated in Appendix F
- Location: within the boundaries of the development lot or in adjoining road reserves
- Fuel load: reduced to and maintained at 2 tonnes per hectare
- All tree crowns are a minimum of 10 m apart
- All trees to have lower branches pruned to a height of 2 m
- All tall shrubs or trees are not to be located within 2 m of a building (including windows)
- No tree crowns or foliage is to be within 2 m of any building, this includes existing trees and shrubs and new plantings
- All fences and sheds are constructed with non-combustible materials (i.e. colorbond, brick or limestone)
- All shrubs to contain no dead material within the plant
- No tall shrubs are to be in clumps within 3 m of the building
- No trees are to contain dead material in the crown or on the bole.

A Hazard Separation Zone (HSZ) does provide additional protection to buildings and occupants by assisting to reduce fire intensity when a bushfire impacts on a building.

HSZ's can extend out to 100 metres from dwellings, however the size of a HSZ can be reduced or removed and the level of risk to dwellings mitigated by increasing building construction standards compliant with the Australian Standard (AS3959).

The Australian Standard (AS 3959-2009) will apply for all buildings within 100 metres of classified vegetation. The following Bushfire Attack Level (BAL) assessment examples demonstrate that the fuel managed BPZ zone results in a maximum Bushfire Attack Level of BAL-29. This achieves acceptable levels of risk for the development. Building construction standards will be increased to compensate for any reduction in size of the hazard separation zone. Further site specific assessments will need to be undertaken during each subdivision application stage in the form of a fire management plan.

The following Bushfire Attack Level (BAL) assessment demonstrates that the fuel management surrounding the development achieves acceptable levels of risk.

7.1.1 Building Siting and Predicted Bushfire Attack Levels

The AS 3959-2009 has six categories of Bushfire Attack Level, namely BAL-LOW, BAL-12.5, BAL-19, BAL-29, BAL-40 and BAL-FZ. These categories are based on heat flux exposure thresholds.

The method for determining the BAL involves a site assessment of vegetation and local topography. The assumed Fire Danger Index (FDI) for Western Australia is 80. The BAL identifies the appropriate construction standard that applies as a minimum standard in Construction of buildings in bushfire-prone areas (AS 3959-2009).

Methodology and Assumptions

The following BAL examples were determined using the methodology in Appendix A of AS 3959-2009. This methodology is also outlined in the Planning for Bush Fire Protection Guidelines. Example BAL assessments were undertaken in eight different representative locations and chosen adjacent to the representative vegetation types, with sites located on each perimeter of the development (Appendix F). The results of these assessments are shown in Table 1.

The criteria to determine the BAL is outlined as follows:

Designated FDI : 80
Flame Temperature : 1090
Slope : Various (See Table 1)
Vegetation Class : Woodland and Forest
Setback distances : 20, 21 and 27 m (See Table 1)

BAL Assessment Number	Setback Distance	Classified Vegetation	Effective Slope (degrees)	BAL Rating
1	20 m minimum	Woodland	Upslope	BAL-19
2	27 m minimum	Open Forest	Downslope 1-2	BAL-29
3	20 m minimum	Woodland	Upslope	BAL-19
4	20 m minimum	Woodland	Upslope	BAL-19
5	20 m minimum	Woodland	Downslope 1-2	BAL-29
6	20 m woodland 21 m open forest	Woodland Open forest	Both upslope	BAL-29 BAL-19
7	20 m minimum	Woodland	Downslope 1-2	BAL-29 BAL-19
8	27 m minimum	Open Forest	Downslope 1-2	BAL-29

Table 1: Example "worse case" BAL scenarios on the perimeter of the development (See Appendix F for location)

A 20 m setback from woodland vegetation is sufficient to not exceed BAL-29 on effective downslope of 1-2 degrees. A 21 m setback is required to achieve BAL-29 for Open Forest with an effective upslope. A 27 metre setback achieves a BAL rating of BAL-29 adjacent to Open Forest with a downslope of 1-2 degrees (Table 1).

The proposed design of the development at structure plan stage will incorporate a minimum 20 metres low fuel zone around the perimeter of the site that is immediately adjacent to classified vegetation. As outlined in table 1, this setback distance needs to reflect the vegetation class adjoining the development and the effective slope under the vegetation. In some areas adjacent to open forest, 21 and 27 metres setback distance is required. On all sides of the development site this results in a predicted maximum BAL rating of BAL-29 which provides an acceptable solution under the PBPG (edition 2). Construction standards will be increased to mitigate the hazard on new dwellings.

7.1.2 Landscaping Considerations

Landscaping can both assist in the survival of the building and be a determining measure in its destruction. Landscaping can protect buildings by forming a barrier or deflector for windborne debris and radiant heat. It can also bring the fire directly to the building so a degree of care needs to be exercised when selecting and locating landscaping.

All plants will burn under the right conditions and plants do not achieve a “fire resistance level” to meet the Building Code of Australia (BCA). Placing plants too close to a building, under timber decks or next to windows will provide a direct threat to the building. Having a clearance around the building will achieve the desired effect of creating a break between the vegetation and the building. A pathway around the building may be one way to achieve this requirement. The landscaping can then be provided further out from the building.

Bark chips and combustible mulch near a building is not recommended and is a particular problem when the windows have low sill heights. The flames can have a direct connection with the glass which was identified as a major issue during the Canberra bushfires of 2003 where over 500 homes were destroyed. The recently released FESA document titled “Plant Guide within the Building Protection Zone” provides a useful list of species and spacing requirements to achieve compliance with vegetation within a building protection zone in the Swan Coastal Plain. It will provide some guidance for appropriate revegetation of POS areas.

7.2 Element: Vehicular Access

The intention is to ensure that the vehicular access serving a subdivision development is safe in the event of a bushfire occurring. This can be achieved where the layout, design, and construction of public and private vehicle access in the development allows emergency and other access vehicles to pass through it easily and safely at all times.

Vehicular access throughout the development is still at concept stage as outlined in Appendix B, however there are three main public roads that connect with the east and west perimeter. Eighty Road also dissects the study site. The preliminary subdivision design demonstrates a number of perimeter roads which are a good vehicular access feature. It is expected that many proposed internal roads will intersect with the existing public road system.

The residential development is unlikely to require emergency or fire access routes due to the intensity of development. Standards for public roads are outlined in the PBPG (edition 2).

Further details regarding vehicular access requirements and minimum standards will be outlined in a Fire Management Plan that will be required at future subdivision application stages.

7.3 Element: Water

The development will be provided with a reticulated water supply, together with fire hydrants, in accordance with the specifications of the Water Corporation and FESA. The type of development, land zoning and class of building proposed will ultimately determine the fire hydrant coverage required.

For building classes 2 - 9 in the Building Code of Australia, the process to determine hydrant coverage and compliance with Australian and FESA standards is outlined in FESA guideline No: GL-07 which can be downloaded at : http://www.fesa.wa.gov.au/regulationandcompliance/buildingplanassessment/Guidelines/GL-07-Submission_of_plans_for_assessment_against_the_Deemed-to-Satisfy_fire_requirements_of_the_BCA.pdf.

If the proposed structure/s are to be a Class 1a (residential dwelling) then the requirement is to have fire hydrants within (or every) 200 metres in residential zoned land. Fire services require ready access to an adequate water supply during fire emergencies. Further details will be provided when a Fire Management Plan is completed during each subdivision application stage.

7.4 Further Analysis Required at Subdivision Application Stage

Further bushfire management planning at each subdivision application stage is required to specifically assess building siting, water supply and vehicular access requirements on the development to enable life and property to be defended. It is envisaged that a full Fire Management Plan will be required at each future subdivision application stage. This is usually when more detailed assessment is completed.

8. Conclusion

This report outlines a detailed bushfire hazard assessment for the subject land. The site is predominantly cleared, with some remnant woodland and open forest. Some adjoining properties contain large areas of woodland vegetation. The landscape is rated low, moderate and extreme bushfire hazard depending on the vegetation type and structure.

Acceptable solutions are outlined that comply with the performance criteria in Planning for Bush Fire Protection (WAPC et. al. 2010) for building siting. Adjacent to Woodland vegetation, a minimum 20 m perimeter BPZ between all buildings and bushfire hazard will drop predicted radiant heat flux exposure levels to below 29kW/m^2 (or BAL-29 or lower). For Open Forest, a setback of 27 m is required when the effective slope is 0-5 degrees downslope. Construction standards will be increased to mitigate any reduced setback distances consistent with the Australian Standard AS3959.

Vehicular access will be designed to minimum standards outlined in PBPG (edition 2). A reticulated water supply will be provided to all lots with hydrants provided to FESA, Water Corporation Standards and City of Rockingham standards.

A full Fire Management Plan is required to be developed at each subdivision application stage which will provide more specific bushfire planning requirements.

9. References

Abbott, I. (2003). Aboriginal fire regimes in south-west Western Australia: evidence from historical documents. Pages 119-146 in I. Abbott and N. Burrows, editors. Fire in ecosystems of south-west Western Australia: impacts and management. Backhuys, Leiden, The Netherlands.

Blanchi, R. Lucas, C. Leonard, J and Finkele K. (2010) Meteorological conditions and wildfire -related house loss in Australia. CSIRO Publishing, Melbourne

Burrows, N., and I. Abbott. 2003. Fire in south-west Western Australia: synthesis of current knowledge, management implications and new research directions. Pages 437-452 in N. Burrows and I. Abbott, editors. Fire in ecosystems of south-west Western Australia: impacts and management. Backhuys, Leiden, The Netherlands.

Cheney P & Sullivan P (2008) Grassfires. Fuel, Weather and Fire Behaviour. 2nd edition CSIRO Publishing.

Crisp M. D, Burrows G. E, Cook L. G, Thornhil A. Hl & Bowman D (2011) Flammable biomes dominated by eucalypts originated at the Cretaceous–Palaeogene boundary. In Nature Communications 2. Article No 193.

Gibbons P, van Bommel L, Gill AM, Cary GJ, Driscoll DA, et al. (2012) Land Management Practices Associated with House Loss in Wildfires. PLoS ONE 7(1): e29212. doi:10.1371/journal.pone.0029212

Gould J. S, McCaw W. L, Cheeney N. P, Ellis P. F, Knight I. K, and Sullivan A. L (2007) Project Vesta - Fire in Dry Eucalypt Forest: Fuel Structure, fuel dynamics and fire behaviour. Ensis-CSIRO, Canberra ACT, and Department of Environment and Conservation, Perth WA.

Hallam, S. J. 1975. Fire and Hearth: A study of Aboriginal usage and European surpation in south-western Australia. Australian Institute of Aboriginal Studies, Canberra, Australia.

Leonard J. (2009) Report to the 2009 Victorian Royal Commission Building Performance in Bushfires. CSIRO Sustainable Ecosystems.

Risk Frontiers, Bushfire CRC and RMIT University (2008). 100 Years of Australian civilian bushfire fatalities: exploring the trends in relation to the ‘stay or go policy‘ Report for the Bushfire CRC http://www.bushfirecrc.com/research/downloads/Fatality-Report_final_new.pdf

Standards Australia. (2009) Australian Standard AS 3959-2009 Construction of buildings in bushfire-prone areas.

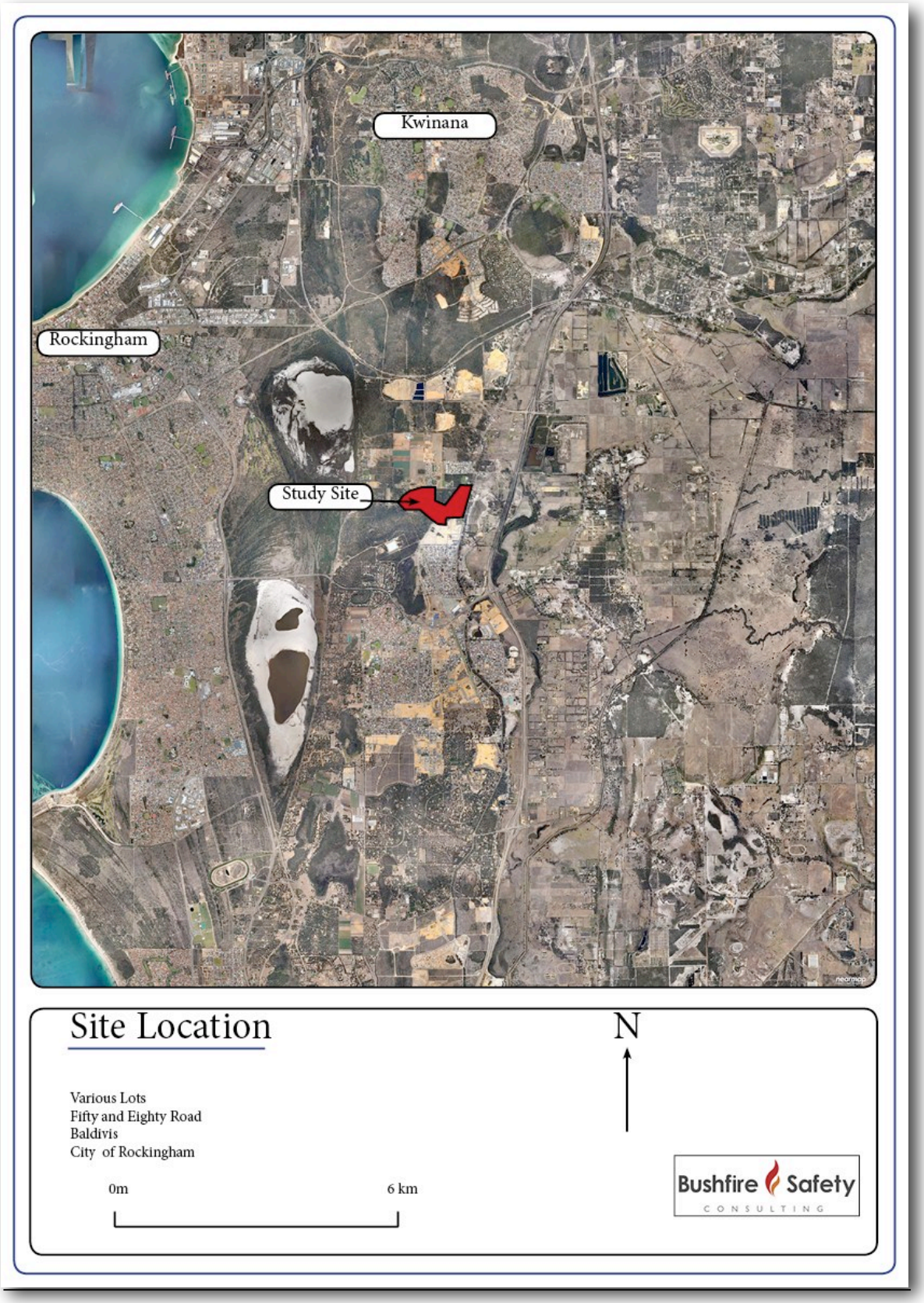
Victorian Bushfires Royal Commission (VBRC) Final Report (2010). Government Printer for the State of Victoria.

Western Australian Planning Commission (WAPC), FESA and Department of Planning and Infrastructure (2010), Planning for Bush Fire Protection - Edition 2. Western Australian Planning Commission, Perth.

Walker, J. 1981. Fuel dynamics in Australian vegetation. Pages 101-127 in A. M. Gill, R. H. Groves, and I. R. Noble, editors. Fire and the Australian biota. Australian Academy of Science, Canberra, Australia.

10. Appendices

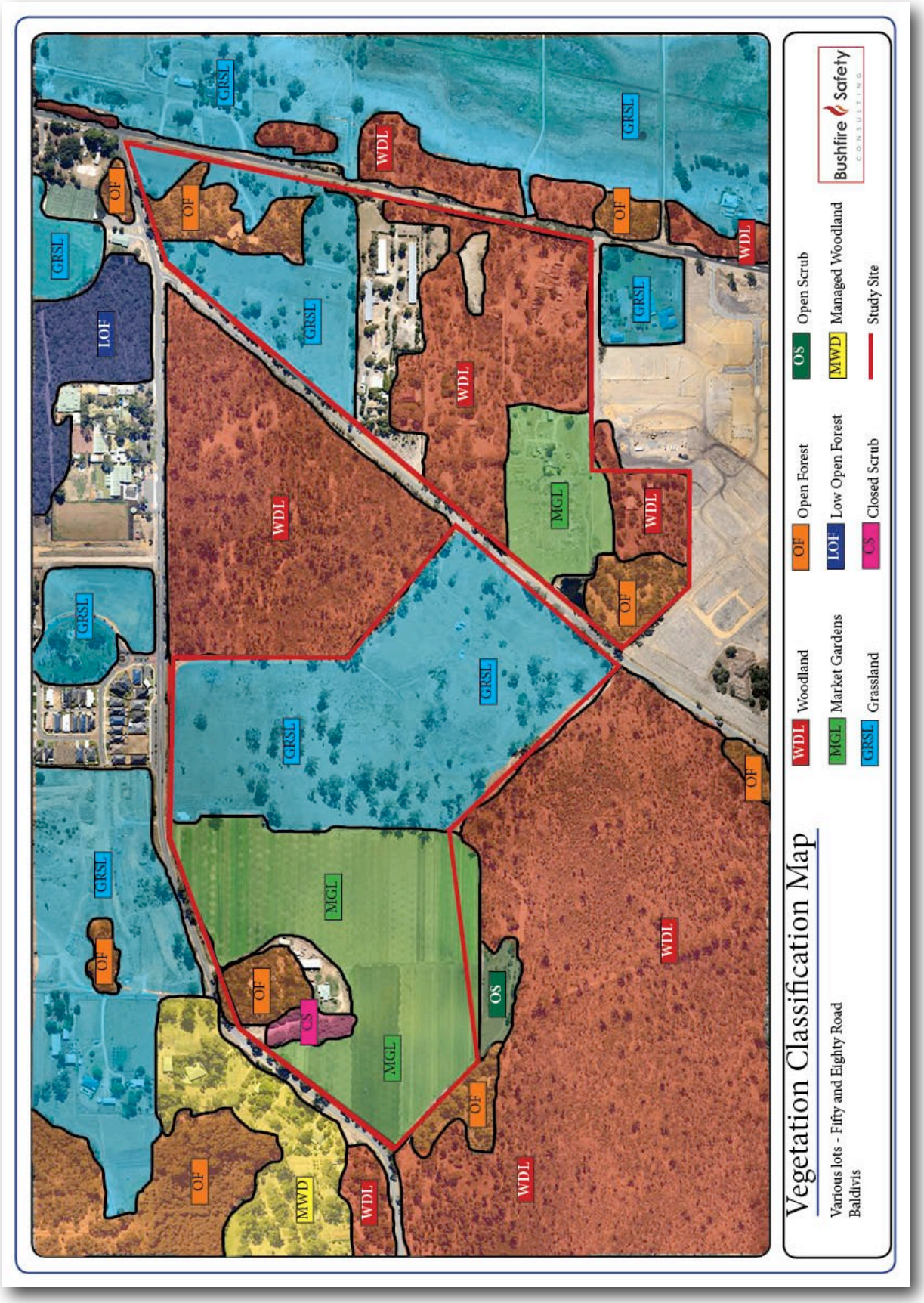
Appendix A: Site Location



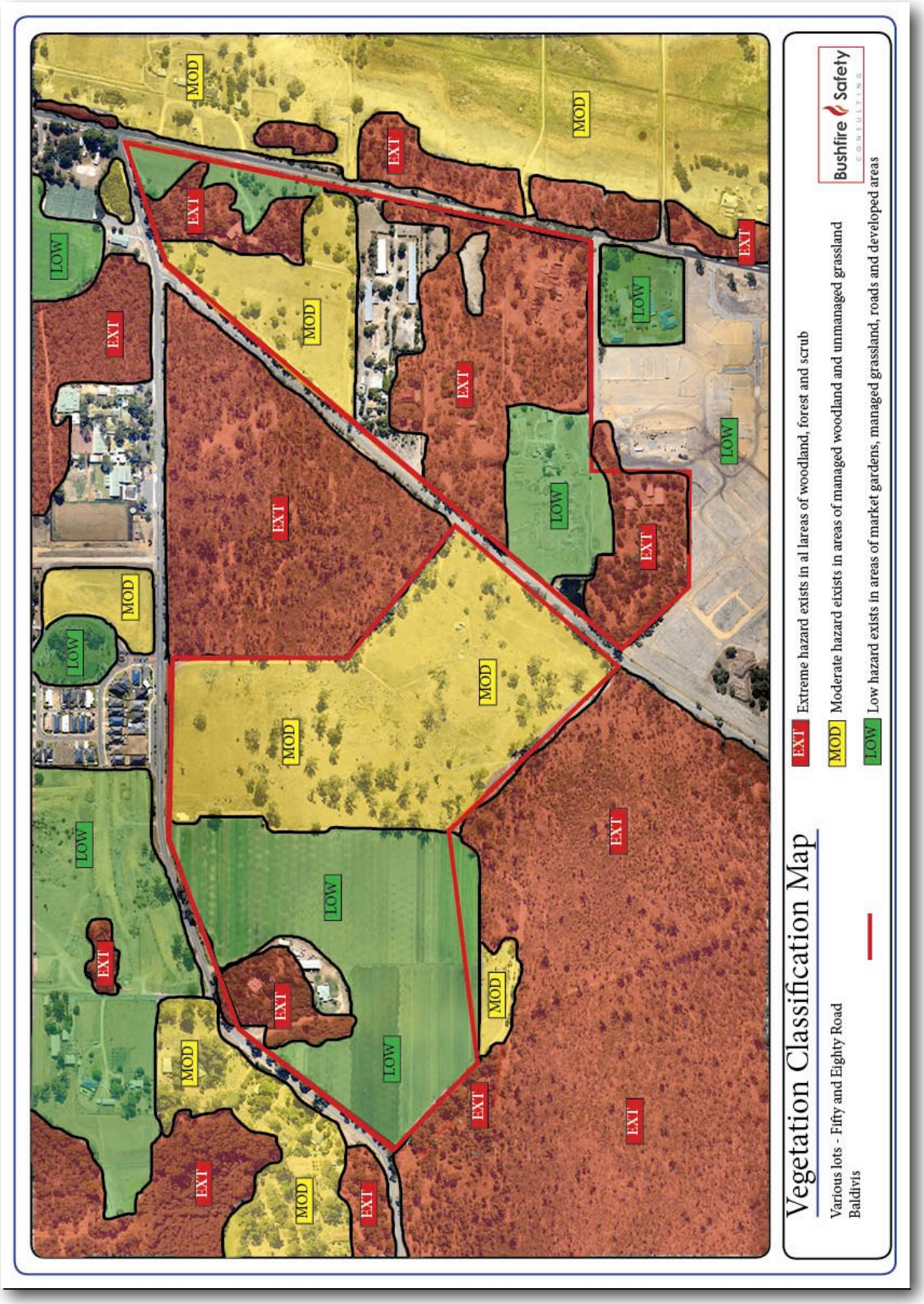
Appendix B: Subdivision Plan

Appendix C: Structure Plan Context

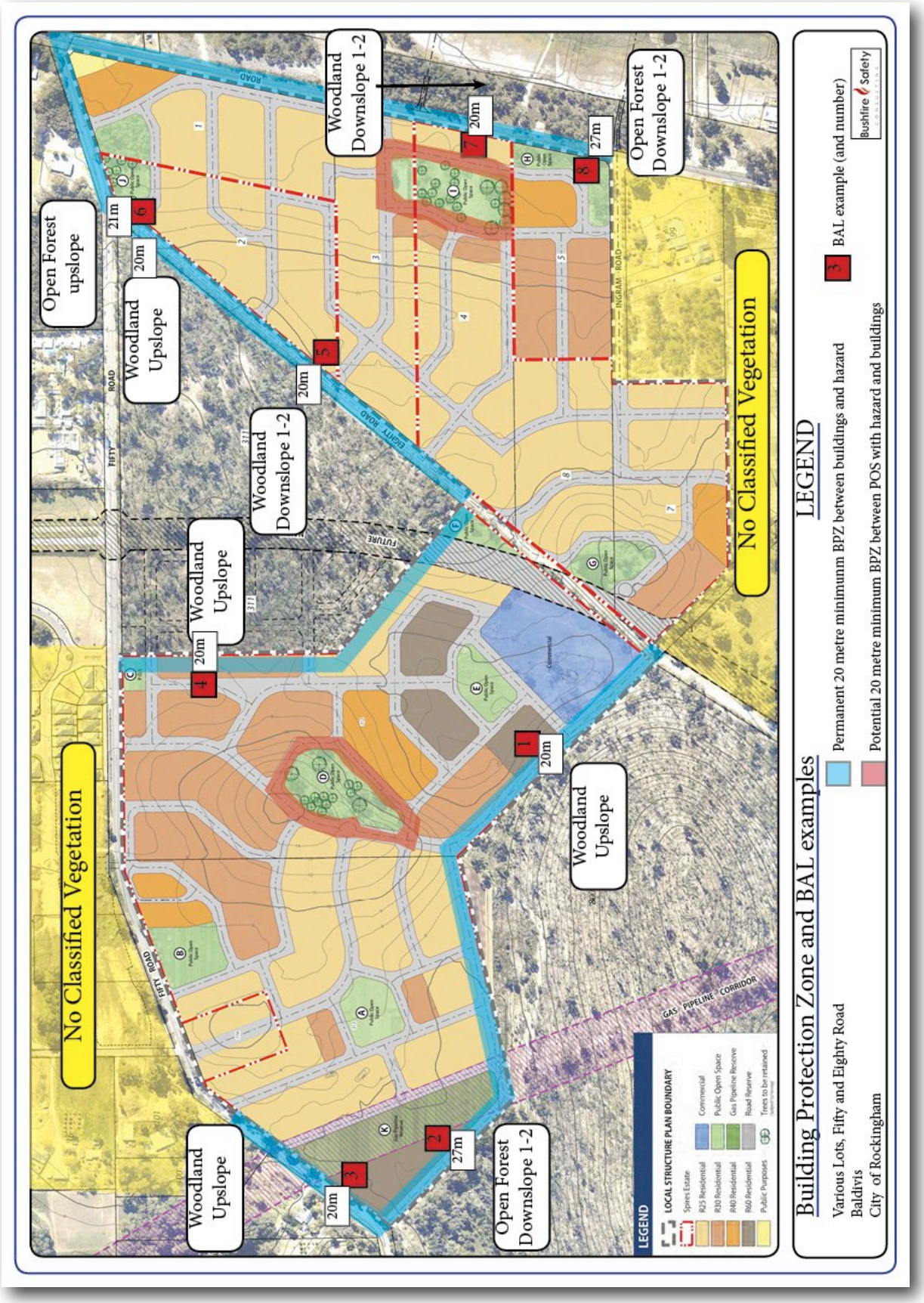
Appendix D: Vegetation Class Map



Appendix E: Bushfire Hazard Rating Map



Appendix F: Building Protection Zone and BAL examples



Appendix 2
Fire Management Plan compliance checklist

Compliance checklist for performance criteria and acceptable solutions

Element	Acceptable solution	Compliance	Yes/No	Explanation (if no)
1. Location	A1.1 Development location	Does the proposal comply with performance criteria P1 by applying acceptable solution A1.1?	Yes	
2. Vehicular access	A2.1 Two access routes	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.1?	Yes	
	A2.2 Public roads	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.2?	Yes	
	A2.3 Cul-de-sacs	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.3?	Yes	
	A2.4 Battle axes	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.4?	N/A	
	A2.5 Private driveways	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.5?	Yes	
	A2.6 Emergency access ways	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.6?	N/A	
	A2.7 Fire service access routes	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.7?	N/A	
	A2.8 Gates	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.8?	N/A	
	A2.9 Firebreak widths	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.9?	N/A	
	A2.10 Signs	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.10?	N/A	
3. Water	A3.1 Reticulated areas	Does the proposal comply with performance criteria P3 by applying acceptable solution A3.1?	Yes	
	A3.2 Non-reticulated areas (a)	Does the proposal comply with performance criteria P3 by applying acceptable solution A3.2?	N/A	
	A3.3 Non-reticulated areas (b)	Does the proposal comply with performance criteria P3 by applying acceptable solution A3.3?	N/A	
4. Siting of development	A4.1 Hazard separation – moderate to extreme bush fire hazard level	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.1?	Yes	
	A4.2 Hazard separation – low bush fire hazard level	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.2?	Yes	
	A4.3 Building protection zone	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.3?	Yes	
	A4.4 Hazard separation zone	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.4?	Yes	
	A4.5 Reduction in bush fire attack level due to shielding	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.5?	Yes	
5. Design of development	A5.1 Compliant development	Does the proposal comply with performance criteria P5 by applying acceptable solution A5.1?	Yes	
	A5.2 Non-compliant development	Does the proposal comply with performance criteria P5 by applying acceptable solution A5.2?	N/A	

Note: Performance criteria and acceptable solutions are in accordance with *Planning for Bush Fire Protection Guidelines (Edition 2)* (WAPC et al. 2010).

Applicant Declaration

I declare that the information provided is true and correct to the best of my knowledge.

Full name: Roger Banks

Applicant signature:

Date: 26/03/2014

Appendix 3

January wind profiles for Medina Research Centre

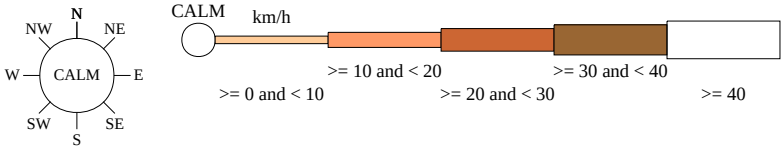
Rose of Wind direction versus Wind speed in km/h (01 Apr 1983 to 30 Sep 2010)

Custom times selected, refer to attached note for details

MEDINA RESEARCH CENTRE

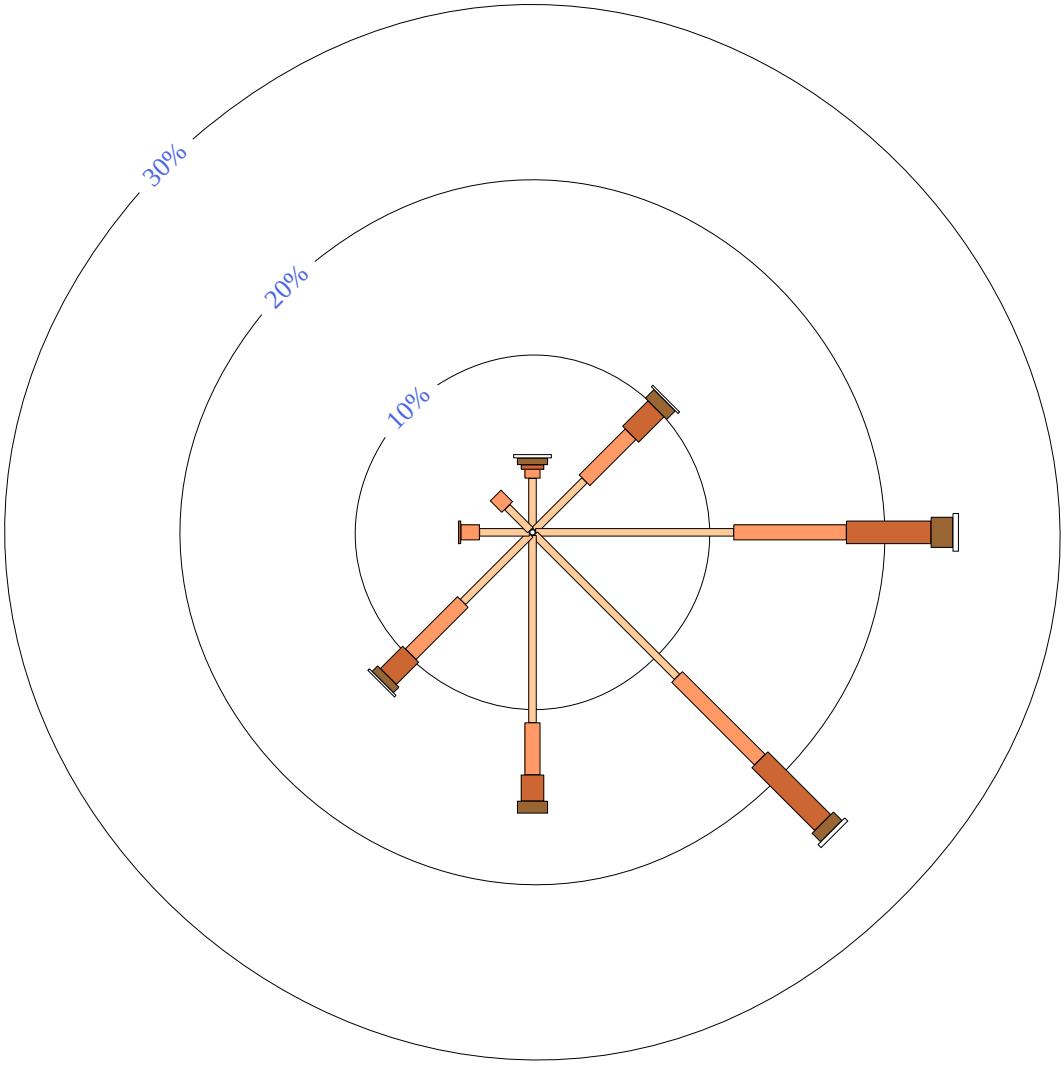
Site No: 009194 • Opened Apr 1983 • Still Open • Latitude: -32.2208° • Longitude: 115.8075° • Elevation 14m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



9 am Jan
796 Total Observations

Calm 1%



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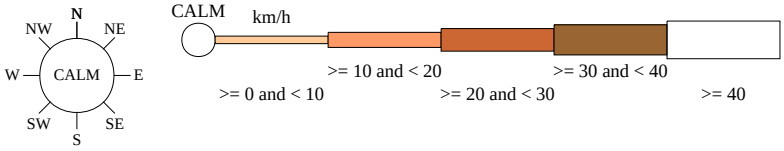
Rose of Wind direction versus Wind speed in km/h (01 Apr 1983 to 30 Sep 2010)

Custom times selected, refer to attached note for details

MEDINA RESEARCH CENTRE

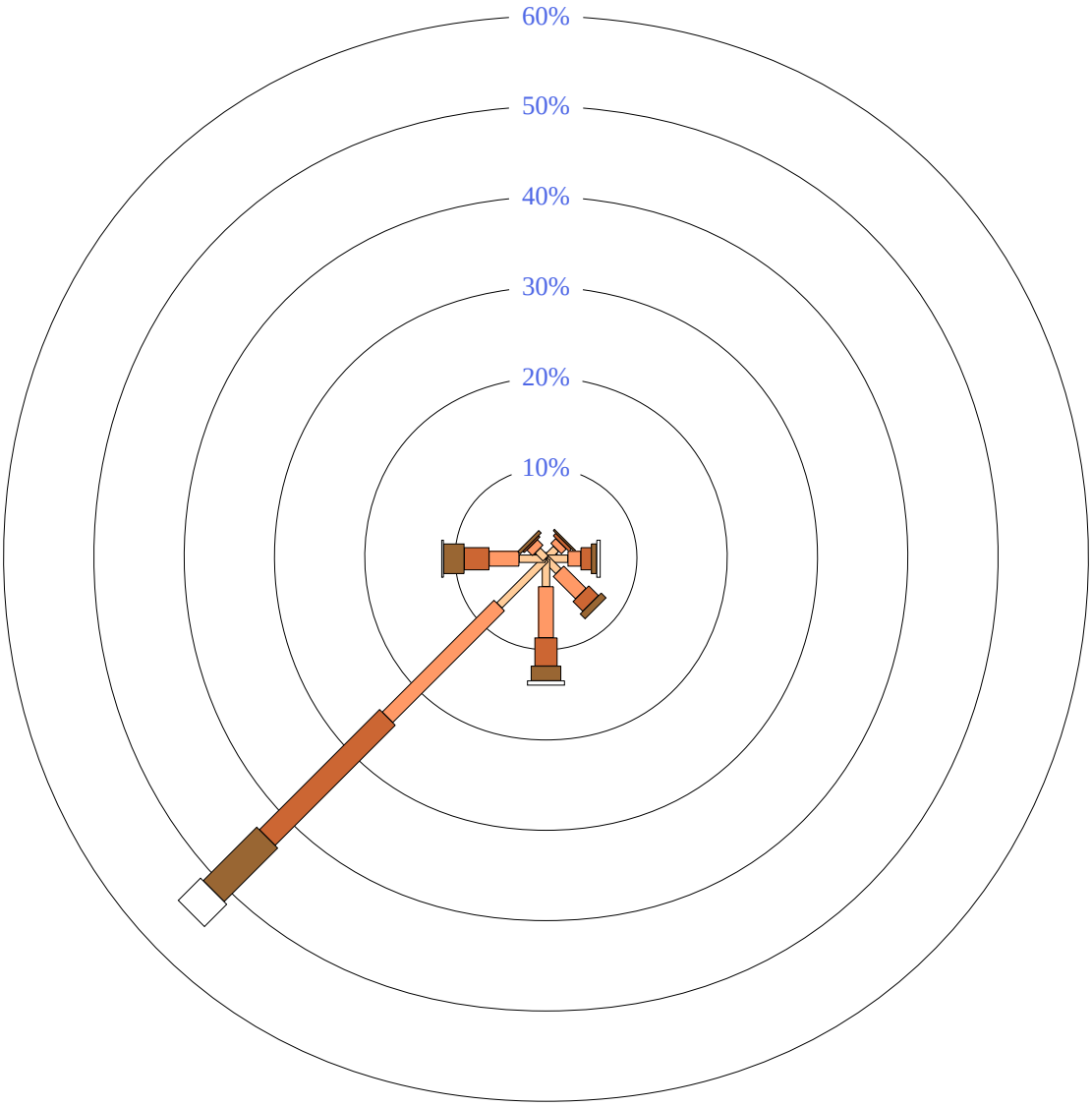
Site No: 009194 • Opened Apr 1983 • Still Open • Latitude: -32.2208° • Longitude: 115.8075° • Elevation 14m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



3 pm Jan
532 Total Observations

Calm *



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Appendix 4
Construction standards for BAL 12.5, BAL 19 and BAL 29 as per AS 3959–2009

SECTION 5 CONSTRUCTION FOR BUSHFIRE ATTACK LEVEL 12.5 (BAL — 12.5)

5.1 GENERAL

A building assessed in Section 2 as being BAL—12.5 shall comply with Section 3 and Clauses 5.2 to 5.8.

NOTE: There are a number of Standards that specify requirements for construction; however, where this Standard does not provide construction requirements for a particular element, the other Standards apply.

Any element of construction or system that satisfies the test criteria of AS 1530.8.1 may be used in lieu of the applicable requirements contained in Clauses 5.2 to 5.8 (see Clause 3.8).

NOTE: BAL—12.5 is primarily concerned with protection from ember attack and radiant heat up to and including 12.5 kW/m^2 where the site is less than 100 m from the source of bushfire attack.

5.2 SUBFLOOR SUPPORTS

This Standard does not provide construction requirements for subfloor support posts, columns, stumps, piers and poles.

NOTE: The exclusion of requirements for subfloor supports applies to the principal building only and not to verandas, decks, steps, ramps and landings (see Clause 5.7).

C5.2 *Ideally, storage of combustible materials beneath a floor at this BAL would not occur and on this assumption, there is no requirement to enclose the subfloor space or to protect flooring materials from bushfire attack. However, should combustible materials be stored, it is recommended the area be protected as materials stored in the subfloor space may be ignited by embers and cause an impact to the building.*

5.3 FLOORS

5.3.1 Concrete slabs on ground

This Standard does not provide construction requirements for concrete slabs on the ground.

5.3.2 Elevated floors

This Standard does not provide construction requirements for elevated floors, including bearers, joists and flooring.

5.4 EXTERNAL WALLS

5.4.1 Walls

That part of an external wall surface that is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less

than 18 degrees to the horizontal and extending more than 110 mm in width from the wall (see Figure D3, Appendix D) shall be of—

(a) non-combustible material; or

(b) fibre-cement external cladding, a minimum of 6 mm in thickness; or

(c) bushfire-resisting timber (see Appendix F); or

(d) a timber species as specified in Paragraph E1 and listed in Table E1, Appendix E; or

(e) a combination of any of Items (a), (b), (c) or (d) above.

There are no requirements for external wall surfaces 400 mm or more from the ground or for external wall surfaces 400 mm or more above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the wall (see Figure D3, Appendix D).

5.4.2 Joints

All joints in the external surface material of walls shall be covered, sealed, overlapped, backed or butt-jointed to prevent gaps greater than 3 mm.

Alternatively, sarking-type material may be applied over the outer face of the frame prior to fixing any external cladding.

5.4.3 Vents and weepholes

Vents and weepholes in external walls shall be screened with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium, except where the vents and weepholes are less than 3 mm (see Clause 3.6), or are located in an external wall of a subfloor space.

5.5 EXTERNAL GLAZED ELEMENTS AND ASSEMBLIES AND EXTERNAL DOORS

5.5.1 Bushfire shutters

Where fitted, bushfire shutters shall comply with Clause 3.7 and be made from—

(a) non-combustible material; or

(b) a timber species as specified in Paragraph E1 and listed in Table E1, Appendix E; or

(c) bushfire-resisting timber (see Appendix F); or

(d) a combination of any of Items (a), (b) or (c) above.

5.5.2 Windows

Window assemblies shall comply with one of the following:

(a) They shall be completely protected by a bushfire shutter that complies with Clause 5.5.1.

or

(b) They shall be completely protected externally by screens with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

or

(c) They shall comply with the following:

(i) For window assemblies less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the window frame (see Figure D3, Appendix D), window frames and window joinery shall be made from one of the following:

(A) Bushfire-resisting timber (see Appendix F).

or

(B) A timber species specified in Paragraph E2 and listed in Table E2, Appendix E.

or

(C) Metal.

Or

(D) Metal-reinforced PVC-U. The reinforcing members shall be made from aluminium, stainless steel, or corrosion-resistant steel and the frame and sash shall satisfy the design load, performance and structural strength of the member.

(ii) Externally fitted hardware that supports the sash in its functions of opening and closing shall be metal.

(iii) Where glazing is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the window frame (see Figure D3, Appendix D), the glazing shall be Grade A safety glass minimum 4 mm, or glass blocks with no restriction on glazing methods.

NOTE: Where double glazed units are used the above requirements apply to the external face of the window assembly only.

(iv) Where glazing is other than that specified in Item (iii) above, annealed glass may be used.

(v) The openable portions of windows shall be screened with mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

5.5.3 Doors—Side-hung external doors (including French doors, panel fold and bi-fold doors)

Side-hung external doors, including French doors, panel fold and bi-fold doors, shall comply with one of the following:

(a) They shall be protected by a bushfire shutter that complies with Clause 5.5.1.

or

(b) They shall be completely protected externally by screens with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

or

(c) They shall comply with the following:

(i) Doors shall be—

(A) non-combustible; or

(B) a solid timber door, having a minimum thickness of 35 mm for the first 400 mm above the threshold; or

(C) a door, including a hollow core door, with a non-combustible kickplate on the outside for the first 400 mm above the threshold; or

(D) a fully framed glazed door, where the framing is made from materials required for bushfire shutters (see Clause 5.5.1), or from a timber species specified in Paragraph E2 and listed in Table E2, Appendix E.

(ii) Where doors incorporate glazing, the glazing shall comply with the glazing requirements for windows.

(iii) Doors shall be tight-fitting to the doorframe and to an abutting door, if applicable.

(iv) Where any part of the door assembly is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the door (see Figure D3, Appendix D), that part of the door assembly shall be made from one of the following:

(A) Bushfire-resisting timber (see Appendix F).

or

(B) A timber species specified in Paragraph E2 and listed in Table E2, Appendix E.

or

(C) Metal.

or

(D) Metal-reinforced PVC-U. The reinforcing members shall be made from aluminium, stainless steel, or corrosion-resistant steel and the door assembly shall satisfy the design load, performance and structural strength of the member.

(v) Weather strips, draught excluders or draught seals shall be installed at the base of side-hung external doors.

5.5.4 Doors—Sliding doors

Sliding doors shall comply with one of the following:

(a) They shall be protected by a bushfire shutter that complies with Clause 5.5.1.

or

(b) They shall be completely protected externally by screens with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

or

(c) They shall comply with the following:

(i) Any glazing incorporated in sliding doors shall be Grade A safety glass complying with AS 1288.

(ii) There is no requirement to screen the openable part of the sliding door. However, if screened, the screens shall be a mesh or perforated sheet made of corrosion-resistant steel, bronze or aluminium.

NOTE: The construction of manufactured sliding doors should prevent the entry of embers when the door is closed. There is no requirement to provide screens to the openable part of these doors as it is assumed that a sliding door will be closed if occupants are not present or during a bushfire event. Screens of materials other than those specified may not resist ember attack.

(iii) Sliding doors shall be tight-fitting in the frames.

5.5.5 Doors—Vehicle access doors (garage doors)

The following apply to vehicle access doors:

(a) The lower portion of a vehicle access door that is within 400 mm of the ground when the door is closed (see Figure D4, Appendix D) shall be made from—

(i) non-combustible material; or

(ii) bushfire-resisting timber (see Appendix F); or

(iii) fibre-cement sheet, a minimum of 6 mm in thickness; or

(iv) a timber species specified in Paragraph E1 and listed in Table E1, Appendix E; or

(v) a combination of any of Items (i), (ii), (iii) or (iv) above.

(b) Panel lift, tilt doors or side-hung doors shall be fitted with suitable weather strips, draught excluders, draught seals or guide tracks, as appropriate to the door type, with a maximum gap no greater than 3 mm.

(c) Roller doors shall have guide tracks with a maximum gap no greater than 3 mm and shall be fitted with a nylon brush that is in contact with the door (see Figure D4, Appendix D).

(d) Vehicle access doors shall not include ventilation slots.

5.6 ROOFS (INCLUDING VERANDA AND ATTACHED CARPORT ROOFS, PENETRATIONS, EAVES, FASCIAS, GABLES, GUTTERS AND DOWNPIPES)

5.6.1 General

The following apply to all types of roofs and roofing systems:

(a) Roof tiles, roof sheets and roof-covering accessories shall be non-combustible.

(b) The roof/wall junction shall be sealed, to prevent openings greater than 3 mm, either by the use of fascia and eaves linings or by sealing between the top of the wall and the underside of the roof and between the rafters at the line of the wall.

(c) Roof ventilation openings, such as gable and roof vents, shall be fitted with ember guards made of non-combustible material or a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

5.6.2 Tiled roofs

Tiled roofs shall be fully sarked. The sarking shall—

(a) have a flammability index of not more than 5;

(b) be located directly below the roof battens;

(c) cover the entire roof area including the ridge; and

(d) be installed so that there are no gaps that would allow the entry of embers where the sarking meets fascias, gutters, valleys and the like.

5.6.3 Sheet roofs

Sheet roofs shall—

(a) be fully sarked in accordance with Clause 5.6.2, except that foil-backed insulation blankets may be installed over the battens;

or

(b) have any gaps greater than 3 mm, under corrugations or ribs of sheet roofing and between roof components, sealed at the fascia or wall line and at valleys, hips and ridges by—

(i) a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium; or

(ii) mineral wool; or

(iii) other non-combustible material; or

(iv) a combination of any of Items (i), (ii) or (iii) above.

5.6.4 Veranda, carport and awning roofs

The following apply to veranda, carport and awning roofs:

(a) A veranda, carport or awning roof forming part of the main roof space [see Figure D1(a), Appendix D] shall meet all the requirements for the main roof, as specified in Clauses 5.6.1, 5.6.2, 5.6.3, 5.6.5 and 5.6.6.

(b) A veranda, carport or awning roof separated from the main roof space by an external wall [see Figures D1(b) and D1(c), Appendix D] complying with Clause 5.4 shall have a non-combustible roof covering.

NOTE: There is no requirement to line the underside of a veranda, carport or awning roof that is separated from the main roof space.

5.6.5 Roof penetrations

The following apply to roof penetrations:

(a) Roof penetrations, including roof lights, roof ventilators, roof-mounted evaporative cooling units, aerials, vent pipes and supports for solar collectors, shall be adequately sealed at the roof to prevent gaps greater than 3 mm. The material used to seal the penetration shall be non-combustible.

(b) Openings in vented roof lights, roof ventilators or vent pipes shall be fitted with ember guards made from a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(c) All overhead glazing shall be Grade A laminated safety glass complying with AS 1288.

(d) Glazed elements in roof lights and skylights may be of polymer provided a Grade A safety glass diffuser, complying with AS 1288, is installed under the glazing. Where glazing is an insulating glazing unit (IGU), Grade A toughened safety glass, minimum 4 mm, shall be used in the outer pane of the IGU.

(e) Flashing elements of tubular skylights may be of a fire-retardant material, provided the roof integrity is maintained by an under-flashing of a material having a flammability index no greater than 5.

(f) Evaporative cooling units shall be fitted with butterfly closers at or near the ceiling level or, the unit shall be fitted with non-combustible covers with a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(g) Vent pipes made from PVC are permitted.

5.6.6 Eaves linings, fascias and gables

The following apply to eaves linings, fascias and gables:

(a) Gables shall comply with Clause 5.4.

(b) Eaves penetrations shall be protected the same as for roof penetrations, as specified in Clause 5.6.5.

(c) Eaves ventilation openings greater than 3 mm shall be fitted with ember guards made of non-combustible material or a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

Joints in eaves linings, fascias and gables may be sealed with plastic joining strips or timber storm moulds.

This Standard does not provide construction requirements for fascias, bargeboards and eaves linings.

5.6.7 Gutters and downpipes

This Standard does not provide material requirements for—

(a) gutters, with the exception of box gutters; and

(b) downpipes.

If installed, gutter and valley leaf guards shall be non-combustible.

Box gutters shall be non-combustible and flashed at the junction with the roof with non-combustible material.

5.7 VERANDAS, DECKS, STEPS, RAMPS AND LANDINGS

5.7.1 General

Decking shall be either spaced or continuous (i.e., without spacing).

There is no requirement to enclose the subfloor spaces of verandas, decks, steps, ramps or landings.

C5.7.1 *Spaced decking is nominally spaced at 3 mm (in accordance with standard industry practice); however, due to the nature of timber decking with seasonal changes in moisture content, that spacing may range from 0–5 mm during service. The preferred dimension for gaps is 3 mm (which is in line with other 'permissible gaps') in other parts of this Standard. It should be noted that recent research studies have shown that gaps at 5 mm spacing afford opportunity for embers to become lodged in between timbers, which may contribute to a fire. Larger gap spacings of 10 mm may preclude this from happening but such a spacing regime may not be practical for a timber deck.*

5.7.2 Enclosed subfloor spaces of verandas, decks, steps, ramps and landings

5.7.2.1 *Materials to enclose a subfloor space*

This Standard does not provide construction requirements for the materials used to enclose a subfloor space except where those materials are less than 400 mm from the ground.

Where the materials used to enclose a subfloor space are less than 400 mm from the ground, they shall comply with Clause 5.4.

5.7.2.2 *Supports*

This Standard does not provide construction requirements for support posts, columns, stumps, stringers, piers and poles.

5.7.2.3 *Framing*

This Standard does not provide construction requirements for the framing of verandas, decks, ramps or landings (i.e., bearers and joists).

5.7.2.4 *Decking*

This Standard does not provide construction requirements for decking that is more than 300 mm from a glazed element.

Decking less than 300 mm (measured horizontally at deck level) from glazed elements that are less than 400 mm (measured vertically) from the surface of the deck (see Figure D2, Appendix D) shall be made from—

(a) non-combustible material; or

(b) bushfire-resisting timber (see Appendix F); or

(c) a timber species, as specified in Paragraph E1 and listed in Table E1 of Appendix E;

(d) PVC-U; or

(e) a combination of any of Items (a), (b), (c) or (d) above.

5.7.3 Unenclosed subfloor spaces of verandas, decks, steps, ramps and landings

5.7.3.1 *Supports*

This Standard does not provide construction requirements for support posts, columns, stumps, stringers, piers and poles.

5.7.3.2 *Framing*

This Standard does not provide construction requirements for the framing of verandas, decks, ramps or landings (i.e., bearers and joists).

5.7.3.3 *Decking*

This Standard does not provide construction requirements for decking unless it is less than 300 mm from a glazed element.

Decking less than 300 mm (measured horizontally at deck level) from glazed elements that are less than 400 mm (measured vertically) from the surface of the deck (see Figure D2, Appendix D) shall be made from—

(a) non-combustible material; or

(b) bushfire-resisting timber (see Appendix F); or

(c) a timber species, as specified in Paragraph E1 and listed in Table E1, Appendix E; or

(d) a combination of any of Items (a), (b) or (c) above.

5.7.4 Balustrades, handrails or other barriers

This Standard does not provide construction requirements for balustrades, handrails and other barriers.

5.8 WATER AND GAS SUPPLY PIPES

Above-ground, exposed water and gas supply pipes shall be metal.

SECTION 6 CONSTRUCTION FOR BUSHFIRE ATTACK LEVEL 19 (BAL — 19)

6.1 GENERAL

A building assessed in Section 2 as being BAL—19 shall comply with Section 3 and Clauses 6.2 to 6.8.

NOTE: There are a number of Standards that specify requirements for construction; however, where this Standard does not provide construction requirements for a particular element, the other Standards apply.

Any element of construction or system that satisfies the test criteria of AS 1530.8.1 may be used in lieu of the applicable requirements contained in Clauses 6.2 to 6.8 (see Clause 3.8).

NOTE: BAL—19 is primarily concerned with protection from ember attack and radiant heat greater than 12.5 kW/m2 up to and including 19 kW/m2.

6.2 SUBFLOOR SUPPORTS

This Standard does not provide construction requirements for subfloor support posts, columns, stumps, piers and poles.

NOTE: The exclusion of requirements for subfloor supports applies to the principal building only and not to verandas, decks, steps, ramps and landings (see Clause 6.7).

C6.2 Ideally, storage of combustible materials beneath a floor at this BAL would not occur and on this assumption, there is no requirement to enclose the subfloor space or to protect flooring materials from bushfire attack. However, should combustible materials be stored, it is recommended the area be protected as materials stored in the subfloor space may be ignited by embers and cause an impact to the building.

6.3 FLOORS

6.3.1 Concrete slabs on the ground

This Standard does not provide construction requirements for concrete slabs on ground.

6.3.2 Elevated floors

This Standard does not provide construction requirements for elevated floors, including bearers, joists and flooring.

6.4 EXTERNAL WALLS

6.4.1 Walls

That part of an external wall surface that is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18

degrees to the horizontal and extending more than 110 mm in width from the wall (see Figure D3, Appendix D) shall be made from—

(a) non-combustible material; or

(b) fibre-cement external cladding, a minimum of 6 mm in thickness; or

(c) bushfire-resisting timber (see Appendix F); or

(d) a timber species, as specified in Paragraph E1 and listed in Table E1, Appendix E; or

(e) a combination of any of Items (a), (b), (c) or (d) above.

This Standard does not provide construction requirements for external wall surfaces 400 mm or more from the ground or for external wall surfaces 400 mm or more above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the wall (see Figure D3, Appendix D).

6.4.2 Joints

All joints in the external surface material of walls shall be covered, sealed, overlapped, backed or butt-jointed to prevent gaps greater than 3 mm.

Alternatively, sarking-type material may be applied over the outer face of the frame prior to fixing any external cladding.

6.4.3 Vents and weepholes

Vents and weepholes in external walls shall be screened with mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium, except where they are less than 3 mm (see Clause 3.6), or are located in an external wall of a subfloor space.

6.5 EXTERNAL GLAZED ELEMENTS AND ASSEMBLIES AND EXTERNAL DOORS

6.5.1 Bushfire shutters

Where fitted, bushfire shutters shall comply with Clause 3.7 and be made from—

(a) non-combustible material; or

(b) a timber species, as specified in Paragraph E1 and listed in Table E1, Appendix E; or

(c) bushfire-resisting timber (see Appendix F); or

(d) a combination of any of Items (a), (b), or (c) above.

6.5.2 Windows

Window assemblies shall comply with one of the following:

(a) They shall be completely protected by a bushfire shutter that complies with Clause 6.5.1.

or

(b) They shall be completely protected externally by screens with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

or

(c) They shall comply with the following:

(i) For window assemblies less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings, having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the window frame (see Figure D3, Appendix D), window frames and window joinery, shall be made from one of the following:

(A) Bushfire-resisting timber (see Appendix F).

or

(B) A timber species, as specified in Paragraph E2 and listed in Table E2, Appendix E.

or

(C) Metal.

or

(D) Metal-reinforced PVC-U. The reinforcing members shall be made from aluminium, stainless steel, or corrosion-resistant steel and the frame and the sash shall satisfy the design load, performance and structural strength of the member.

(ii) Externally fitted hardware that supports the sash in its functions of opening and closing, shall be metal.

(iii) Where glazing is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings, having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the window frame (see Figure D3, Appendix D), the glazing shall be toughened glass, minimum 5 mm, or glass blocks with no restriction on glazing methods.

NOTE: Where double-glazed units are used, the above requirements apply to the external face of the window assembly only.

(iv) Where glazing is other than that specified in Item (iii) above, annealed glass may be used. Where annealed glass is used, the fixed and openable portions of windows shall be screened externally with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(v) Where toughened glass is used, the openable portions of windows shall be screened internally or externally with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(vi) Glazed elements that are designed to take internal screens shall use toughened glass and the openable portion shall be screened in such a way to have no gaps greater than 3 mm in diameter. Screening material shall be a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

6.5.3 Doors—Side-hung external doors (including French doors, panel fold and bi-fold doors)

Side-hung external doors, including French doors, panel fold and bi-fold doors, shall comply with one of the following:

(a) They shall be protected by a bushfire shutter that complies with Clause 6.5.1.

or

(b) They shall be completely protected externally by screens with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

or

(c) They shall comply with the following:

(i) Doors shall be—

(A) non-combustible; or

(B) a solid timber door, having a minimum thickness of 35 mm for the first 400 mm above the threshold; or

(C) a door, including a hollow core door, with a non-combustible kickplate on the outside for the first 400 mm above the threshold; or

(D) a fully-framed glazed door, where the framing is made from materials specified for bushfire shutters (see Clause 6.5.1).

(ii) Where doors incorporate glazing, the glazing shall be toughened glass minimum 5 mm.

(iii) Doors shall be tight-fitting to the doorframe and to an abutting door, if applicable.

(iv) Where the doorframe is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the door (see Figure D3, Appendix D) the doorframe shall be made from one of the following:

(A) Bushfire-resisting timber (see Appendix F).

or

(B) A timber species, as specified in Paragraph E2 and listed in Table E2, Appendix E.

or

(C) Metal.

or

(D) Metal-reinforced PVC-U. The reinforcing members shall be made from aluminium, stainless steel, or corrosion-resistant steel and the door assembly shall satisfy the design load, performance and structural strength of the member.

(v) Weather strips, draught excluders or draught seals shall be installed at the base of side-hung external doors.

6.5.4 Doors—Sliding doors

Sliding doors shall comply with one of the following:

(a) They shall be completely protected by a bushfire shutter that complies with Clause 6.5.1.

or

(b) They shall be completely protected externally by screens with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

or

(c) They shall comply with the following:

(i) Any glazing incorporated in sliding doors shall be toughened glass, minimum 5 mm.

(ii) There is no requirement to screen the openable part of the sliding door. However, if screened, the screens shall be mesh or perforated sheet made of corrosion-resistant steel, bronze or aluminium.

NOTE: The construction of manufactured sliding doors should prevent the entry of embers when the door is closed. There is no requirement to provide screens to the openable part of these doors as it is assumed that a sliding door will be closed if occupants are not present or during a bushfire event. Screens of materials other than those specified may not resist ember attack.

(iii) Sliding doors shall be tight-fitting in the frames.

6.5.5 Doors—Vehicle access doors (garage doors)

The following apply to vehicle access doors:

(a) The lower portion of a vehicle access door that is within 400 mm of the ground when the door is closed (see Figure D4, Appendix D) shall be made from—

(i) non-combustible material; or

(ii) bushfire-resisting timber (see Appendix F); or

(iii) fibre-cement sheet, a minimum of 6 mm in thickness; or

(iv) a timber species, as specified in Paragraph E1 and listed in Table E1, Appendix E; or

(v) a combination of any of Items (i), (ii), (iii) or (iv) above.

(b) Panel lift, tilt doors or side-hung doors shall be fitted with suitable weather strips, draught excluders, draught seals or guide tracks, as appropriate to the door type, with a maximum gap no greater than 3 mm.

(c) Roller doors shall have guide tracks with a maximum gap no greater than 3 mm and shall be fitted with a nylon brush that is in contact with the door (see Figure D4, Appendix D).

(d) Vehicle access doors shall not include ventilation slots.

6.6 ROOFS (INCLUDING VERANDA AND ATTACHED CARPORT ROOFS, PENETRATIONS, EAVES, FASCIAS, GABLES, GUTTERS AND DOWNPIPES)

6.6.1 General

The following apply to all types of roofs and roofing systems:

(a) Roof tiles, roof sheets and roof-covering accessories shall be non-combustible.

(b) The roof/wall junction shall be sealed, to prevent openings greater than 3 mm, either by the use of fascia and eaves linings or by sealing between the top of the wall and the underside of the roof and between the rafters at the line of the wall.

(c) Roof ventilation openings, such as gable and roof vents, shall be fitted with ember guards made of non-combustible material or a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

6.6.2 Tiled roofs

Tiled roofs shall be fully sarked. The sarking shall—

(a) have a flammability index of not more than 5, when tested to AS 1530.2;

(b) be located directly below the roof battens;

(c) cover the entire roof area including the ridge; and

(d) be installed so that there are no gaps that would allow the entry of embers where the sarking meets fascias, gutters, valleys and the like.

6.6.3 Sheet roofs

Sheet roofs shall—

(a) be fully sarked in accordance with Clause 6.6.2, except that foil-backed insulation blankets may be installed over the battens;

or

(b) have any gaps greater than 3 mm under corrugations or ribs of sheet roofing and between roof components sealed at the fascia or wall line and at valleys, hips and ridges by—

(i) a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium; or

(ii) mineral wool; or

(iii) other non-combustible material; or

(iv) a combination of any of Items (i), (ii), or (iii) above.

6.6.4 Veranda, carport and awning roofs

The following apply to veranda, carport and awning roofs:

(a) A veranda, carport or awning roof forming part of the main roof space [see Figure D1(a), Appendix D] shall meet all the requirements for the main roof, as specified in Clauses 6.6.1, 6.6.2, 6.6.3, 6.6.5 and 6.6.6.

(b) A veranda, carport or awning roof separated from the main roof space by an external wall [see Figures D1(b) and D1(c), Appendix D] complying with Clause 6.4 shall have a non-combustible roof covering.

NOTE: There is no requirement to line the underside of a veranda, carport or awning roof that is separate from the main roof space.

6.6.5 Roof penetrations

The following apply to roof penetrations:

(a) Roof penetrations, including roof lights, roof ventilators, roof-mounted evaporative cooling units, aerials, vent pipes and supports for solar collectors shall be adequately sealed at the roof to prevent gaps greater than 3 mm. The material used to seal the penetration shall be non-combustible.

(b) Openings in vented roof lights, roof ventilators or vent pipes shall be fitted with ember guards made from a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(c) All overhead glazing shall be Grade A laminated safety glass complying with AS 1288.

(d) Glazed elements in roof lights and skylights may be of polymer provided a Grade A safety glass diffuser, complying with AS 1288, is installed under the glazing. Where glazing is an insulating glazing unit (IGU), Grade A toughened safety glass of minimum 4 mm shall be used in the outer pane of the IGU.

(e) Flashing elements of tubular skylights may be of a fire-retardant material, provided the roof integrity is maintained by an under-flashing of a material having a flammability index no greater than 5.

(f) Evaporative cooling units shall be fitted with butterfly closers at or near the ceiling level, or the unit shall be fitted with non-combustible covers with a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

6.6.6 Eaves linings, fascias and gables

The following apply to eaves linings, fascias and gables:

(a) Gables shall comply with Clause 6.4.

(b) Eaves penetrations shall be protected the same as for roof penetrations, as specified in Clause 6.6.5.

(c) Eaves ventilation openings greater than 3 mm shall be fitted with ember guards made of non-combustible material or a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

Joints in eaves linings, fascias and gables may be sealed with plastic joining strips or timber storm moulds.

This Standard does not provide construction requirements for fascias, bargeboards and eaves linings.

6.6.7 Gutters and downpipes

This Standard does not provide material requirements for—

(a) gutters, with the exception of box gutters; and

(b) downpipes.

If installed, gutter and valley leaf guards shall be non-combustible.

Box gutters shall be non-combustible and flashed at the junction with the roof with non-combustible material.

6.7 VERANDAS, DECKS, STEPS, RAMPS AND LANDINGS

6.7.1 General

Decking shall be either spaced or continuous (i.e., without spacings).

There is no requirement to enclose the subfloor spaces of verandas, decks, steps, ramps or landings.

C6.7.1 Spaced decking is nominally spaced at 3 mm (in accordance with standard industry practice); however, due to the nature of timber decking with seasonal changes in moisture content, that spacing may range from 0–5 mm during service. The preferred dimension for gaps is 3 mm (which is in line with other ‘permissible gaps’) in other parts of this Standard. It should be noted that recent research studies have shown that gaps at 5 mm spacing afford opportunity for embers to become lodged in between timbers, which may contribute to a fire. Larger gap spacings of 10 mm may preclude this from happening but such a spacing regime may not be practical for a timber deck.

6.7.2 Enclosed subfloor spaces of verandas, decks, steps, ramps and landings

6.7.2.1 *Materials to enclose a subfloor space*

This Standard does not provide construction requirements for the materials used to enclose a subfloor space except where those materials are less than 400 mm from the ground.

Where the materials used to enclose a subfloor space are less than 400 mm from the ground, they shall comply with Clause 6.4.

6.7.2.2 *Subfloor supports*

This Standard does not provide construction requirements for subfloor support posts, columns, stumps, stringers, piers and poles.

6.7.2.3 *Framing*

This Standard does not provide construction requirements for the framing of verandas, decks, ramps or landings (i.e., bearers and joists).

6.7.2.4 *Decking*

This Standard does not provide construction requirements for decking that is more than 300 mm from a glazed element.

Decking less than 300 mm (measured horizontally at deck level) from glazed elements that are less than 400 mm (measured vertically) from the surface of the deck (see Figure D2, Appendix D) shall be made from—

(a) non-combustible material; or

(b) bushfire-resisting timber (see Appendix F); or

(c) a timber species, as specified in Paragraph E1 and listed in Table E1, Appendix E; or

(d) a combination of any of Items (a), (b), or (c) above.

6.7.3 Unenclosed subfloor spaces of verandas, decks, steps, ramps and landings

6.7.3.1 *Supports*

This Standard does not provide construction requirements for support posts, columns, stumps, stringers, piers and poles.

6.7.3.2 *Framing*

This Standard does not provide construction requirements for the framing of verandas, decks, ramps or landings (i.e., bearers and joists).

6.7.3.3 *Decking*

This Standard does not provide construction requirements for decking that is more than 300 mm from a glazed element.

Decking less than 300 mm (measured horizontally at deck level) from glazed elements that are less than 400 mm (measured vertically) from the surface of the deck (see Figure D2, Appendix D) shall be made from—

(a) non-combustible material; or

(b) bushfire-resisting timber (see Appendix F); or

(c) a timber species, as specified in Paragraph E1 and listed in Table E1, Appendix E; or

(d) a combination of any of Items (a), (b), or (c) above.

6.7.4 Balustrades, handrails or other barriers

This Standard does not provide construction requirements for balustrades, handrails and other barriers.

6.8 WATER AND GAS SUPPLY PIPES

Above-ground, exposed water and gas supply pipes shall be metal.

SECTION 7 CONSTRUCTION FOR BUSHFIRE ATTACK LEVEL 29 (BAL — 29)

7.1 GENERAL

A building assessed in Section 2 as being BAL—29 shall comply with Section 3 and Clauses 7.2 to 7.8.

NOTE: There are a number of Standards that specify requirements for construction; however, where this Standard does not provide construction requirements for a particular element, the other Standards apply.

Any element of construction or system that satisfies the test criteria of AS 1530.8.1 may be used in lieu of the applicable requirements contained in Clauses 7.2 to 7.8 (see Clause 3.8).

NOTE: BAL—29 is primarily concerned with protection from ember attack and radiant heat greater than 19 kW/m2 up to and including 29 kW/m2.

7.2 SUBFLOOR SUPPORTS

This Standard does not provide construction requirements for subfloor supports where the subfloor space is enclosed with—

(a) a wall that complies with Clause 7.4; or

(b) a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium; or

(c) a combination of Items (a) and (b) above.

Where the subfloor space is unenclosed, the support posts, columns, stumps, piers and poles shall be—

(i) of non-combustible material; or

(ii) of bushfire-resisting timber (see Appendix F); or

(iii) a combination of Items (i) and (ii) above.

NOTE: This requirement applies to the principal building only and not to verandas, decks, steps, ramps and landings (see Clause 7.7).

C7.2 Combustible materials stored in the subfloor space may be ignited by embers and cause an impact to the building.

7.3 FLOORS

7.3.1 Concrete slabs on ground

This Standard does not provide construction requirements for concrete slabs on ground.

7.3.2 Elevated floors

7.3.2.1 *Enclosed subfloor space*

This Standard does not provide construction requirements for elevated floors, including bearers, joists and flooring, where the subfloor space is enclosed with—

(a) a wall that complies with Clause 7.4; or

(b) a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium; or

(c) a combination of Items (a) and (b) above.

7.3.2.2 *Unenclosed subfloor space*

Where the subfloor space is unenclosed, flooring material, including bearers, joists and flooring less than 400 mm above finished ground level, shall be—

(a) non-combustible (e.g., concrete, steel); or

(b) of bushfire-resisting timber (see Appendix F); or

(c) particleboard or plywood flooring where the underside is lined with sarking-type material or mineral wool insulation; or

(d) a system complying with AS 1530.8.1; or

(e) a combination of any of Items (a), (b), (c) or (d) above.

This Standard does not provide construction requirements for elements of elevated floors, including bearers, joists and flooring, if the underside of the element is 400 mm or more above finished ground level.

7.4 EXTERNAL WALLS

7.4.1 Walls

Walls shall be one of the following:

(a) Made of non-combustible material (e.g., full masonry, brick veneer, mud brick, concrete, aerated concrete).

or

(b) Made of timber-framed or steel-framed walls that are sarked on the outside of the frame and clad with—

(i) fibre-cement external cladding, a minimum of 6 mm in thickness; or

(ii) steel sheet; or

(iii) bushfire-resisting timber (see Appendix F); or

(iv) a combination of any of Items (i), (ii) or (iii) above.

or

(c) A combination of Items (a) and (b) above.

7.4.2 Joints

All joints in the external surface material of walls shall be covered, sealed, overlapped, backed or butt-jointed to prevent gaps greater than 3 mm.

Alternatively, sarking-type material can be applied over the frame prior to fixing any external cladding.

7.4.3 Vents and weepholes

Vents and weepholes in external walls shall be screened with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium, except where they are less than 3 mm (see Clause 3.6).

7.5 EXTERNAL GLAZED ELEMENTS AND ASSEMBLIES AND EXTERNAL DOORS

7.5.1 Bushfire shutters

Where fitted, bushfire shutters shall comply with Clause 3.7 and be made from—

(a) non-combustible material; or

(b) bushfire-resisting timber (see Appendix F); or

(c) a combination of Items (a) and (b) above.

7.5.2 Windows

Windows shall comply with one of the following:

(a) They shall be completely protected by a bushfire shutter that complies with Clause 7.5.1.

or

(b) They shall comply with the following:

(i) Window frames and window joinery and shall be made from one of the following:

(A) Bushfire-resisting timber (see Appendix F).

or

(B) Metal.

or

(C) Metal-reinforced PVC-U. The reinforcing members shall be made from aluminium, stainless steel, or corrosion-resistant steel, and the frame and the sash shall satisfy the design load, performance and structural strength of the member.

(ii) Externally fitted hardware that supports the sash in its functions of opening and closing shall be metal.

(iii) Glazing shall be toughened glass minimum 5 mm.

(iv) Where glazing is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the window frame (see Figure D3, Appendix D) that portion shall be screened with a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(v) The openable portions of windows shall be screened with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

7.5.3 Doors—Side-hung external doors (including French doors, panel fold and bi-fold doors)

Side-hung external doors, including French doors, panel fold and bi-fold doors, shall comply with one of the following:

(a) They shall be protected by a bushfire shutter that complies with Clause 7.5.1.

or

(b) They shall be completely protected externally by screens with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium

or

(c) They shall comply with the following:

(i) Doors shall be—

(A) non-combustible; or

(B) a solid timber door, having a minimum thickness of 35 mm for the first 400 mm above the threshold; or

(C) a door, including a hollow core door, protected on the outside by a screen door or a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium; or

(D) a fully framed glazed door, where the framing is made from non-combustible materials or from bushfire-resisting timber (see Appendix F).

(ii) Externally fitted hardware that supports the panel in its functions of opening and closing shall be metal.

(iii) Where doors incorporate glazing, the glazing shall be toughened glass, minimum 5 mm.

(iv) Where glazing is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the door (see Figure D3, Appendix D), that portion shall be screened with a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(v) Doorframes shall be made from one of the following:

(A) Bushfire-resisting timber (see Appendix F).

or

(B) Metal.

or

(C) Metal-reinforced PVC-U. The reinforcing members shall be made from aluminium, stainless steel, or corrosion-resistant steel and the door assembly shall satisfy the design load, performance and structural strength of the member.

(vi) Doors shall be tight-fitting to the doorframe and to an abutting door, if applicable.

(vii) Weather strips, draught excluders or draught seals shall be installed at the base of side-hung external doors.

7.5.4 Doors—Sliding doors

Sliding doors shall comply with one of the following:

(a) They shall be protected by a bushfire shutter that complies with Clause 7.5.1.

or

(b) They shall be completely protected externally by screens with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

or

(c) They shall comply with the following:

(i) Doorframes shall be of bushfire-resisting timber (see Appendix F) or aluminium or steel.

(ii) Externally fitted hardware that supports the panel in its functions of opening and closing shall be metal.

(iii) Where sliding doors incorporate glazing, the glazed assembly shall be toughened glass minimum 6 mm except where both the fixed and openable portions of doors are screened by a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(iv) Sliding doors shall be tight-fitting in the frames.

7.5.5 Doors—Vehicle access doors (garage doors)

The following apply to vehicle access doors:

(a) Vehicle access doors shall be made from—

(i) non-combustible material; or

(ii) bushfire-resisting timber (see Appendix F); or

(iii) fibre-cement sheet, a minimum of 6 mm in thickness; or

(iv) a combination of any of Items (i), (ii) or (iii) above.

(b) Panel lift, tilt doors or side-hung doors shall be fitted with suitable weather strips, draught excluders, draught seals or guide tracks, as appropriate to the door type, with a maximum gap no greater than 3 mm.

(c) Roller doors shall have guide tracks with a maximum gap no greater than 3 mm and shall be fitted with a nylon brush that is in contact with the door (see Figure D4, Appendix D).

(d) Vehicle access doors shall not include ventilation slots.

7.6 ROOFS (INCLUDING VERANDA AND ATTACHED CARPORT ROOFS, PENETRATIONS, EAVES, FASCIAS, GABLES, GUTTERS AND DOWNPIPES)

7.6.1 General

The following apply to all types of roofs and roofing systems:

(a) Roof tiles, roof sheets and roof-covering accessories shall be non-combustible.

(b) The roof/wall junction shall be sealed, to prevent openings greater than 3 mm, either by the use of fascia and eaves linings or by sealing between the top of the wall and the underside of the roof and between the rafters at the line of the wall.

(c) Roof ventilation openings, such as gable and roof vents, shall be fitted with ember guards made of non-combustible material or a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(d) A pipe or conduit that penetrates the roof covering shall be non-combustible.

7.6.2 Tiled roofs

Tiled roofs shall be fully sarked. The sarking shall—

(a) have a flammability index of not more than 5, when tested to AS 1530.2;

(b) be located directly below the roof battens;

(c) cover the entire roof area including the ridge; and

(d) extend into gutters and valleys.

7.6.3 Sheet roofs

Sheet roofs shall—

(a) be fully sarked in accordance with Clause 7.6.2, except that foil-backed insulation blankets may be installed over the battens;

or

(b) have any gaps greater than 3 mm under corrugations or ribs of sheet roofing and between roof components sealed at the fascia or wall line and at valleys, hips and ridges by—

(i) a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium; or

(ii) mineral wool; or

(iii) other non-combustible material; or

(iv) a combination of any of Items (i), (ii) or (iii) above.

7.6.4 Veranda, carport and awning roofs

The following apply to veranda, carport and awning roofs:

(a) A veranda, carport or awning roof forming part of the main roof space [see Figure D1(a), Appendix D] shall meet all the requirements for the main roof, as specified in Clauses 7.6.1, 7.6.2, 7.6.3, 7.6.5 and 7.6.6.

(b) A veranda, carport or awning roof separated from the main roof space by an external wall [see Figures D1(b) and D1(c), Appendix D] complying with Clause 7.4 shall have a non-combustible roof covering and the support structure shall be—

(i) of non-combustible material; or

(ii) bushfire-resisting timber (see Appendix F); or

(iii) timber rafters lined on the underside with fibre-cement sheeting a minimum of 6 mm in thickness, or with material complying with AS 1530.8.1; or

(iv) a combination of any of Items (i), (ii) or (iii) above.

7.6.5 Roof penetrations

The following apply to roof penetrations:

(a) Roof penetrations, including roof lights, roof ventilators, roof-mounted evaporative cooling units, aerials, vent pipes and supports for solar collectors, shall be adequately sealed at the roof to prevent gaps greater than 3 mm. The material used to flash the penetration shall be non-combustible.

(b) Openings in vented roof lights, roof ventilators or vent pipes shall be fitted with ember guards made from a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(c) All overhead glazing shall be Grade A laminated safety glass complying with AS 1288.

(d) Glazed elements in roof lights and skylights may be of polymer provided a Grade A safety glass diffuser, complying with AS 1288, is installed under the glazing. Where glazing is an insulating glazing unit (IGU), Grade A toughened safety glass, minimum 4 mm, shall be used in the outer pane of the IGU.

(e) Where roof lights are installed in roofs having a pitch of less than 18 degrees to the horizontal, the glazing shall be protected with ember guards made from a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(f) Evaporative cooling units shall be fitted with butterfly closers at or near the ceiling level, or the unit shall be fitted with non-combustible covers with a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

7.6.6 Eaves linings, fascias and gables

The following apply to eaves linings, fascias and gables:

(a) Joints in eaves linings, fascias and gables may be sealed with plastic joining strips or timber storm moulds.

(b) Gables shall comply with Clause 7.4.

(c) Fascias and bargeboards shall—

(i) where timber is used, be made from bushfire-resisting timber (see Appendix F); or

(ii) where made from metal, be fixed at 450 mm centres; or

(iii) be a combination of Items (i) and (ii) above.

(d) Eaves linings shall be—

(i) fibre-cement sheet, a minimum 4.5 mm in thickness; or

(ii) bushfire-resisting timber (see Appendix F); or

(iii) a combination of Items (i) and (ii) above.

(e) Eaves penetrations shall be protected the same as for roof penetrations (see Clause 7.6.5).

(f) Eaves ventilation openings greater than 3 mm shall be fitted with ember guards made of non-combustible material or a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

7.6.7 Gutters and downpipes

This Standard does not provide construction-specific material requirements for downpipes.

If installed, gutter and valley leaf guards shall be non-combustible.

With the exception of box gutters, gutters shall be metal or PVC-U.

Box gutters shall be non-combustible and flashed at the junction with the roof, with non-combustible materials.

7.7 VERANDAS, DECKS, STEPS, RAMPS AND LANDINGS

7.7.1 General

Decking shall be either spaced or continuous (i.e., without spacing).

There is no requirement to enclose the subfloor spaces of verandas, decks, steps, ramps or landings.

C7.7.1 Spaced decking is nominally spaced at 3 mm (in accordance with standard industry practice); however, due to the nature of timber decking with seasonal changes in moisture content, that spacing may range from 0–5 mm during service. The preferred dimension for gaps is 3 mm (which is in line with other ‘permissible gaps’) in other parts of this Standard. It should be noted that recent research studies have shown that gaps at 5 mm spacing afford opportunity for embers to become lodged in between timbers, which may contribute to a fire. Larger gap spacings of 10 mm may preclude this from happening but such a spacing regime may not be practical for a timber deck.

7.7.2 Enclosed subfloor spaces of verandas, decks, steps, ramps and landings

7.7.2.1 *Materials to enclose a subfloor space*

The subfloor spaces of verandas, decks, steps, ramps and landings are considered to be ‘enclosed’ when—

(a) the material used to enclose the subfloor space is—

(i) non-combustible; or

(ii) bushfire-resisting timber (see Appendix F); or

(iii) a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium; or

(iv) a combination of any of Items (i), (ii) or (iii) above; and

(b) all openings greater than 3 mm are screened with a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

7.7.2.2 *Supports*

This Standard does not provide construction requirements for support posts, columns, stumps, stringers, piers and poles.

7.7.2.3 *Framing*

This Standard does not provide construction requirements for the framing of verandas, decks, ramps or landings (i.e., bearers and joists).

7.7.2.4 *Decking*

Decking shall be—

(a) of non-combustible material; or

(b) of bushfire-resisting timber (see Appendix F); or

(c) a combination of Items (a) and (b) above.

7.7.3 Unenclosed subfloor spaces of verandas, decks, steps, ramps and landings

7.7.3.1 *Supports*

Support posts, columns, stumps, stringers, piers and poles shall be—

(a) of non-combustible material; or

(b) of bushfire-resisting timber (see Appendix F); or

(c) a combination of Items (a) and (b) above.

7.7.3.2 *Framing*

Framing of verandas, decks, ramps or landings (i.e., bearers and joists) shall be—

(a) of non-combustible material; or

(b) of bushfire-resisting timber (see Appendix F); or

(c) a combination of Items (a) and (b) above.

7.7.3.3 *Decking*

Decking shall be—

(a) of non-combustible material; or

(b) of bushfire-resisting timber (see Appendix F); or

(c) a combination of Items (a) and (b) above.

7.7.4 Balustrades, handrails or other barriers

Those parts of the handrails and balustrades less than 125 mm from any glazing or any combustible wall shall be—

(a) of non-combustible material; or

(b) bushfire-resisting timber (see Appendix F); or

(c) a combination of Items (i) and (ii) above.

Those parts of the handrails and balustrades that are 125 mm or more from the building have no requirements.

7.8 WATER AND GAS SUPPLY PIPES

Above-ground, exposed water and gas supply pipes shall be metal.

Appendix 5
City of Rockingham fire control notice 2014–2014

Fire Control Notice

First and Final Notice (Under Section 33 of the *Bushfires Act 1954*)

NOTICE TO OWNERS AND/OR OCCUPIERS OF LAND IN THE CITY OF ROCKINGHAM

As a landowner or occupier you have a legal requirement under Section 33 of the *Bush Fires Act 1954* to carry out fire prevention work on your property in accordance with the provisions of this Fire Control Notice. Inspection of all properties will be carried out in all areas for compliance with this notice after 30 November. Persons who fail to comply with the requirements of this order will be issued with an infringement notice ($250).

It is the property owners' not the contractors who are responsible for the standard and quality of the fire prevention work undertaken and maintained as per this notice.

***BUSHFIRES ACT 1954* (as amended)**
Pursuant to the powers contained in Section 33 of the *Bushfires Act 1954* (as amended) you are hereby required, on or before 30 November 2013, to remove from land owned or occupied by you all flammable material or to clear firebreaks to mineral earth in accordance with the following and thereafter to maintain the land or the firebreaks clear of all flammable material up to and including 31 May 2014.

Correct Rural Firebreak

Incorrect Rural Firebreak

1. Rural Land
On or before 30 November 2013 and thereafter up until and including 31 May 2014.

1.1 Have FIREBREAKS not less than three (3) metres wide immediately inside and along all boundaries of land and including the land abutting road, rail and drain reserves and all public open space reserves, with all overhanging tree branches, tree limbs etc. to be trimmed back clear of the firebreak area to a height of four metres.

1.2 Have FIREBREAKS not less than three metres wide so far as to surround all buildings, sheds and haystacks, with all overhanging branches, trees, limbs etc. to be trimmed back clear of the firebreak area to a height of four metres.

2. Urban Areas (Vacant Land)
On or before 30 November 2013 and maintained until and including 31 May 2014.

2.1 Have the entire vacant land clear of all flammable material where the area of land is less than 2,000m^2 by SLASHING, MOWING or other means to a height no greater than 50mm.

2.2 Where the area of land exceeds 2,000m^2 have FIREBREAKS not less than three metres wide immediately inside and along all boundaries of the vacant land with all overhanging tree branches, trees, limbs etc. to be trimmed back clear of the firebreak area to a height of four metres.

3. Alternative Situations
Variation applications must be lodged in writing to the City of Rockingham by the third week in October each year.

An Application to Vary Location and Type of Firebreaks can be downloaded from the City's website or is available from the Emergency Services Administration Officer on 9527 0732.

4. Fire Management Plans
All properties within subdivisions/developments within the City of Rockingham shall comply with the Fire Management Plans for their estates to the satisfaction of Council or its duly authorised Officer.

5. Penalty
If you do not meet your responsibilities specified in this Notice you will be fined a minimum of $250 and be required to meet the cost of the City's efforts to make your property comply with the Fire Control Notice.

Fire Control Enquiries
8.30am – 4.30pm Monday to Friday
Phone: 9527 0732
Email: firecontrol@rockingham.wa.gov.au

www.rockingham.wa.gov.au

city of Rockingham
where the coast comes to life

Appendix 6
AFAC bush fire glossary

afac
Australasian Fire and Emergency Service Authorities Council

BUSHFIRE GLOSSARY

Prepared by Rural and Land Management Group for AFAC Agencies

January 2012

Disclaimer
While all possible care has been taken to ensure a comprehensive and accurate publication, the Australasian Fire Authorities Council and its servants or agents shall not be liable for technical or editorial errors contained herein or omissions there from; nor for incidental or consequential liability in any way resulting from the information or advice that is contained in this publication or use of that material.

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January 2012

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Preface

The AFAC Bushfire Glossary has been developed to promote an exchange of information between member agencies on terminology used specifically in bushfires.

The Glossary has been developed based on a set of agreed business rules. It includes the bushfire technical terms, their definition or description as adopted and applied by the AFAC member agencies. It does include some fire terms that are of a general industry wide nature for completeness. It excludes terms for which an agreed definition could not be reached by the member agencies.

This document is not designed to be a text book or to provide a discussion of a term beyond the definition/description of that term. Nor is it an attempt to modify or redefine terms defined in codes, standards or legislation. Terms that have been adopted for use by the fire management industry from another discipline will maintain the meaning ascribed to them in their originating discipline.

It is proposed that this Glossary will be reviewed regularly to ensure that it continues to be relevant and meets the needs of AFAC member agencies. This is the fifth review. It is the current 2012 version.

AFAC acknowledges the significant contribution of the Rural and Land Management Glossary Working Group lead by Greg Esnouf and Country Fire Authority staff, Matthew Fraser and Jo Richards, who contributed generously of their time and expertise in the establishment of this document and the work of the Genesis Institute to provide a framework for refining the glossary.

Previous versions of the Glossary were titled Wildfire Glossary. The term wildfire has been replaced with the term bushfire in line with a trend towards using language more accepted by the general public.

The terms appear in alphabetical order excluding spaces. In this way it is possible to find a compound word without knowing if it is one or two words.

Aim

The purpose of this Glossary is to seek to facilitate a greater understanding by using common language between bushfire and land management agencies and support organisations during the prevention of, preparedness for, response to and recovery from bushfires.

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Term	Definition
Accelerant	Any substance (such as oil, gasoline, etc) that is applied to a fuel-bed to expedite the burning process.
Adaptor	A fitting used to couple different sized hoses, hoses of the same size with different threads, or different types of couplings, or to connect the male to male, or female to female parts of the same type of coupling.
Adsorption	The taking in of water vapour from the air by dead plant material.
Advance burn	A prescribed fire that reduces fuel through a forest area before felling operations. It is intended to improve the safety of timber harvesting operations and as a silvicultural tool to protect lignotubers and standing trees.
Advancing fire	That portion of the fire with rapid fire spread and higher intensity which is normally burning with the wind and/or up slope.
Aerial detection	The discovering, locating and reporting of fires from aircraft.
Aerial fuel	See: Elevated fuel
Aerial ignition	Ignition of fuels by dropping incendiary devices or materials from aircraft.
Aerial ignition device (AID)	Inclusive term applied to equipment designed to ignite wildland fuels from an aircraft.
Aerial Observer	See: Air Observer
Aerial reconnaissance	Use of aircraft for detection of fires and observing fire behaviour, values-at-risk, suppression activity, and other critical factors to facilitate command decisions on strategy and tactics needed for fire suppression.
Aerosol	Airborne solid or liquid particles dispersed or suspended in a gas stream.
After action review (AAR)	A discussion, focused on performance standards, of an event that enables those involved to discover what happened, why it happened, and how to sustain strengths and improve on weaknesses. An After action review is a tool incident command personnel and units can use to get maximum benefit from every incident. It provides a review of the incident upon its completion to identify and discuss effective and non-effective performance and lessons learned and how to apply them in the future. (adapted from NWCG)
AIIMS structure	The combination of facilities, equipment, personnel, procedures, and communications operating within a common organisational structure with responsibility for the management of allocated resources to effectively accomplish stated objectives relating to an incident (AIIMS).
Air attack	The direct use of aircraft in the suppression of bushfires.
Air attack Supervisor	Primarily responsible for the safety and efficient tactical coordination of aircraft operations when fixed and/or rotary firebombing aircraft are operating at a fire (Air Attack Supervisor Training Manual).
Air base Manager	An experienced, trained person who is appointed to manage all the functions and personnel on an air base or helicopter base.
Air mass	A meteorological term referring to an extensive body of air within which the conditions of temperature and moisture in a horizontal plane are essentially uniform.
Air Observer	The primary role of the air observer is to aerially obtain intelligence to assist the planning of fire suppression operations (NSWRFS).
Air operations	The use of aircraft in support of an incident for the purposes of suppression, transportation of personnel, equipment or supplies, or for aerial reconnaissance.

Term	Definition
Air operations Manager	The air operations manager position is responsible for overall coordination of air operations and air support activities in support of an incident.
Aircraft Officer	The aircraft officer is responsible for ground operations and overall provision of support, enabling a safe and efficient air operation to be conducted.
Airside	The parts of an airport not normally open to unauthorised people. It comprises the apron, taxiways, runways and the areas containing them.
Allocated resources	Resources working at an incident (AIIMS).
Anchor point	An advantageous location, usually a barrier to fire spread, from which to start constructing a fireline. The anchor point is used to minimize the chance of being flanked by the fire while the line is being constructed (NWCG).
Aqueous film forming-foam (AFFF)	A synthetic amber coloured liquid concentrate mixed with water to form an agent that is capable of forming water-solution films on the surface of flammable liquids that prevent the escape of fuel vapours, excludes oxygen and maintain the surface when disturbed (self healing).
Area ignition	Ignition of several individual fires throughout an area, either simultaneously or in rapid succession, and so spaced that they add to and influence the main body of the fire to produce a hot, fast-spreading fire condition. Also called simultaneous ignition.
Area of origin	General location where the fire started.
Arson	The deliberate setting of a fire where the intent of the person responsible was to cause harm or destruction to life or property.
Aspect	The direction towards which a slope faces.
Asphyxiants	Substances which interfere with the respiratory process.
Assembly area	See Staging area.
Assessment	The process of determining if an individual has the prescribed skills, knowledge and experience needed to acquire a specific capability.
Assets	Anything valued by people which includes houses, crops, forests and, in many cases, the environment.
Assisting agency	An agency directly contributing suppression, support or service resources to another agency.
Atmospheric stability	The degree to which the atmosphere resists turbulence and vertical motion.
Attack time	See Elapsed time
Australasian Inter-service Incident Management System (AIIMS)	A nationally adopted structure to formalise a coordinated approach to emergency incident management.
Automatic dispatch	See Pre-planned dispatch.
Automatic weather station (AWS)	The Bureau's standard AWSs use sensors to monitor temperature, humidity, wind speed and direction, pressure and rainfall. Various advanced sensors are available for specialised applications. These sensors can monitor cloud height (ceilometer), visibility, present weather, thunderstorms, soil temperature (at a range of depths) and terrestrial temperature. (Developed from the BOM)
Available fuel	The portion of the total fuel that would actually burn under various environmental conditions.
Available resources	The resources at an incident and available for allocation at short notice. (AIIMS)

Term	Definition
Backburn	1. A fire started intentionally along the inner edge of a fireline during indirect attack operations to consume fuel in the path of a bushfire (Australia). 2. A counterfire commenced from within continuous fuel for the purpose of fighting a fire (New Zealand).
Back fire	See: Backburn (Preferred term).
Backing fire	The part of a fire which is burning back against the wind or down slope, where the flame height and rate of spread are reduced.
Bark fuel	The flammable bark on tree trunks and upper branches.
Bark heaps	Accumulations of bark and branch material resulting from timber harvesting operations. Soil may be mixed with bark heaps, but generally the heap is formed by a machine dropping fresh bark on the top of the heap.
Basal accumulation	Bark fallen from a tree and forming a relatively high and localized accumulation of fine fuel.
Base camp	A location where personnel are accommodated and fed for a period of time. A base camp usually contains catering, ablution and accommodation facilities, a water supply and a lighting system, and may include other facilities such as car parking maintenance and servicing. (AIIMS)
Bay(s)	A marked indentation (s) in the fire perimeter usually located between two fingers.
Beaufort wind scale	A system for estimating wind speeds based on observation of visible wind effects. A series of descriptions of visible wind effects upon land objects or sea surfaces is matched with a corresponding series of wind speed ranges, each being allocated a *Beaufort number.*
Blacking out	The process of extinguishing or removing burning material along or near the fire control line, felling stags, trenching logs to prevent rolling and the like, in order to make the fire safe.
Blackspot	An area where two-way radio coverage does not exist.
Blank cap	The metal cap used on delivery outlets and on the suction inlet of the pump to prevent discharge of water.
Blow down	See: Wind throw.
Blow up	Sudden increase in fireline intensity or rate of spread of a fire sufficient to preclude direct control or to upset existing suppression plans. Often accompanied by violent convection and may have other characteristics of a fire storm. (NWCG)
Bole	The trunk of a tree.
Bole damage	The damage to the trunk of a living tree by fire, mechanical equipment or disease.
Bracken	Bracken fern varies significantly in height and density. If Bracken is generally upright (either alive or dead) with the majority of its biomass in the top half of the plant and only the stems in touch with the ground, then it is considered to be part of the elevated fuel. If however, it has collapsed and most of its biomass is in touch with the ground, then it is considered to be Near-surface fuel.
Branch	A tapered pipe, fitted to the end of a hose line, which increases the velocity (converting pressure energy to kinetic energy) of the water or foam solution travelling through the hose, and forms an effective firefighting jet or spray.
Breakaway	The points at which a fire, after it has been contained, escapes into unburnt areas across a fireline or fire edge.

Term	Definition
Breeching	A device to divide one hose line into two or collect two hose lines into one.
Briefing	A general overview of an operation.
Broad area hazard reduction	Large scale removal of selected fuel before the onset of a bushfire danger period.
Broadcast burning	See: Prescribed burning (Preferred term)
Buffer	A strip or block of land on which the fuels are reduced to provide protection to surrounding lands.
Bulk water carrier	A large tanker used for replenishing water to firefighting tankers.
Burn back	See: Reburn (Preferred term).
Burning brands	Lofted burning material such as bark, usually flaming.
Burning conditions	The state of the combined components of the fire environment that influence fire behaviour and fire impact in a given fuel type. Usually specified in terms of such factors as fire weather elements, fire danger indices, fuel load and slope.
Burning off	Generally setting fire - with more or less regard to areas carrying unwanted vegetation such as rough grass, slash and other fuels.
Burning out	To intentionally light fires to consume islands of unburned fuel inside the fire perimeter.
Burning program	A program of prescribed burns scheduled these for a designated area over a nominated time, normally looking ahead over one fire season (for the coming spring to the following autumn), but can also look ahead five years or more.
Burning rotation	The period between burning of a prescribed area for management purposes.
Burning unit	A specified land area for which prescribed burning is planned.
Burn out	1. A fire set to consume islands of unburnt fuel inside the fire perimeter and between the fire edge and fireline (Australia). 2. A counterfire commenced from a natural or previously constructed firebreak for the purpose of fighting a fire (New Zealand).
Burn over	A section of fire that overruns personnel and/or equipment.
Burn plan	The plan which is approved for the conduct of prescribed burning. It contains a map identifying the area to be burnt and incorporates the specifications and conditions under which the operation is to be conducted.
Bushfire	Un planned vegetation fire. A generic term which includes grass fires, forest fires and scrub fires both with and without a suppression objective.
Bushfire danger period	A period of the year either established by legislation or declared by the relevant agency, when restrictions are placed on the use of fire due to dry vegetation and the existence of conditions conducive to the spread of fire.
Bushfire management	All those activities directed to prevention, detection, damage mitigation, and suppression of bushfires. Includes bushfire legislation, policy, administration, law enforcement, community education, training of fire fighters, planning, communications systems, equipment, research, and the multitude of field operations undertaken by land managers and emergency services personnel relating to bushfire control.
Byram-Keetch Drought index (BKDI)	See: Keetch-Byram Drought Index
Cache	A predetermined complement of supplies stored in a designated location. (CIMS).
Campaign fire	A fire normally of a size and/or complexity that requires substantial firefighting resources, and possibly several days or weeks to suppress.

Term	Definition
Candle (Candling)	A tree (or small clump of trees) is said to candle when its foliage ignites and flares up, usually from the bottom to top.
Candlebark	Long streamers of bark that have peeled from some eucalypt species that form fire brands conducive to very long distance spotting.
Canopy	The crowns of the tallest plants in a forest – the overstorey cover.
Canopy cover	Canopy cover refers to 2 dimensions (ie plan view, area coverage)
Canopy density	Canopy density refers to 3 dimensions (ie mass/volume)
Catastrophic fire danger	The highest fire danger rating as determined by fire agencies and generally with a Forest fire danger index greater than 100 or a Grassland fire danger index greater than 150.
Central ignition	A method of prescribed burning in which fires are set in the centre of an area to create a strong convective column. Additional fires are then set progressively closer to the outer control lines causing indraft winds to build up. This has the effect of drawing the fires towards the centre.
Chaining	The process of flattening vegetation (usually mallee or scrub) by dragging a heavy chain or cable between two large tractors or bulldozers.
Charged line	A line of fire hose filled with water under pressure and ready to use.
CIMS	Coordinated Incident Management System used in New Zealand.
Class A foam	See: Foam
Class labels	Class labels identify the type of hazardous material being stored or transported. These are grouped under broad classifications according to the predominant type of risk involved.
Climate	The atmospheric conditions of a place over an extended period of time.
Clinometer	An instrument used to measure the angle of a slope.
Cloud cover	The amount of sky covered or obscured by cloud, expressed in eighths. Eight eighths is complete cloud cover.
Coarse fuels	Dead woody material, greater than 25mm in diameter, in contact with the soil surface (fallen trees and branches). Some researchers categorise forest fuels as: fine <6 mm diameter; twigs 6-25 mm diameter; coarse >25 mm diameter.
Code of Practice	Document giving methods developed to assist compliance with acts and regulations in the performance of work.
Cold front	A cold front is the delineation between cold polar air moving towards the equator and undercutting warm tropical air moving poleward. The temperature differences across a cold front can be extreme and associated with strong winds. The warm tropical air is forced to rise and become unstable with the development of large cumuliform clouds. Severe weather such as thunderstorms, squall lines and severe turbulence may accompany these cold fronts. (BOM)
Cold trailing	A method of determining whether or not a fire is still burning, involving careful inspection and feeling with the hand, or by use of a hand-held infrared scanner, to detect any heat source.
Collecting head	A collecting head is used to collect (usually from two to four) lines into the suction inlet of a pump.
Combat agency/authority	See: Control authority
Combustion	Rapid oxidation of fuels producing heat, and often light.

Term	Definition
Command	The direction of members and resources of an agency in the performance of the agency's role and tasks. Authority to command is established in legislation or by agreement within an agency. Command relates to agencies and operates vertically within an agency.
Communications plan	Details the methods and systems for people to communicate with each other, the incident management structure, including the actual radio channels/mobile phone numbers. (AIIMS)
Compartment	(1) Forestry Definition – A basic administrative unit of a managed forest. (2) Building Definition - An enclosed space with floor, walls and ceiling.
Competency	Skills and knowledge and their application within an occupation to the standard of performance required in the workplace. (Vic report)
Conduction	The transfer of thermal energy between regions of matter due to temperature gradient.
Contained	The status of a wildfire suppression action signifying that a control line has been completed around the fire, and any associated spot fires, which can reasonably be expected to stop the fire's spread. (NWCG)
Contour lines	Contour lines connect points of equal elevation on a topographical map.
Control	The overall direction of response activities in an emergency situation. Authority for control is established in legislation or in an emergency response plan, and carries with it the responsibility for tasking and coordinating other agencies in accordance with the needs of the situation. Control relates to situations and operates horizontally across agencies.
Control authority	The agency, service, organization or authority with legislative responsibility for control of the incident. (Also referred to as the responsible authority or agency.) (AFAC)
Controlled	The stage during fire suppression activities at which the complete perimeter of a fire is secured and no breakaway is expected.
Controlled burning	See: Prescribed burning.
Control line	See: Fireline
Convection	1. As applied in meteorology, atmospheric motions that are predominantly vertical, resulting in vertical transport and mixing of atmospheric properties; distinguished from advection. 2. As applied in thermodynamics is a mechanism of heat transfer occurring because of the bulk movement of fluids.
Convection burn	See: Central ignition
Convection column	The rising column of smoke, ash, burning embers and other particle matter generated by a fire.
Convective activity	General term for manifestations of convection in the atmosphere, alluding particularly to the development of convective clouds and resulting weather phenomena, such as showers, thunderstorms, squalls, hail, and tornadoes. (NWCG)
Convergence zone	1. See: Junction zone. 2. In fire weather, that area where two winds come together from opposite directions and are forced upwards often creating clouds and precipitation. (NWCG)
Convoy	Two or more vehicles driving together under the control of a single Convoy Leader.

Term	Definition
Coordination	The bringing together of agencies and elements to ensure effective response to an incident or emergency. It is primarily concerned with the systematic acquisition and application of resources in accordance with the requirements imposed by the emergency or emergencies. Coordination relates primarily to resources and operates: • vertically, within an agency, as a function of the authority to command; • horizontally, across agencies, as a function of the authority to control.
Cordon	A cordon is the means to maintain an area and is used to restrict movement into and out of an area.
Coupe	A defined forest area in which timber harvesting takes place.
Crew	See: Fire crew.
Crew leader	Person responsible for the supervision and management of crews
Critical burnout time	Total time a fuel can burn and continue to feed energy to the base of a forward-travelling convection column.
Critical incident stress	Unusually strong emotional reactions which have the potential to interfere with the ability of personnel to function, either at the incident scene or later, arising from any situation faced during operations.
Critical incident stress debriefing	The process in which teams of professional and peer counsellors provide emotional and psychological support to incident personnel who are or have been involved in a critical (highly stressful) incident.
Cross bearings	Intersecting lines of sight from two or more points on the same object; used to determine the location of bushfire from lookouts.
Crown fire	A fire that advances from top to top of trees or shrubs.
Crown scorch	Browning of the needles or leaves in the crown of a tree or shrub caused by heat from a fire.
Crowning	A fire ascending into the crowns of trees and spreading from crown to crown.
Crowning potential	A probability that a crown fire may start, calculated from inputs of foliage moisture content and height of the lowest part of the tree crowns above the surface. (NWCG)
Curing	Drying and browning of herbaceous vegetation due to mortality or senescence.
Dead fuel	Fuels with no living tissue in which moisture content is governed almost entirely by absorption or evaporation of atmospheric moisture (relative humidity and precipitation). (NWCG)
Debrief	To gather information from the participants in an action so as to gauge the success or otherwise of the action at the end of the task, shift, tour or incident.
Deep-seated fire	A fire burning far below the surface in duff, mulch, peat, or other combustibles as contrasted with a surface fire.
Defensive strategy	A firefighting strategy used where the protection of life and assets is a priority when a fire is: (i) located in inaccessible or remote location OR (ii) too intense to be safely or effectively attacked directly.
Dehydration	Excessive loss of water from the body's tissues. Dehydration may follow any condition in which there is a rapid depletion of body fluids.
Delayed aerial ignition devices (DAID)	An incendiary device that will ignite after a predetermined time.

Term	Definition
Deliberate fire	A fire resulting from a person placing burning material to cause ignition. The intent of the person may have been to cause harm or destruction to life or property (arson-criminal offence) or to modify fuels and/or vegetation for land management purposes (summary offence). See also Arson.
Delivery hose	Hose used to transport water under pressure.
Delivery valve	On a pump, the valved outlet through which water is discharged.
Demobilisation	The orderly release of resources no longer required at an incident.
Depth of burn	The reduction in forest floor litter thickness (cm) due to consumption by fire. Most commonly used in connection with prescribed burning.
Desiccant	A chemical that, when applied to a living plant causes or accelerates the drying out of its aerial parts.
Desorption	The loss of moisture to the atmosphere from dead plant material.
Detection	The discovery of a fire. Individuals, fire towers, reconnaissance aircraft and automatic devices may be used, either alone or in combination.
Dew	The moisture which collects in small droplets on the surface of substances and vegetation by atmospheric condensation, chiefly at night.
Dew point temperature	This is a measure of the moisture content of the air and is the temperature to which air must be cooled in order for dew to form. The dew-point is generally derived theoretically from dry and wet-bulb temperatures, with a correction for the site's elevation. (BOM)
Dieback	The progressive dying, from the top downward, of twigs, branches or tree crowns.
Diffused pattern	A spray pattern (as opposed to straight stream) of water or foam.
Direct attack	A method of fire attack where wet or dry firefighting techniques are used. It involves suppression action right on the fire edge which then becomes the fireline.
Dispatch	The act of ordering attack crews and/or support units to respond to a fire, or from one place to another.
Division	A portion of the incident comprising of two or more sectors. The number of sectors grouped in a Division should be such as to ensure effective direction and control of operations. Divisions are generally identified by a local geographic name.
Dominant height	Mean height of the largest trees in a stand. A specified number per unit area are generally selected.
Downwind	Away from the wind direction. In the direction opposite to the direction from which the wind is blowing. The direction that smoke will travel.
Dozer	A crawler tractor fitted with a blade which can be transported to a fire on a tray truck or trailer. Dozer is a shortened form of "Bulldozer"
Dozer line	Fireline constructed by the front blade of a dozer.
Drain time	The time (minutes) it takes for foam solution to drop out from the foam mass; for a specified percent of the total solution contained in the foam to revert to liquid and drain out of the bubble structure.
Drift	The effect of wind on smoke or on a water drop.
Drip torch	A canister of flammable fuel fitted with a wand, a burner head and a fuel flow control device. It is used for lighting fires for prescribed burning, backburning and burning out.

Term	Definition
Drop pass	Indicates that the firefighting aircraft has the target in sight and will make a drop of fire control agent on this run over the target.
Drop pattern	The distribution of an aerially delivered fire control agent drop on the target area in terms of its length, width, and momentum (velocity x mass) as it approaches the ground. The latter determines the relative coverage level of the fire control agent on fuels within the pattern.
Drop zone (DZ)	Target area for firefighting aircraft, or cargo dropping.
Drought	Prolonged absence or marked deficiency of precipitation (rain). (BOM)
Drought index	A numerical value reflecting the dryness of soils, deep forest litter, logs and living vegetation.
Dry bulb temperature	Technically, the temperature registered by the dry-bulb thermometer of a psychrometer. However, it is identical to the temperature of the air. (Degrees Celsius). (NZ)
Dry firefighting	The suppression of a fire without the use of water. This is normally achieved by removing the fuel by the use of hand tools, burning or machinery.
Duff	The layer of decomposing vegetative matter on the forest floor below the litter layer, the original structure still being recognisable.
Ecological burning	A form of prescribed burning. Treatment with fire of vegetation in nominated areas to achieve specified ecological objectives.
Edge burning	A term used to describe perimeter burning of an area in mild conditions prior to large scale prescribed burning. This practice is used to strengthen buffers and to reduce mop-up operations.
Elevated fuel	The standing and supported combustibles not in direct contact with the ground and consisting mainly of foliage, twigs, branches, stems, bark and creepers.
Embers	Glowing particles cast from the fire (as ‘showers’ or ‘storms’). (Vic report)
Emergency centre	A facility where the coordination of the response and support to the incident is provided.
En route resources	Resources despatched to an incident that have not yet checked in. (AIIMS)
Entrapment	A situation in which individuals are exposed to life threatening or potentially life threatening conditions from which they cannot safely remove themselves.
Equilibrium moisture content (EMC)	The moisture content that a fuel element would attain if exposed for an infinite period in an environment of specified constant dry-bulb temperature and relative humidity. When a fuel element has reached its EMC, it neither gains nor loses moisture as long as conditions remain constant.
Equipment	All material supplied to an incident excluding personnel and vehicles.
Escape route	A planned route away from danger areas at a fire.
Evacuation	The temporary relocation of persons from dangerous or potentially dangerous areas to safe areas.

Term	Definition
Exposures	Parts of the same structure or other structures or property not directly involved in the fire but at risk of being burnt or damaged if the fire is not controlled. In the bushfire context: 1. Property that may be endangered by a fire burning in another structure or by a bushfire. In general, property within 12 metres of a fire may be considered to involve an exposure hazard, although in very large fires the danger may exist at much greater distances. 2. Direction in which a slope faces, usually with respect to cardinal directions (N, S, E, W). 3. The general surroundings of a site, with special reference to its openness to winds and sunshine.
Extinguishing agent	A substance used to put out a fire by cooling the burning material or blocking the supply of oxygen, or chemically inhibiting combustion or combinations of these mechanisms.
Extreme fire behaviour	A level of bushfire behaviour characteristics that ordinarily precludes methods of direct suppression action. One or more of the following is usually involved: • high rates of spread • prolific crowning and/or spotting • presence of fire whirls • a strong convective column. Predictability is difficult because such fires often exercise some degree of influence on their environment and behave erratically, sometimes dangerously.
Extreme fire danger	The second highest fire danger rating as determined by fire agencies and generally with a Forest fire danger index between 75 and 99 or a Grassland fire danger index greater between 100 and 149.
Facilities	Permanent and temporary facilities where personnel sleep, cook, maintain and repair equipment. (AIIMS)
Fall back fire control line	Any fire control line which is at a distance from the fire perimeter, and is the second control line at which the fire perimeter may be stopped should it cross the first fire control line. Also known as 'fallback line'.
Fine fuel	Fuel such as grass, leaves, bark and twigs less than 6mm in diameter that ignite readily and are burnt rapidly when dry.
Fingers	Long and narrow slivers of fire which extend beyond the head or flanks. (AFAC)
Fire	The chemical reaction between fuel, oxygen and heat. Heat is necessary to start the reaction and once ignited, fire produces its own heat and becomes self-supporting.
Fire access track	A track constructed and/or maintained expressly for fire management purposes.
Fire behaviour	The manner in which a fire reacts to the variables of fuel, weather and topography.
Fire Behaviour Analyst	Person responsible for developing fire behaviour predictions based on fire history, fuel, weather, and topography. (NWCG)amended
Fire behaviour model	A set of mathematical equations that can be used to predict certain aspects of fire behaviour.
Fire behaviour prediction	Prediction of probable fire behaviour usually prepared by a fire behaviour analyst in support of fire suppression or prescribed burning operations. (NWCG)
Fire behaviour prediction system	A system that uses a set of mathematical equations to predict certain aspects of fire behaviour in wildland fuels when provided with data on fuel and environmental conditions.

Term	Definition
Fire bombing	A technique of suppressing a bushfire by dropping water, foam or retardants on it from an aircraft.
Fire brand	A piece of flaming or smouldering material capable of acting as an ignition source. eg eucalypt bark.
Fire climate	The composite pattern or integration over time of the fire weather elements that affect fire occurrence and fire behaviour in a given area.
Fire control	See Fire suppression.
Fire control agent	A substance that acts as an Extinguishing agent, and or a Fire retardant and or a Fire suppressant.
Fire control line	See: Fireline.
Fire crew	A general term for two or more firefighters organised to work as a unit. (NWCG)
Fire danger	Sum of constant danger and variable danger factors affecting the inception, spread, and resistance to control, and subsequent fire damage; often expressed as an index. (NWCG)
Fire danger class	A segment of a fire danger index scale identified by a descriptive term and or a colour code. The classification system may be based on more than one fire danger index and an assessment of risk exposure.
Fire danger index (FDI)	A relative number denoting the potential rates of spread, or suppression difficulty for specific combinations of temperature, relative humidity, drought effects and wind speed.
Fire danger rating	A relative class denoting the potential rates of spread, or suppression difficulty for specific combinations of temperature, relative humidity, drought effects and wind speed, indicating the relative evaluation of fire danger.
Fire ecology	The study of the relationships between fire, the physical environment and living organisms.
Fire edge	Any part of the boundary of a going fire at a given time. *NOTE*: The entire boundary is termed the 'fire perimeter'.
Fire effects	The physical, biological and ecological impact of fire on the environment. (NWCG)
Fire environment	The surrounding conditions, influences, and modifying forces of topography, fuel, and weather that determine fire behaviour. (NWCG)
Firefighter	Any employee, volunteer or agent of any fire agency who occupies, or is designated, to undertake a role for the purpose of fire suppression.
Firefighting operations	Any work or activity directly associated with control of fire.
Fire frequency	A general term referring to the recurrence of fire in a given area over time (NWCG). Also see: Fire regime
Fire front	The part of a fire within which continuous flaming combustion is taking place. Unless otherwise specified, the fire front is assumed to be the leading edge of the fire perimeter. In ground fires, the fire front may be mainly smouldering combustion. (NWCG)
Fireground	The area in the vicinity of a fire suppression operations, and the area immediately threatened by the fire. It includes burning and burnt areas; constructed and proposed fire lines; the area where firefighters, vehicles, machinery and equipment are located when deployed; roads and access points under traffic management control; tracks and facilities in the area surrounding the actual fire; and may extend to adjoining area directly threatened by the fire.

Term	Definition
Fire hazard	A fuel complex, defined by volume, type condition, arrangement, and location, that determines the degree of ease of ignition and of resistance to control.
Fire intensity	See: Fireline intensity.
Fireline	A natural or constructed barrier, or treated fire edge, used in fire suppression and prescribed burning to limit the spread of fire.
Fireline intensity	The rate of energy release per unit length of fire front usually expressed in kilowatts per metre (Kw/m). The rate of energy release per unit length of fire front, defined by the equation I=Hwr, where I = fireline intensity (kW/m) H = heat yield of fuel (kJ/kg)-16,000 kJ/kg w = dry weight of fuel consumed (kg/m2) (mean total less mean unburnt) r = forward rate of spread (m/s) The equation can be simplified to I = w r/2 where I = fireline intensity (kW/m) w = dry weight of fuel consumed (tonnes/ha) r = forward rate of spread (m/hr)
Fire lookout	A structure strategically located and manned to detect the occurrence and the location of fires. It may be a tower or a structure on a high point
Fire management	All activities associated with the management of fire prone land, including the use of fire to meet land management goals and objectives.
Fire potential	The chance of a fire or number of fires occurring of such size, complexity or impact that requires resources (both a pre-emptive management and suppression capability) from beyond the area of the fire origin. (BCRC)
Fire preparedness	All activities undertaken in advance of bushfire occurrence to decrease its extent and severity and to ensure more effective fire suppression.
Fire prevention	All activities concerned with minimising the incidence of bushfire particularly those of human origin.
Fire regime	The history of fire in a particular vegetation type or area including the frequency, intensity and season of burning. It may also include proposals for the use of fire in a given area. (AFAC)
Fire report	An official record of a fire, generally including information on cause, location, action taken, damage, costs, etc., from start of the fire until completion of suppression action. These reports vary in form and detail from agency to agency (NWCG). Also see Report of Fire
Fire retardant	A chemical generally mixed with water, designed to retard combustion by a chemical reaction. It is applied as slurry from the ground or air to fuels ahead of the fire.
Fire risk	Processes, occurrences or actions that increase the likelihood of fires occurring.
Fire run	A rapid advance of a fire front. It is characterised by a marked transition in intensity and rate of spread.
Fire scar	1) A healing or healed-over injury caused or aggravated by fire on a woody plant. 2) A mark left on a landscape by fire.
Fire season	The period during which bushfires are likely to occur, spread and do sufficient damage to warrant organised fire control.
Fire simulator	A device that imposes simulated fire and smoke on a projected landscape scene, for the purpose of informing fire suppression personnel of potential fire situations either for an actual fire or hypothetical fire(s).
Fire spread	Development and travel of fire across surfaces.

Term	Definition
Fire storm	Violent convection caused by a large continuous area of intense bushfire often characterised by destructively violent surface indrafts, a towering convection column, long distance spotting, and sometimes by tornado-like whirlwinds. (AFAC)
Fire suppressant	An additive designed to reduce the surface tension of water and/or to hold water in suspension thus increasing water's efficiency as a fire extinguishing agent. Suppressants are applied directly to the burning fuels.
Fire suppression	The activities connected with restricting the spread of a fire following its detection and before making it safe.
Fire suppression organisation	1. The personnel and equipment collectively assigned to the suppression of a specific fire or group of fires. 2. The personnel responsible for fire suppression within a specified area. 3. The management structure, usually shown in the form of an organization chart of the persons and groups having specific responsibilities in fire suppression. (NWCG)
Fire suppression plan	See Incident action plan (IAP).
Fire tetrahedron	An instructional aid in which the sides of the tetrahedron (comprising 4 triangular shaped figures) are used to represent the 4 components of combustion and flame production process-fuel, heat, oxygen and the chemical chain reaction.
Fire threat	The impact a fire will have on a community.
Fire tower	Tower strategically located and manned to detect and report the occurrence and location of fires. A type of Fire lookout
Fire training simulator	A training device that imposes simulated fire and smoke on a projected landscape scene, for the purpose of instructing fire suppression personnel in fire situations and fire suppression techniques.
Fire triangle	Diagrammatic expression of the three elements that are necessary for a fire to occur. FUEL – HEAT – OXYGEN. The removal of any one of these will extinguish a fire.
Fire weather	Weather conditions which influence fire ignition, behaviour, and suppression. (NWCG)
Fire weather forecast	A weather prediction specially prepared for use in wildland fire operations and prescribed fire. (NWCG)
Fire whirl	Spinning vortex column of ascending hot air and gases rising from a fire and carrying aloft smoke, debris, and flame. Fire whirls range in size from less than one foot to over 500 feet in diameter. Large fire whirls have the intensity of a small tornado. (NWCG)
Fire wind	The inflow of air close to a fire caused by the action of convection. It is not to be confused with a prevailing wind.
First attack	See: Initial attack
Fixed wing aircraft	A heavier than air aircraft which obtains lift for flight by forward motion of wings through the air.
Flame angle	The angle of the flame in relation to the ground, caused by wind direction or the effect of a slope.
Flame depth	The depth of the zone within which continuous flaming occurs behind the fire edge.

Term	Definition
Flame height	The average maximum vertical extension of flames at the leading edge of the fire front. Occasional flashes that rise above the general level of flames are not considered. This distance is less than the flame length if flames are tilted due to wind or slope. (NWCG)
Flame length	The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface), an indicator of fire intensity. (NWCG)
Flame Zone	The highest level of bushfire attack as a consequence of direct exposure to flames from the fire front in addition to heat flux and ember attack. (AS 3959 - 2009)
Flame zone	The area around fuels where the combustion of gases occurs to form flames.
Flaming zone	See: Flame zone.
Flammability	The ease with which a substance is set on fire.
Flammable	Capable of being ignited and of burning with a flame.
Flank attack	Obtaining control of a fire by attacking its side/s (flank).
Flanks of a fire	Those parts of a fire's perimeter that are roughly parallel to the main direction of spread. (NWCG)
Flare up	Any sudden acceleration of fire spread, or intensification of fire, or a part of the fire. A flare up is of relatively short duration and does not radically change existing control plans. (NWCG)
Flash fire	A fast moving fire consuming most of the fine fuels available.
Foam	Foam is a mass of bubbles formed by mixing air with water and a foam concentrate in specific proportions. It is used as a firefighting agent to form a smothering, cooling and/or ignition preventing layer of the surface over a fuel.
Foam blanket	A layer of foam which forms an insulating and reflective barrier to heat and is used for fuel protection, suppression, and mop-up. (NWCG)
Foam Class A	A mixture of foam concentrate & water specifically formulated for extinguishing bushfires. The foam is biodegradable, non toxic and is used at very low concentrates. It may be delivered aspirated or non-aspirated. (See also Foam solution).
Foam Class B	A foam formulated for application on Class B fires
Foam concentrate	The concentrated foaming agent as received from the manufacturer which, when added to water, creates a foam solution.
Foam inductor	Equipment consisting of an inlet connection, ejector pump and a discharge assembly, for the induction of foam concentrate.
Foam solution	The mixture of water and foam concentrate.
Forest	An area, incorporating all living and non-living components, that is dominated by trees having usually a single stem and a mature or potentially mature stand height exceeding 2 metres and with existing or potential crown cover of overstorey strata about equal to or greater than 20 per cent. This definition includes Australia's diverse native forests, woodlands and plantations, regardless of age.
Forest fire	A fire burning mainly in forest and/or woodland.
Forest type	A category for describing a forest commonly based on the predominant tree species, tree form and structure.

Term	Definition
Forward looking infrared (FLIR)	Hand held or aircraft mounted device designed to detect heat differentials and display them. FLIRs have thermal resolution similar to IR line scanners, but their spatial resolution is substantially less; commonly used to detect hot spots and flare ups obscured by smoke, evaluate the effectiveness of firing operations, or detect areas needing mop-up. (NWCG)
Forward rate of spread (FROS)	The speed with which a head fire moves in a horizontal direction across the landscape.
Frontal fire intensity	See: Fireline Intensity
Front end loader	Earthmoving equipment designed to move loose earth and/or loads into vehicles. A multi-purpose bucket is fitted to articulated arms at the front of the vehicle. May be either wheeled or tracked.
Fuel	Any material such as grass, leaf litter and live vegetation which can be ignited and sustains a fire. Fuel is usually measured in tonnes per hectare. Related Terms: Available fuel, Coarse fuel, Dead fuel, Elevated dead fuel, Fine fuel Ladder fuels, Surface fuels, and Total fine fuel.
Fuel age	The period of time lapsed since the fuel was last burnt.
Fuel arrangement	A general term referring to the spatial distribution and orientation of fuel particles or pieces. (NWCG)
Fuel array	The totality of fuels displayed in a location: fine and coarse, live and dead. (Vic report)
Fuel assessment	The estimation or calculation of total and available fuel present in a given area.
Fuel bed depth	Average height of surface fuels contained in the combustion zone of a spreading fire front. (NWCG)
Fuelbreak	A natural or manmade change in fuel characteristics which affects fire behaviour so that fires burning into them can be more readily controlled.
Fuelbreak system	A series of modified strips or blocks tied together to form continuous strategically located fuel breaks around land units.
Fuel continuity	The degree or extent of continuous or uninterrupted distribution of fuel particles in a fuel bed thus affecting a fire's ability to sustain combustion and spread. This applies to aerial fuels as well as surface fuels.
Fuel depth	The average distance from the bottom of the litter layer to the top of the layer of fuel, usually the surface fuel.
Fuel load	The oven dry weight of fuel per unit area. Commonly expressed as tonnes per hectare. (AFAC). (Also known as fuel loading)
Fuel management	Modification of fuels by prescribed burning, or other means. (AFAC)
Fuel map	A map showing areas of varying fuel quantities and types and usually indicates past fire history.
Fuel model	Simulated fuel complex for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified. (NWCG)
Fuel modification	Manipulation or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control (e.g., lopping, chipping, crushing, piling and burning).(NWCG)
Fuel moisture content	The water content of a fuel expressed as a percent of the oven dry weight of the fuel particle. (%ODW)

Term	Definition
Fuel moisture differential	A term used to describe the situation where the difference in the moisture content between fuels on adjacent areas results in noticeably different fire behaviour on each area.
Fuel profile	The vertical cross section of a fuel bed down to mineral earth.
Fuel quantity	See: Fuel load.
Fuel reduction	Manipulation, including combustion, or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control.
Fuel reduction burning	The planned application of fire to reduce hazardous fuel quantities; undertaken in prescribed environmental conditions within defined boundaries.
Fuel separation	The action of separating fuel for the purpose of providing a mineral earth firebreak. Also means the actual gap between fuel layers or particles eg gap between individual hummock grasses or gap between surface and canopy fuels
Fuel type	An identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics that will cause predictable rate of spread or difficulty of control under specified weather conditions. (AFAC)
Fuel weight	See Fuel load.
General origin area	The larger area where the fire started that is readily identifiable based on macro scale indicators and witness statements. (NWCG)
Going fire	Any bushfire which is expanding and suppression actions have not yet contained the fire.
Grass fire	Any fire in which the predominant fuel is grass or grass like. (NWCG)
Grassland curing	The proportion of dead material in grasslands – usually increases over summer as tillers die off and dry out, increasing the risk of grassland fire.
Grid ignition	A method of lighting prescribed fires where ignition points are set individually at a predetermined spacing through an area.
Ground crew	See: Hand crew.
Ground fire	Fire that consumes the organic material beneath the surface litter ground, such as a peat fire. (NWCG)
Ground fuel	All combustible materials below the surface litter, including duff, roots, peat and saw dust dumps that normally support a glowing or smouldering combustion without flame.
Habitat	The local environment of conditions in which an animal or plant lives.
Hand crew	A fire suppression crew trained and equipped to fight fire with hand tools.
Hand line	A fireline constructed with hand tools. (NWCG) (Wildfire context)
Hand trail	See Hand line.
Hang up	A situation in which a tree is lodged in another and prevents it from falling to the ground.
Hazard	A source of potential harm or a situation with potential to cause loss.
Hazard reduction	See: Fuel Management
Head	See: Head Fire
Head attack	Directly knocking down the head of a fire. Recommended only for low intensity fires where firefighters can be sure that the fire will not flare up unexpectedly.
Head fire	The part of a fire where the rate of spread, flame height and intensity are greatest, usually when burning downwind or upslope.

Term	Definition
Heat exhaustion	A form of shock, due to depletion of body fluids resulting from overexposure to a hot environment.
Heat stress	Illness caused by the body overheating.
Heat stroke	A life-threatening condition that develops when the body's temperature-regulating and cooling mechanisms are overwhelmed and body systems begin to fail.
Heat transfer	The transfer of thermal energy from one physical system to another by conduction, convection or thermal radiation.
Heavy fuels	See: Coarse fuels.
Heel	See: Rear (Preferred term).
Heel fire	See: Backing Fire.
Helibase (HB)	A location for parking, refuelling and maintenance of helicopters operating in support of an incident.
Helicopter	A form of heavier-than-air, rotor-wing aircraft whose lift is produced by engine-driven rotors which behave as if they were both propellers and wings.
Helipad (HP)	A designated location which meets specific requirements for a helicopter to take off and land.
Helitack crew	An initial attack crew specially trained in the tactical and logistical use of helicopters for fire suppression.
Heli-torch	An aerial ignition device hung from or mounted on a helicopter to disperse ignited lumps of gelled gasoline. Used for backburns, burnouts, or prescribed burns. (NWCG)
High fire danger	The second lowest fire danger rating as determined by fire agencies and generally with a Forest fire danger index between 25 and 49 or a Grassland fire danger index between 25 and 49.
High intensity fire	Fires with an average intensity greater than 3000 $kW.m^{-1}$ and flame heights greater than 3 m, causing complete crown scorch or possibly crown fires in forests. Uncontrollable by direct attack. The term is also applied to stationary fires burning in very high fuel loads (such as logging slash).
Hold over fire	See: Sleeper
Hop over	See: Breakaway.
Hose bandage	A means of affecting a temporary repair to a canvas or synthetic hose.
Hose strangler	A crimping device for stopping the flow of water in a hose.
Hot Refueller	A trained person responsible for the operation of the equipment for the 'hot' refuelling of helicopters.
Hot spot	1. A particularly active part of a fire. 2. An area of smouldering fuels requiring to be extinguished during patrol operations.
Humus	Layer of decomposed organic matter on the forest floor beneath the fermentation layer and directly above the soil. It is that part of the duff in which decomposition has rendered vegetation unrecognizable and mixing of soil and organic matter is underway. See Also: Duff & Litter
Hygrometer	An Instrument which measures the humidity in the air.
Ignition	The beginning of flame production or smouldering combustion; the starting of a fire.

Term	Definition
Ignition pattern	The manner in which a prescribed burn, backburn, or burnout is set, determined by weather, fuel, ignition system, topographic and other factors having an influence on fire behaviour and the objective of the burn.
Ignition source	A source of energy sufficient to initiate combustion.
Incendiary	A burning compound or metal used to produce intense heat or flame, like a bomb.
Incendiary device	Device designed and used to start a fire.
Incident	Any unplanned event requiring emergency intervention. (AIIMS)
Incident Action Plan (IAP)	The plan used to describe the incident objectives, strategies, resources and other information relevant to the control of an incident. (AIIMS)
Incident control	See: Incident management
Incident Control Centre (ICC)	The location where the Incident Controller and various members of the Incident Management Team provide overall direction of response activities. (See also Incident Control Point)
Incident Controller	The individual responsible for the management of all incident control activities across a whole incident (AIIMS)
Incident Control Point (ICP)	The location where the Incident Controller and, where established, members of the Incident Management Team provide overall direction of response activities in an emergency situation. (See also Incident Control Centre)
Incident control system (ICS)	A command structure to systematically and logically manage suppression of emergency incidents including bushfires, from small, simple incidents to large, difficult or multiple situations. It is designed to develop in modular fashion from the top (Incident Controller) downwards. Refer NIMS, AIIMS, CIMS
Incident management	The process of controlling the incident and coordinating resources. (EMA)
Incident Management Team (IMT)	The group of incident management personnel comprising the Incident Controller, and the personnel he or she appoints to be responsible for the functions of Operations, Planning and Logistics. (AIIMS)
Incident objective	An incident objective is a goal statement indicating the desired outcome of the incident. Incident objectives guide the development of the Incident Action Plan and must reflect the policies and needs of the control authority and supporting agencies. All factors affecting the incident and its potential impact must be considered before determining the objective. (AIIMS)
Incident strategies	The incident strategies will be developed from the incident objectives and will describe how the Incident Management Team plans to resolve the incident. There is a requirement for strategies to be developed throughout the incident and they should be reviewed for each operational period. (AIIMS)
Indirect attack	A method of suppression in which the control line is located some considerable distance away from the fire's active edge. Generally done in the case of a fast-spreading or high-intensity fire and to utilize natural or constructed firebreaks or fuelbreaks and favourable breaks in the topography. The intervening fuel is usually backburnt; but occasionally the main fire is allowed to burn to the line, depending on conditions.(NWCG)
Induced wind	See: Fire wind.
Infrared scanning	Use of an optical-electronic system for identifying or obtaining imagery of thermal infrared radiation to detect non-smoking fires or fire perimeters through smoke.
Initial attack	The first suppression work on a fire.

Term	Definition
Instability	The tendency for air parcels to accelerate when they are displaced from their original position; especially, the tendency to accelerate upward after being lifted. Instability is a prerequisite for severe weather - the greater the instability, the greater the potential for severe thunderstorms. (Weather Zone)
Interface	See: Urban Rural interface.
Inversion	A layer of the atmosphere in which temperature increases with increasing elevation. A condition of strong atmospheric stability.
Island	An unburnt area within a fire perimeter.
Isobar	Lines on weather maps joining places which have the same air pressure.(BOM)
I zone	See: Urban Rural interface.
Jump fire	See: Spot fire
Jump over	See: Breakaway
Junction zone	An area of greatly increased fire intensity caused by two fire fronts (or flanks) burning towards one another.
Keetch-Byram Drought Index (KBDI)	A numerical value reflecting the dryness of soils, deep forest litter, logs and living vegetation, and expressed as a scale from 0 - 200 where the number represents the amounts of rainfall (mm) to return the soil to saturation.
Knock down	To reduce the flame or heat on the more vigorously burning parts of a fire edge. (NWCG)
Ladder fuels	Fuels that provide vertical continuity between strata. Fire is able to carry surface fuels into the crowns of trees with relative ease.
Lag time	The time delay in fuel moisture content responding to changing environmental conditions (for example, relative humidity). Technically, it is the time necessary for a fuel particle to lose approximately 63% of the difference between its initial moisture content and its equilibrium moisture content.
Lead agency	The organisation with the legislative or agreed authority for control of an incident.
Lee (leeward)	Away from the wind, on the sheltered side of something that the wind is blowing on.
Legislation	A set of rules made by a State, Territory or Federal Government; includes acts and regulation.
Light fuel	An assessment of fuel quantity indicating a low weight.
Lighting pattern	See: Ignition pattern.
Lightning	The flash of light accompanying a sudden electrical discharge which takes place from or inside a cloud, or less often from high structures or the ground or from mountains. A large electrical spark. Caused when the negative charge in the lower part of the cloud and the positive charge in the upper part of the cloud become so great that they can overcome the natural resistance of the air and discharge between negative and positive takes place. (BOM)
Lightning fire	A fire caused by lightning.
Lightning formation	See: Lightning.
Light patrol unit	See: Tanker.
Line ignition	See: Strip burning.

Term	Definition
Litter	The top layer of the forest floor composed of loose debris of dead sticks, branches, twigs, and recently fallen leaves and needles, little altered in structure by decomposition. (The litter layer of the forest floor). (NWCG)
Litter bed fuel	Dead fine fuel, including surface fuel and fuel lower in the fuel profile.
Litter fall	The addition of litter that falls from vegetation to the forest floor.
Living fuels	Fuels made up of living vegetation.
Living shrub fuel	Living understorey fine fuel less than 2 metres above ground level.
Local winds	Winds which are generated over a comparatively small area by local terrain and weather. They differ from those which would be appropriate to the general pressure pattern. (NWCG)
Log	Documentation of information and actions arising during an incident
Logistics	The provision of facilities, services and materials in support of an incident.
Lookout	1. A person designated to detect and report fires from a fixed vantage point. 2. A member of a fire crew designated to observe the fire and warn the crew when there is danger. 3. For structure see: Fire lookout
Lookout tower	See: Fire tower.
Low intensity fire	A fire which travels slowly and only burns lower storey vegetation, like grass and lower tree branches, with an average intensity of less than 500 $kW.m^{-1}$ and flame height less than 1.5m. Usually causes little or no crown scorch and is easily controlled.
Low-moderate fire danger	The lowest fire danger rating as determined by fire agencies and generally with a Forest fire danger index less than 12 or a Grassland fire danger index less than 12.
Medium fuels	See Course fuels.
Mineral earth	When used in the context of fire control refers to a non-flammable surface (either natural or prepared) which provides a break in understorey, litter and humus fuels and hence a barrier (of varied effectiveness depending, amongst other things, on its width and the intensity of the approaching fire) to fire travelling on or near the ground surface.
Mobilisation	The processes and procedures for organisations to activate, assemble, and transport the requested resources to an incident.
Moisture content	See Fuel moisture content.
Mopping up	See Blacking out
Mosaic	Used in reference to the spatial arrangement of burnt and unburnt fuels at either a local or a landscape scale.
Move up method	See: Step-up method
Multi-agency response	The response to an incident where one or more agencies assist the jurisdictional control agency or agencies.
Multiple fire situation	A circumstance of high fire incidence over short periods of time in any administrative unit, usually overtaxing the normal initial attack capability of the unit.
Natural barrier	Any area where lack of flammable material obstructs the spread of vegetation fires.

Term	Definition
Near surface fuel	Live and dead fuel, including suspended leaves, bark or twigs, effectively in touch with the ground but not lying on it, with a mixture of vertical and horizontal orientation.
Needle bed	A fuel bed consisting mainly of pine needles.
Nozzle	A fitting that is used with a branch to control the size, pattern and/or velocity of water or extinguishing medium being discharged.
One lick method	A progressive system of building a fireline on a wildfire without changing relative positions in the line. Each worker does one to several "licks", or strokes removing a set proportion of the fuel on the line, with a given tool and then moves forward a specified distance to make room for the worker behind. (NWCG)
Operations	The direction, supervision and implementation of tactics in accordance with the Incident Action Plan.
Operations point	The location from which the overall field operations are commanded by the Operations Officer. (AIIMS)
Parallel attack	Method of fire suppression in which fireline is constructed approximately parallel to, and just far enough from the fire edge to enable workers and equipment to work effectively, though the fireline may be shortened by cutting across unburned bays. The intervening strip of unburned fuel is normally burned out as the control line proceeds but may be allowed to burn out unassisted where this occurs without undue delay or threat to the fireline. (NWCG)
Parallel fire suppression	See: Parallel attack.
Parallel method	See: Parallel attack.
Parts of a Fire	See: Bay(s), Fingers, Flanks of a fire, Head.
Patch burning	Burning in patches to prepare sites for group planting or sowing or to form a barrier to subsequent fires. (NWCG)
Patrol	1. To travel over a given route to prevent, detect, and suppress fires. Includes interaction with the public for wildland fire prevention and educational purposes. 2. To go back and forth vigilantly over a length of control line during and/or after construction to prevent breakaways, suppress spot fires, and extinguish overlooked hot spots. 3. A person or group of persons who carry out patrol actions. (NWCG)
Peat	An amorphous organic material formed by anaerobic decomposition which usually means that the area is seasonally or permanently inundated with water. Peat fires burn by smouldering combustion and generate very high amounts of energy per unit area.
Perimeter	See: Fire perimeter.
Peri urban interface	See: Urban rural interface.
Permit burn	A burn carried out under permit from a Fire Authority.
Personal protection equipment (PPE)	The equipment and clothing designed to mitigate the risk of injury from the chemical, physical and thermal hazards that may be encountered at an incident.
Personal protective clothing (PPC)	The clothing designed to mitigate the risk of injury from the chemical, physical and thermal hazards that may be encountered at an incident.
Plan of attack	See: Incident Action Plan (Preferred term)
Planned burning	See: Prescribed burning.
Pocket	See: Island.

Term	Definition
Point of attack	The part of the fire on which work is started when suppression forces arrive.
Point of origin	The specific location where the fire started.
Portable dam	A temporary water storage used in conjunction with power pumps and hose lines.
Predicted rate of spread	The rate of spread predicted by the application of fire spread models utilising appropriate inputs of fuel conditions, topography and weather. Also see Rate of Spread.
Pre-incident plan	Advanced planning and preparation for an emergency situation.
Pre-suppression plan	See Pre-Incident Plan
Prepared community	A community that has developed effective emergency management arrangements at the local level, resulting in: • An alert, informed and active community that supports its voluntary organizations • An active and involved local government • Agreed and coordinated arrangements from prevention, preparedness, response and recovery.
Preparedness	All activities undertaken in advance of the occurrence of an incident to decrease the impact, extent and severity of the incident and to ensure more effective response activities.
Pre-planned dispatch	The pre-planned dispatch of designated suppression forces to fires in predetermined zones. It is usually dependent on the location of the fire, and the forecast fire danger.
Prescribed burn	A fire utilised for Prescribed burning.
Prescribed burn plan	See: Burn plan.
Prescribed burning	The controlled application of fire under specified environmental conditions to a predetermined area and at the time, intensity, and rate of spread required to attain planned resource management objectives.
Prescribed fire	Any fire ignited by management actions to meet specific objectives. A written, approved burn plan must exist, and approving agency requirements (where applicable) must be met, prior to ignition.
Prescription	A written statement defining the objectives to be attained during prescribed burning.
Prevention	All activities concerned with minimising the occurrence of incidents, particularly those of human origin.
Profile litter moisture content	The moisture content, expressed as a percentage of oven-dry weight, of the entire leaf litter bed above the mineral soil surface.
Profile moisture content	See Fuel moisture content.
Psychrometer	The general name for instruments designed for determining the relative humidity of the air. A psychrometer consists of wet and dry bulb thermometers, generally with the aid of psychrometric tables or a psychrometric slide rule. (BOM)
Pulaski tool	A combination chopping and trenching tool widely used in fireline construction, which combines a single-bitted axe blade with a narrow adze-like trenching blade fitted to a straight handle. (NWCG)
Pumper	A firefighting vehicle equipped with a large capacity pump, water tank and hose. Generally intended to be operated when stationary, from reticulated or static water supplies.

Term	Definition
Quick-fill pump	A high volume water pump used for filling tankers.
Rain gauge	The general name for instruments designed to measure the amount of rain that has fallen.
Rakehoe (McLeod tool)	A hand tool used for bushfire fighting, consisting of a combination of a heavy rake and hoe.
Rate of spread (ROS)	The speed with which a fire moves in a horizontal direction across the landscape at a specified part of the fire perimeter. See also Forward rate of spread.
Reaction time	The time taken between the report of a fire or incident, and the departure of the crew. See also Response time.
Rear	1. That portion of a fire spreading directly into the wind or down slope. 2. That portion of a fire edge opposite the head. 3. Slowest spreading portion of a fire edge. Also called heel of a fire. (NWCG)
Reburn	Repeat burning of an area over which a fire has previously passed, but left fuel that later ignites when burning conditions are more favourable. (NWCG)
Reconnaissance	To examine a fire area to obtain information about current and probable fire behaviour and other related fire suppression information. (NWCG)
Recovery	The coordinated process of supporting emergency affected communities in reconstruction of the physical infrastructure and restoration of emotional, social, economic and physical wellbeing.
Red Flag Warning	A process for passing critical safety information to incident suppression resources and support resources on which they can base decisions regarding strategy, tactics and deployment.
Regeneration burn	A burn lit under prescribed conditions for the purpose of achieving regeneration of a particular vegetation type.
Re-ignition	The action of a material that ignites again after it has been extinguished.
Relative humidity (RH)	The amount of water vapour in a given volume of air, expressed as a percentage of the maximum amount of water vapour the air can hold at that temperature.
Relay pumping	Using a series of pumps positioned at intervals along a line or lines of hose to share the workload of pumping water over a long distance.
Relief	The replacement of personnel whose period of time at the incident has concluded.
Report of fire	The notification of the detection of a fire to the fire service. (AFAC)
Residence time	The time required for the flaming zone of a fire to pass a stationary point; the width of the flaming zone divided by the rate of spread of the fire.
Resources	All personnel and equipment available, or potentially available, for incident tasks.
Response	Actions taken in anticipation of, during, and immediately after an incident to ensure that its effects are minimised, and that people affected are given immediate relief and support.
Response time	The time taken between the report of a fire or incident, and arrival at the scene. It includes both reaction time and travel time.
Responsible authority	See: Control authority.
Retardant	See: Fire retardant.

Term	Definition
Risk	The exposure to the possibility of such things as economic or financial loss or gain, physical damage, injury or delay, as a consequence of pursuing a particular course of action. The concept of risk has two elements, i.e. the likelihood of something happening and the consequences if it happens. (AS4360)
Risk analysis	A systematic use of available information to determine how often specific events may occur and the magnitude of their likely consequences.
Road Management Point	A strategic position from which traffic can be observed and controlled. (See also Traffic Management Point and Vehicle Control Point)
Rural	Any area wherein residences and other developments are scattered and intermingled with forest, range, or farm land and native vegetation or cultivated crops.
Rural urban interface (RUI)	See Urban rural interface
Safe	The stage of bushfire suppression or prescribed burning when it is considered that no further suppression action or patrols are necessary.
Safety zone	An area cleared of flammable materials used for escape if the line is outflanked or in case a spot fire outside the control line renders the line unsafe. In fire operations, crews progress so as to maintain a safety zone close at hand, allowing the fuels inside the control line to be consumed before going ahead. Safety zones may also be constructed as integral parts of fuelbreaks. They are greatly enlarged areas which can be used with relative safety by fire fighters and their equipment in the event of a blow up in the vicinity. (Vic report)
Scorch height	1. The height above ground level up to which foliage has been browned by a fire. 2. A measurement for determining the acceptable height of flame during prescribed burning.
Scout	A person who checks and reports on conditions in the fire area.
Scrub	Refers to vegetation such as heath, wiregrass and shrubs, which grows either as an understorey or by itself in the absence of a tree canopy.
Scrub fire	Fires burning in scrub.
Secondary fire control line	See: Fall back fire control line.
Sector	A specific area of an incident which is under the control of a Sector Commander who is supervising a number of crews.
Seen area	The ground, or vegetation, that is directly visible from an established or proposed lookout point, or aerial detection flight route.
Severe fire danger	The third highest fire danger rating as determined by fire agencies and generally with a Forest fire danger index between 50 and 74 or a Grassland fire danger index between 50 and 74.
Shift	The period resources are allocated during an operation at the incident or on the fireground.
Shift change	Replacement of allocated crews and or equipment during operations.
Situation report **(Sitrep)**	A report on the progress of the fire and the efforts to control it. It confirms the location of the fire, its status and potential and the number, nature and effectiveness of resources deployed. Situation reports are normally provided at regular times until the fire is declared safe.
Size up	The evaluation of a fire to determine a course of action for suppression.
Slash	Accumulated fuel resulting from such natural events as wind, fire, snow breakage, or from such human activities as logging, cutting or road construction.

Appendix **Five** – Local Water Management Strategy

COTERRA ENVIRONMENT

LOCAL WATER MANAGEMENT STRATEGY

Lots 312, 313, 2, 4, 5, 7 and 8 Baldivis

Revision 0, May 2012

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EXECUTIVE SUMMARY

Key Elements	Key Issues
Existing Environment	▪ The site currently contains cleared agricultural land, market gardens, remnant bushland and four residential properties. ▪ Topography ranges from 3 to 15mAHD. ▪ The groundwater level is at approximately 2mAHD. ▪ The geology is Cottesloe and Karrakatta sands. ▪ Potential sources of contamination were recognised and subsequent requirements met.
Water Usage Strategy	▪ Wastewater will be disposed of to the main connection and household water will be supplied by scheme water. ▪ The development will include the following water sustainability initiatives; ➢ Public Open Space will be landscaped effectively in order to reduce irrigation requirements. ➢ Water efficient fixtures and fittings will be mandatory within the buildings. ➢ Lots will be provided with a full landscaping package for front gardens. ➢ Community education will be encouraged to promote the homeowner's role in water resource protection.
Stormwater Management	▪ There are twelve sub catchment areas within the LSP site, of which nine are within the site boundary addressed in this LWMS. ▪ Each catchment has a dedicated infiltration basin designed to contain and infiltrate up to the 100 year ARI rainfall event. ▪ There will be no lot drainage connections to the road drainage network. Lots will infiltrate roof runoff via onsite soak wells. ▪ All stormwater from the road network for up to a 5 year ARI event will be conveyed via the pipe network into the basins. ▪ Stormwater from events greater than 5 year ARI event will be conveyed into the basins as overland flow within the road reserves. ▪ Appropriate vegetation will be planted in all the basins to provide additional water quality treatment during infiltration.
Groundwater Management	▪ There will be two areas of lower lying land that require fill. Minimum fill levels will be to 6mAHD. This ensures that all lots will have greater than the required 1.2m separation from groundwater. ▪ Given the separation distances to groundwater, there will be no subsoil drainage. ▪ Post development catchment and basin infiltration areas are in

Key Elements	Key Issues
	similar proximity to areas where pre development infiltration would have occurred. ▪ All basin inverts are significantly greater than the 0.3m separation distance requirement from groundwater.
Monitoring	▪ Pre-development monitoring was not deemed necessary prior to the LSP/ LWMS stage, due to the significant separation distances from groundwater across the majority of the site and the absence of wetlands. ▪ Similarly post-development monitoring is not proposed due to the fill management that will be undertaken in the lower lying areas, which will provide significant separation distance from groundwater across the whole site.

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1.0 INTRODUCTION

Spatial Property Group, on behalf of the landowners (Carcione Group of Companies) are proposing to develop Lots 312 and 313 Fifty Road, and Lots 2, 4, 5, 7 and 8 Eighty Road, Baldivis for urban subdivision. The site is 52.3 hectares (ha) in size and is located between Fifty Road, Eighty Road and Baldivis Road, Baldivis in the City of Rockingham (CoR), approximately 40 kilometres (km) south of Perth. This location is shown in Figure 1.

1.1 Planning Context

The site is currently zoned 'Urban' under the Metropolitan Region Scheme (MRS) and 'Residential' under the City of Rockingham Town Planning Scheme (TPS) No. 2.

The site has been identified in the North Baldivis District Structure Plan (DSP) as part of the future urban growth of the North Baldivis precinct. The North Baldivis DSP was formulated by the CoR in recognition of the general designation of the North Baldivis locality as being suitable to accommodate future residential development. As such, CoR embarked on a comprehensive 'district level' structure planning exercise in the late 1990's over the potential urban cell east of Baldivis Road, spanning from Kerosene Lane in the north to the future Baldivis Town Centre to the south. This exercise culminated in the release of the Baldivis (North) District Structure Plan as formally adopted by Council in July 2000. The District Structure Plan outlined the preferred broad land use and district road framework for the study area.

In accordance with the objectives of the DSP, the proponent has commissioned the formation of a Local Structure Plan (LSP) over the site, providing a greater level of detail in respect to the structure plan design for the landholdings.

The LSP design was completed by Development Planning Strategies, and is presented in Figure 2.

1.2 Objectives

Lot 313 Fifty Road (Figure 3) was part of Amendment No. 300 of the City of Rockingham's Town Planning Scheme No. 1, which was initiated to rezone the associated landholdings from 'Rural' to 'Development'. The rezoning application was assessed by the EPA in 2001 and determined that the proposal could be implemented subject to conditions. The formal approval and associated conditions are outlined in Ministerial Statement No. 580 (dated 19th December 2001).

Condition 1 identified the drainage and water management reporting requirements with the requirement for a Drainage and Nutrient Management Plan. In accordance with the Department of Water's Better Urban Water Management guidelines (WAPC, 2008), Drainage and Nutrient Management Plans are now superseded by the Better Urban Water Management reporting requirements. In line with these guidelines, a Local Water Management Strategy (LWMS) is required to support the LSP. This report therefore satisfies that requirement and Condition 1.

This LWMS discusses water usage, groundwater and stormwater management, and monitoring requirements for the proposed site. This document has been developed with reference to the following guidance documents:

- Interim: Developing a Local Water Management Strategy (Department of Water, 2008)
- Better Urban Water Management (WAPC, 2008);
- Western Australian State Water Plan (Government of Western Australia, 2007);
- Stormwater Management Manual for Western Australia (Department of Water, 2004-2007).

In addition, an Environmental Assessment Report (Coterra Environment, 2011) has been prepared for the site to support the LSP

2.0 SITE CHARACTERISTICS

2.1 Current and Adjacent Land Uses

The current land use within the site varies across the lots. Cleared agricultural land constitutes approximately 50% of the 52.3 ha site (lots 312, 2 and 8). The remainder consists of market gardens (lot 313) and remnant bushland (lots, 4, 5 and 7). There are four residential properties and associated outbuildings within the site.

Adjacent land uses are highlighted in Figure 4. The Peel Main Drain is located approximately 1.5km east of the site, with a Multiple Use Wetland area present in between the Drain and the site. To the north and south of the site are primarily residential areas which include a school and recreation centre. Market gardens are situated immediately north of lot 313, whereas the remainder of lot 313 and the south western section of lot 312 are surrounded by Bush Forever.

2.2 Climate and Rainfall

The site has a Mediterranean climate with warm dry summers and cool wet winters. The average annual rainfall at the site is approximately 770mm. The average annual evaporation is approximately 2,050mm (BOM, 2010). Rainfall and evaporation monthly averages are presented in Table 1.

Table 1 Rainfall and Evaporation Average Monthly Statistics

Month	Average Rainfall (mm) [1]	Average Evaporation (mm) [2]
January	6.3	316.2
February	11.3	268.8
March	16.3	241.8
April	41.3	150
May	112.8	93
June	165.5	66
July	156.2	65.1
August	117.7	80.6
September	69.2	108
October	42.2	164.3
November	18.2	219
December	11.4	279

Sources:
[1] – Bureau of Meteorology. Fremantle weather station.
[2] - Bureau of Meteorology. Perth Airport weather station.

2.3 Topography

Figure 3 indicates that the existing topography of the site varies between 3 and 15mAHD. A peak occurs on the northern edge of the site, with the remainder of the site graduating down from this point to the low points on the south west corner and the eastern edge of the site.

2.4 Groundwater

2.4.1 Groundwater Levels

2.4.1.1 Regional Data

The Perth Groundwater Atlas (DoW, 2012a) indicates that the maximum groundwater level contours are at approximately 2mAHD across the entire site. The separation distance from groundwater therefore varies in response to the topography. This equates to an existing separation of approximately 1 to 13 mbgl (metres below ground level). The groundwater separation distances are illustrated in Figure 5.

2.4.1.2 Site Data

No site specific groundwater monitoring has been conducted for the site. Prior liaison with the Department of Water (DoW) confirmed that given the significant separation distance to groundwater across the majority of the site, site specific monitoring would not be required for the LWMS. This is discussed further in Section 6.1 and correspondence with DoW is provided in Appendix A.

2.4.2 Groundwater Quality

The Perth Groundwater Atlas (DoW, 2012a) indicates that groundwater salinity of the superficial aquifer ranges from 500 mg/L TDS to 1,000 mg/L TDS for the majority of the site and as such is considered fresh to marginal. The groundwater salinity on the eastern most edge of the site ranges from 1000 mg/L to 3000 mg/L and is considered brackish. The salinity readings observed in the regional bores surrounding the site (within 1km) supports the regional mapping.

Regional water quality data from the surrounding WIN database bores is relatively sparse and intermittent (DoW, 2012b). Conductivity readings taken from all the surrounding WIN bores show conductivity readings ranging from 257 mg/L TDS to 2145 mg/L TDS. Two of the surrounding WIN bores provide some further information as presented in Table 2. The nitrogen levels (as represented by nitrate) are high and above the ANZECC guidelines.

Table 2 Regional Groundwater Quality Data

WIN site ID	Sample Date	Temp (˚C)	pH	Nitrate
ANZECC FW guidelines		**NG**	**6.5-8.5**	**0.7**
Bore 20023730	August 1973	20	7.5	-
Bore 20024013	August 1977	25	7.6	7
	Indicate readings above the ANZECC (2000) FW guidelines			
NG	No guideline levels established			

2.5 Surface Water

There are no natural surface water bodies located within the site. On the western side of Lot 8, there is an artificially constructed dam which is an expression of groundwater and surface water runoff. This dam was historically used for horticultural purposes, but is currently disused.

2.5.1 Wetlands

There are no wetlands within the site.

Approximately 75m to the east of the site across Baldivis Road there is a Multiple Use Wetland (MUW). There are also two pockets of Conservation Category Wetlands (CCWs) approximately 40m and 120m to the west of the site. Wetland mapping is presented in Figure 6.

2.5.2 Floodplain

The project site is not situated within the floodplain.

The flood fringe associated with the Peel Main Drain is approximately 75m to the east of the site.

2.6 Geology and Soils

2.6.1 Soil Description

Regional mapping (Churchward & McArthur, 1980) displayed in Figure 7 indicates that the majority of the project site is comprised of two varying sands from the Spearwood Dune System;

- Cottesloe Sands - Sand (S7): which is described as – pale yellowish brown, medium to coarse grained, sub-angular to well-rounded quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin.

- Karrakatta Sands - Sand (S8): which is described as – very light at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted, of eolian origin as relatively thin veneer over C2 (clay), M4 (silt) and Mc2.

2.6.2 Phosphorus Retention Index (PRI)

Phosphorous in stormwater is removed through the binding of the particles to the iron and aluminium hydrous oxides within the soil (Beek, 1979). Once the upmost soil particles become saturated, phosphorous will leach through the sands to the next soil layer where they will become fixed. This method of adsorption allows for phosphorous to be removed from the stormwater prior to infiltrating into the groundwater.

The rate of adsorption to the soil varies depending on the type and depth of soil. A higher PRI indicates that the soil has a higher capacity for retaining phosphorous, and the deeper the soil, the greater the fixation availability.

Based on the geology, Table 3 suggests that the area of interest would have a PRI of between 2 and 20mL/g.

Table 3 Relative permeability and Phosphorous Retention Index (PRI) for various substrates

Substrate	Permeability (m/day)	PRI (mL/g)
Bassendean Sands	30+	0 - 0.5
Karrakatta Sands	10+	2 - 4
Cottesloe Sands	10+	5 -1 2
Crushed limestone or lime sands	2-5	5 - 20
Natural clay or loam soils	<0.4	30 - 1,000+

Source: Department of Environment and Conservation

This is further supported by the PRI mapping of the Peel-Harvey catchment area (EPA, 2008) which indicates that the site is located within soils with a PRI 5-20mL/g. Table 4 indicates the range and effectiveness of adsorption for varying PRI results, which indicates the site is moderately adsorbing of phosphorus.

Table 4 PRI Fixation Properties

PRI (mL/g)	Description
Negative	desorbing
0ï 2	weakly adsorbing
2ï 20	moderately adsorbing
20ï 100	strongly adsorbing
>100	very strongly adsorbing

Source: Department of Agriculture and Food

2.7 Acid Sulphate Soils

Figure 8 indicates that the eastern half of the site has a moderate to low ASS risk, whereas the remainder is identified as having no known risk. The closest high risk ASS area, the Opwin Swamp Dampland, is located approximately 100m to the northwest of Lot 313.

2.8 Contamination

In accordance with the activities identified within the *Potentially Contaminating Activities, Industries and Landuses* (DEP, 2001a) a number of potential sources of contamination were recognised by Astron Soil and Water. Subsequent recommendations have been provided within their *Preliminary Site Investigation for Contamination* report (Astron, 2011).

3.0 WATER USAGE STRATEGY

3.1 Wastewater Disposal

Wastewater will be disposed of through a connection to the mains sewerage system. Figure 9 shows the proposed sewer design and connection points.

3.2 Household Water Supply

Potable water will be supplied through scheme water.

3.2.1 Water Conservation

Water conservation measures will be adopted to create a 'waterwise' development. The water conservation strategy will reduce scheme water demand through incorporating a variety of effective initiatives in the areas of residential water use, POS landscaping and irrigation. These are described in more detail below.

3.2.1.1 Household Water Use Efficiency

Household water use efficiency will be required through compliance with the 5 Star Plus Codes; Energy Use in Houses Code and Water Use in Houses Code (Department of Housing and Works, 2007a,b). The following requirements will be mandatory for each dwelling and the responsibility of the lot owners;

- All homes must have a gas hot water system with a minimum 5 stars WELS rating (or a solar hot water system, or a high energy efficient electric heat pump).
- 3 or 4 stars WELS rated water efficient fittings and fixtures must be fitted.
- All hot water outlets in new homes will be located close to the hot water system or a recirculating hot water supply to minimise wastage of energy and water.
- New homes must be plumbed to enable connection to an improved water supply at a later date (water tanks, bore water), and enable connection to a grey water diversion scheme.
- New homes with a high water demand for landscaping and internal use must have an approved alternative water supply for appropriate non-potable use.

3.2.1.2 Waterwise Landscaping

Lots will be provided with a full landscape package for the front gardens, which will incorporate a selection of waterwise species, planting layout and water conservation irrigation package. This will reduce the overall potable water supply requirement for irrigation of lots.

3.2.1.3 Community Education

Purchasers will be made aware of the importance of the home owner's role in saving and protecting water resources. This information will be provided within the sales centre and builder displays, describing the following water conservation information:

- Highlight the use of waterwise landscaping techniques in public open space areas and display homes, describing the techniques employed.
- Benefits of water efficient gardens and how to minimise the extent of water-consuming planting.
- Guidance on fertiliser types and regimes and how to minimise the extent of fertiliser-dependent planting.
- Responsible irrigation techniques and the recommended irrigation times based on climatic and soil conditions.
- Water Corporation watering restrictions and rosters.
- Description of the local stormwater management design and responsible practices to assist with stormwater management (e.g. fertiliser and pesticide application, car washing detergents and practices, lawn and garden cutting disposal, and other techniques for minimising stormwater run-off pollutants).

3.2.2 Water Use Efficiency

According to Loh and Coghlan (2003) and Australian Academy of Technological Sciences and Engineering (2002), the Perth single-residential water use after the introduction of watering restrictions in the summer of 2001–2002 was 423 kL/household/annum.

Based on the proposed development size and density, the development would yield approximately 790 lots, which would require an annual water demand of approximately 334 mega litres/annum (ML) for residential use. Results from a 'business as usual' water balance model for the site showed a similar consumption of 412 kL/household/annum.

A water balance estimating the likely water savings from the combined water conservation strategies described above, are estimated to present an approximate 20 - 22% reduction from the typical Perth domestic water usage and 'business as usual' case scenario. This represents a saving between 67 and 73 ML of water per year across the development.

3.3 Public Open Space Water Supply

Formalised Public Open Space (POS) will incorporate passive and active recreational opportunities through open parks and neighbourhood parks. The landscaping of

these spaces will include the use of predominantly endemic or native plant species. Limited use of exotic species is proposed in key areas for amenity and effect. Drip lines, spray irrigation and manual watering will be used for temporary irrigation of plants requiring establishment, depending on the most appropriate application. Spray irrigation will be used for densely planted garden beds and turf in formalised POS areas and other community gardens.

POS irrigation will be scheduled based on site characteristics, application rates, plant types and monthly climate variations. Irrigation scheduling will be configured to encourage deep root growth during plant establishment and application intervals will be progressively reduced following plant establishment to maximise irrigation efficiency. All landscaping and irrigation works will be installed by a reputable contractor experienced in the waterwise concepts being employed.

A Vegetation Management Plan (VMP) will be prepared for the site as a requirement of the Town Planning Scheme (TPS) provisions prior to subdivision. This plan will indentify the long term management of POS areas and retained vegetation, as well as the interface management with the Bush Forever on the southern boundary of Lots 312 and 313. POS designs and plans will be subject to review at the detailed planning stage and information will be included in subsequent UWMPs.

3.3.1 Irrigation Supply

As previously mentioned, Figure 10 and Table 5 indicate that the total POS area across the site is 70,136m^2 or approximately 7.0 ha.

At a rate of 7,500 kL/ha/annum (DEP, 2001b), the amount of water needed to fulfil irrigation requirements is approximately 52,500 kL/annum.

The irrigation water supply for the site will be obtained from the superficial aquifers. An existing groundwater license is in operation and this allocation will be used for post development POS irrigation requirements. The groundwater allocation license from the DoW, granted under section 5C of the *Rights in Water and Irrigation Act 1914* (License number GWL151745) for Lots 4, 8, 313 allows for a total irrigation area of 12.85ha (Lots 4, 8, 313).

4.0 STORMWATER MANAGEMENT

4.1 Overall Drainage Strategy

Liaison with the City of Rockingham has highlighted the requirement that this LWMS consider how the site will interact with the greater North Baldivis catchment area. Lots not included within this site (namely Lots 1, 3 and part of 311), can be addressed separately by managing its' own drainage design and construction independently of this site's strategy. This is demonstrated within the following sections.

4.1.1 Lot drainage

The drainage strategy does not include lot drainage connections to the road drainage network. Given the significant separation to groundwater and the nature and permeability of the site soils, lot drainage will therefore be infiltrated via soakwells. It will be the lot owner's responsibility to provide and install soakwells.

4.1.2 Conveyance System

A piped conveyance system will be used to convey road runoff for up to a 5 year ARI event. Any stormwater from events greater than the 5 year ARI event will be conveyed as overland flow within the road reserves.

4.1.3 Catchment Areas and Infiltration Basins

All stormwater will be conveyed to infiltration basins within each sub catchment. Basins will contain and infiltrate all stormwater events up to the 100 year ARI rainfall event. The basin and catchment details are provided on Figure 10.

There are ten sub catchment areas within the LSP site, each with a dedicated infiltration basin. The catchment areas and basin locations pertaining to this LWMS site boundary are summarised in Table 5 below. Drainage modelling details and results are also presented in Figure 11.

In order to demonstrate that stormwater management for the greater North Baldivis area can be managed independently for each catchment, indicative basin locations and sizing requirements have also been considered for the sub catchments outside this LSP area, namely sub catchments 1, 3 and 11.

Data presented in Table 5 indicates that the area required for storage of the 100 year ARI storm events can be contained within the POS areas in which each basin is located.

Table 5 Drainage Design Details

Catchment and Basin Number	Catchment area	Road reserve area	1yr - Storage required	1 yr - Area at TWL	5yr - Storage required	5 yr - Area at TWL	100yr - Storage required	100 yr – Area at TWL	POS area containing the Basin
Units	(m^2)	(m^2)	(m^3)	(m^2)	(m^3)	(m^2)	(m^3)	(m^2)	(m^2)
2	49,038	17,538	348	842	689	1,110	1,562	1,680	3,000
4	58,750	16,305	329	791	650	1,051	1,466	1,598	8,324
5	61,892	16,951	335	819	655	1,069	1,529	1,640	5,023
6	72,129	40,522	525	1,381	1,048	1,702	2,549	2,491	2,895
7	139,854	39,101	673	1,809	1,328	2,162	3,284	3,080	4,691
8	40,310	12,386	266	637	531	885	1,181	1,372	1,372
9	61,149	16,315	334	812	668	1,099	1,511	1,682	6,043
10A	53842	15,558	327	781	659	1,074	1,437	1,624	6,462
10B	71824	23,141	494	1,188	982	1,607	2,157	2,392	12,355

4.1.3.1 Pipeline Corridor

The Dampier to Bunbury Natural Gas Pipeline Corridor (DBNGP) and a Water Corporation water main passes through the western edge of the site, within Catchments 10A and 10B as illustrated in Figure 10 and 11.

These pipelines are contained within an 11m wide pipeline easement and surrounded by a buffer area, which is proposed to be an unrestricted POS area. The total buffer and easement area is 60m wide.

The drainage basins for catchments 10a and 10b will be contained within the buffer areas, but outside the easement area. Appropriate consultation will be undertaken with the authorities (Water Corporation, APT Pipelines and the CoR) to ensure that any excavation/ earthworks will not occur within the zone of influence of the pipelines. It is anticipated that earthworks occurring in the buffer area will infill to create the drainage basins, rather than excavate existing levels.

4.2 Water Quality Treatment

4.2.1 Vegetation

Vegetation will be planted in all the basins to help prevent erosion, maintain soil infiltration as well as to remove particulate and soluble pollutants, particularly nitrogen. The plants will be appropriately selected based on their intended function using native vegetation as much as possible. The plant species used within the structural devices will be identified within the subsequent Urban Water Management Plans (UWMPs).

4.2.2 Soil Amendment

Given the high natural PRI of the soil (Table 3) and the significant separation distances from the basin inverts to groundwater (discussed below in Section 5.2), it is considered that significant phosphorus adsorption will occur in the natural soil profile, and therefore the added benefit of any soil amendment to the basins is not considered significant.

In addition, any potential advantage in substituting a soil with a higher PRI than the on site soils (approximately 20mL/g), would be offset by a reduction in the ability to infiltrate the stormwater. It is therefore considered that the natural soils are ideally suited to the drainage function for the balance between their water quality treatment function and their infiltration capacity.

4.2.3 Non Structural Controls

As discussed in Section 3.4, non-structural controls such as; public awareness and community education, establishing operation and maintenance activities, as well as controlling land use and management, will provide additional stormwater quality management.

4.3 Flood Management

As highlighted in Section 2.5.2, the site is not within the floodplain.

The Serpentine Floodplain Management Strategy (SKM, 2010) addresses floodplain management to the east of the site. This strategy highlights that development occurring within the flood fringe should ensure that lot levels have at least 0.5m separation distance from the flood fringe level. Given the site is not within the flood fringe, adequate separation distance from lot levels to flood levels is naturally achieved and no further floodplain management through additional fill is necessary.

5.0 GROUNDWATER MANAGEMENT

5.1 Fill Management

There are two areas designated for fill in the south west portion of the site as presented in Figure 11. These areas are the lowest lying areas within the development area both pre and post development,

- One portion of fill will occur in Catchment 7 to a finished level of 6mAHD. This is approximately 4m above groundwater level, well above the 1.2m separation distance requirement for groundwater to finished lot levels.

- The other portion is in Catchments 10a & b and will be filled to a finished level of 6.8mAHD. This is approximately 4.8m above groundwater level, well above the 1.2m separation distance requirement for groundwater to finished lot levels.

- The remaining areas of the site will have finished levels consistent with the pre development topographic contours (approximately 7 – 15m AHD).

On-site soils will be used as fill where possible. Any imported fill will be clean sand, free of organic matter or other deleterious material, and with fines content generally less than 3% to promote drainage.

5.1.1 Subsoil Drainage

There will be no subsoil drainage required given the significant separation distances to groundwater.

5.2 Management of Impacts to Groundwater

In order to ensure impacts to groundwater are minimised, from both a water quality and quantity perspective, stormwater must be managed appropriately. Stormwater will be infiltrated as close to source as possible to mimic pre development infiltration conditions. Post development catchment and basin infiltration areas are in similar proximity to areas where infiltration would have occurred pre development.

The base inverts of the basins must have a minimum separation distance of 0.3m from groundwater to minimise any adverse impacts to groundwater. This will also ensure there will be no standing water as a result of groundwater inundation in the drainage basins. Table 6 shows that there is sufficient distance from the groundwater in all the basins.

Table 6 Groundwater Separation Distances from Basin Inverts

Catchment Basin Number	Base Invert Level (mAHD)	Estimated GW Level (mAHD)	Separation Distance (m)
2	5.1	2	3.1
4	5.7	2	3.7
5	5.0	2	3.0
6	3.0	2	1.0
7	4.3	2	2.3
8	6.0	2	4.0
9	7.0	2	5.0
10A	5.3[1]	2	3.3[1]
10B	4.1[1]	2	2.1[1]

[1] - Levels are based on current topographic contours. Exact levels will be determined at detailed design stage however levels indicated above are likely to be a minimum level. This will be due to the infill, rather than excavation method, to create the basins in the pipeline reserve area, as per detailed in Section 4.1.3.1.

6.0 MONITORING

6.1 Pre-Development Monitoring

No site specific pre-development monitoring was required for the site prior to the LWMS submission. Consultation was undertaken with DoW and confirmation of this is presented in Appendix A.

Pre development monitoring was not deemed necessary due to the unconstrained hydrological conditions of the site, namely;

- There are significant separation distances to groundwater across the majority of the site.
- There are no wetlands on the site.
- The site is not within a flood plain.

Consultation with DoW confirmed the following pre development monitoring strategy for the site would be acceptable;

- Should the LSP and LWMS identify that post development levels are over 5m to groundwater when compared to regional contours, then no site specific monitoring will be required at LWMS or UWMP stage.

- Should the LSP and LWMS identify that post development levels still have some pockets with less than 5m to groundwater when compared to regional contours, then some site specific monitoring will be required in the lower areas at the UWMP stage (for those UWMPs that cover subdivision stages within the lower lying areas).

6.2 Post Development Monitoring

Due to engineering constraints and required gradients, the minimum proposed post-development fill levels are at 6mAHD as indicated in Figure 11. The separation to groundwater at this level would be approximately 4m. This is acknowledged that this is just short of the 5m separation discussed with DoW (Appendix A), however it is still considered a significant separation and therefore no further predevelopment monitoring (prior to the UWMPs) or post-development monitoring is proposed.

7.0 IMPLEMENTATION

The effective implementation of the LWMS requires ongoing involvement by the relevant stakeholders. The roles and responsibilities associated with the site are summarised in Table 7.

7.1 Roles and Responsibilities

Table 7 Roles and Responsibilities for Implementation

Principals	Role	Responsibility	Timescales
Water Usage Strategy	Provision of front landscaping packages.	Proponent	During house design and installation.
	Provision of educational information.	Proponent	During house design and installation.
Stormwater Management	Soakwells for roof drainage.	Lot owner	During house design and installation.
	Constructs of stormwater infrastructure.	Proponent	Following detailed engineering design.
	Maintenance of the drainage basins.	Proponent	Post development until handover to council.
Further Work	The preparation of UWMPs.	Proponent	At subdivision stage.

8.0 REFERENCES

Astron Soil & Water Pty Ltd (June 2011): Lot 313 Fifty Road, Lots 312 & 2 Eighty Road, Lot 4 Baldivis Road, Lots 7 & 8 Ingram Road, Baldivis, Western Australia, Preliminary Site Investigation for Contamination.

Australia Academy of Technological Sciences and Engineering (2002): Perth's water balance – The way forward, ATSE, Perth, November

Beek (1979): Phosphate Retention by Soil in Relation to Water Disposal, Ph.D Thesis. Agricultural University of Wageningen, Netherlands.

Bureau of Meteorology (2011).
http://www.bom.gov.au/climate/averages/tables/cw_009017.shtml

Churchward and McArthur (1980). Landforms and soil of the Darling System, Western Australia

Department of Environmental Protection (DEP), Perth (2001a). Potentially Contaminating Activities, Industries and Landuses.

Department of Environmental Protection and Water and Rivers Commission (2001b). Guidelines for the Establishment and Maintenance of Turf and Grassed Areas.

Department of Housing and Works (2007a): Energy Use in Houses Code

Department of Housing and Works (2007b): Water Use in Houses Code

Department of Water (2012a). Perth Groundwater Atlas.
http://www.water.wa.gov.au/idelve/gwa/

Department of Water (2012b). WIN database Water Resources Data. DR31273

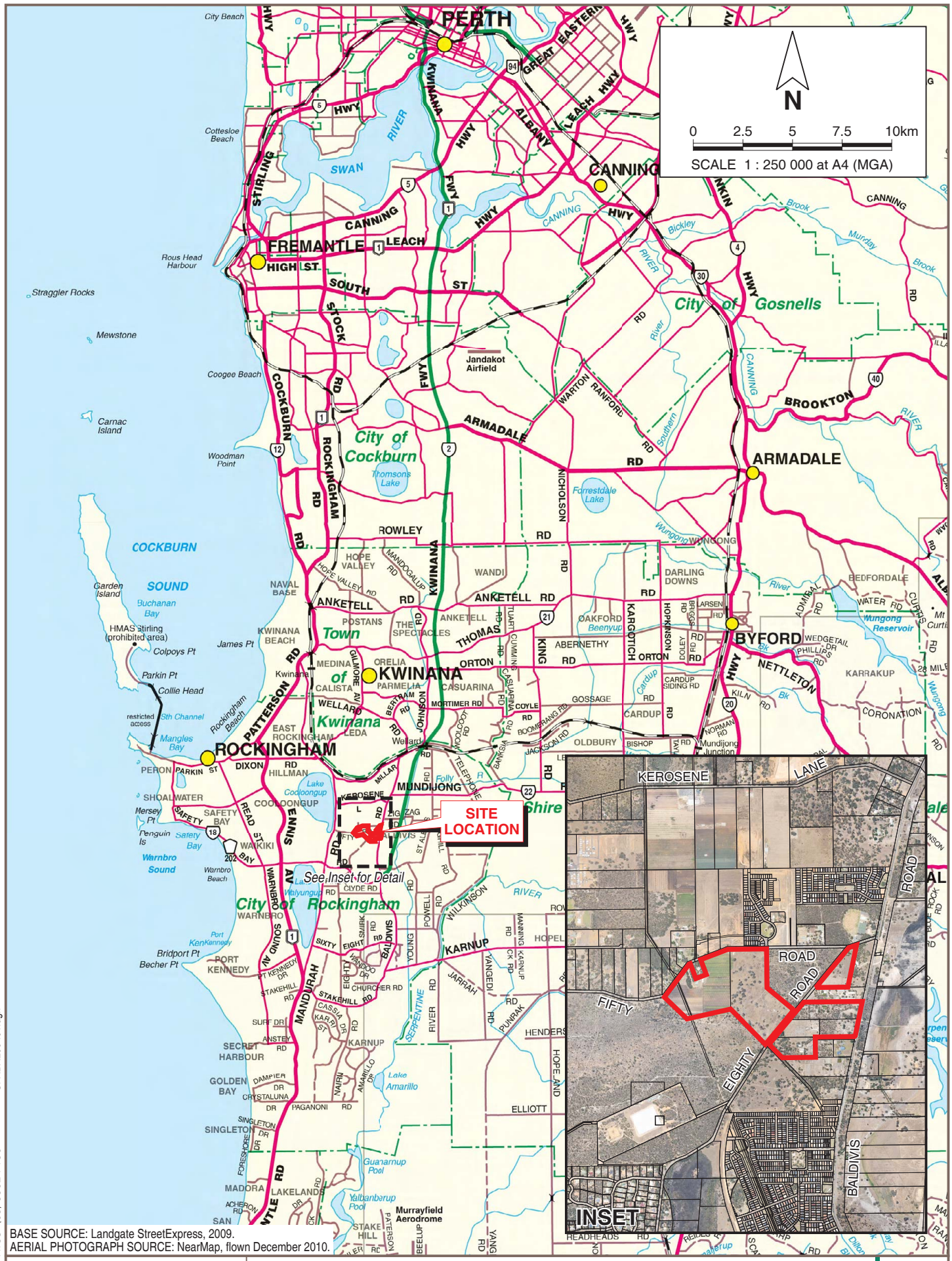
Environmental Protection Authority (EPA) (November 2008): Water Quality Improvement Plan for the Rivers and Estuary of the Peel-Harvey System – Phosphorous Management.

Government of Western Australia (2007). Western Australian State Water Plan.

Loh, M. and Coghlan, P. (2003), Domestic Water Use Study: In Perth, Western Australia 1998–2001, Water Corporation, Perth

SKM (February 2010): Serpentine River Floodplain Management Study

FIGURES



BASE SOURCE: Landgate StreetExpress, 2009.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown December 2010.

PINPOINT CARTOGRAPHICS (08) 9562 7136 SPABAL06-f01.dgn

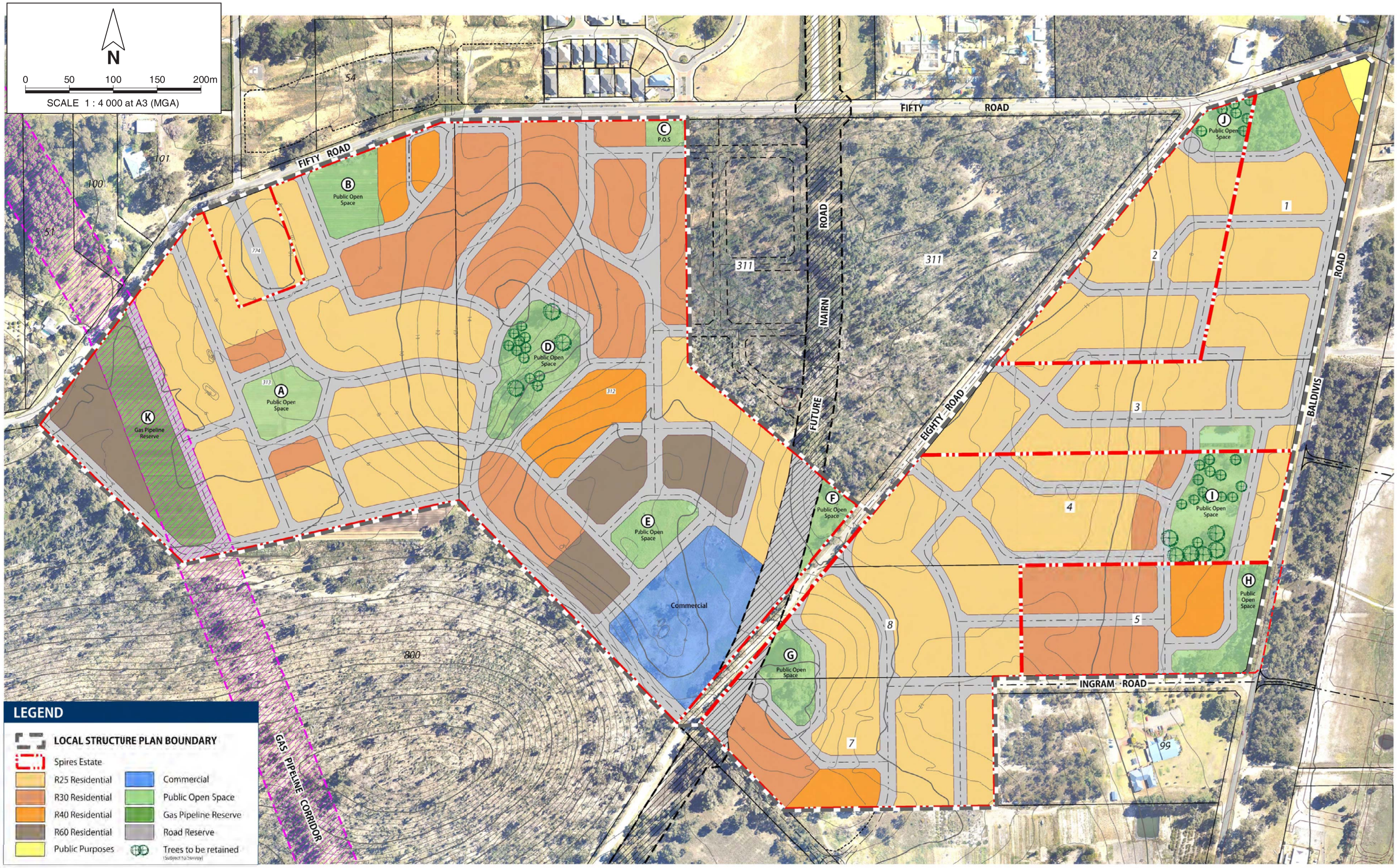
COTERRA ENVIRONMENT

Spatial Property Group
LOCAL WATER MANAGEMENT STRATEGY
NORTH BALDIVIS

Drawn: R. Epworth	Date: 22 Sep 2011
Job: SPABAL06	Revision: A

SITE LOCATION

Figure 1



Development Planning Strategies

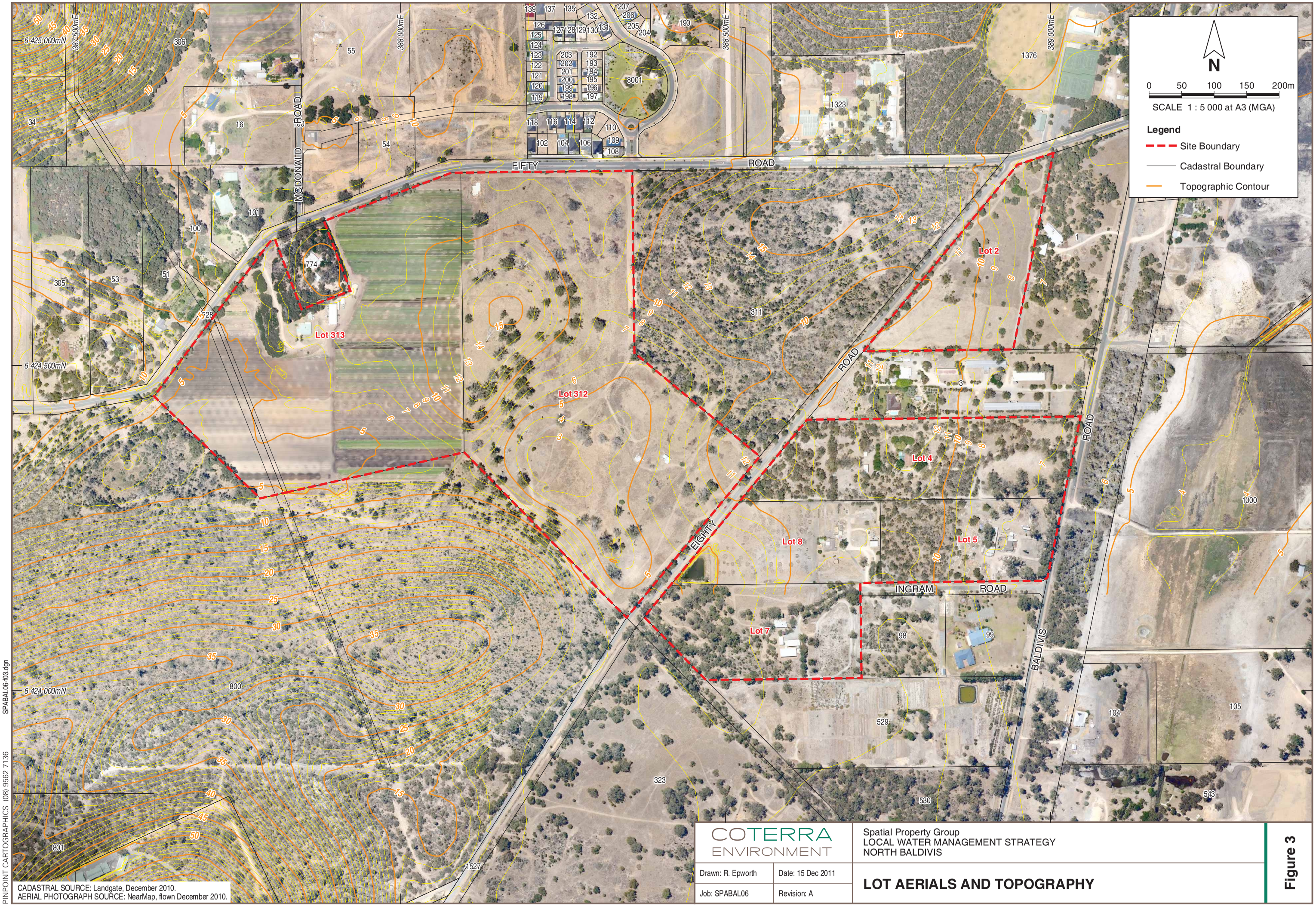
SOURCE: Development Planning Strategies, Dwg No. CARBD067c, 15/02/2012.

PINPOINT CARTOGRAPHICS (08) 9562 7136

SPABAL06-f02.dgn

COTERRA ENVIRONMENT		Spatial Property Group LOCAL WATER MANAGEMENT STRATEGY NORTH BALDIVIS
Drawn: R. Epworth	Date: 28 Feb 2012	**LOCAL STRUCTURE PLAN**
Job: SPABAL06	Revision: A	

Figure 2



SPABAL06-f03.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

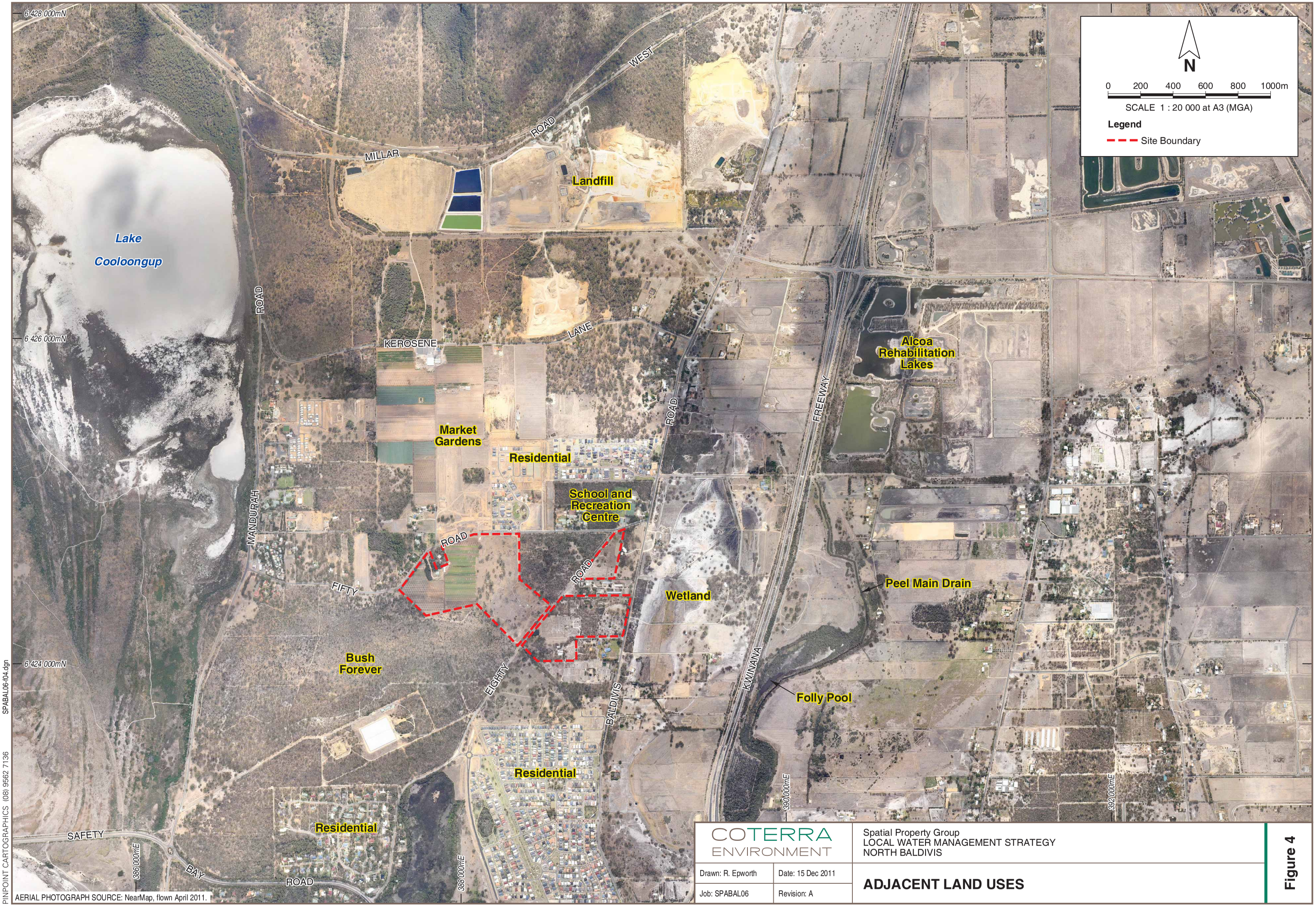
COTERRA ENVIRONMENT

Spatial Property Group
LOCAL WATER MANAGEMENT STRATEGY
NORTH BALDIVIS

Drawn: R. Epworth	Date: 15 Dec 2011
Job: SPABAL06	Revision: A

LOT AERIALS AND TOPOGRAPHY

Figure 3



AERIAL PHOTOGRAPH SOURCE: NearMap, flown April 2011.

COTERRA ENVIRONMENT		Spatial Property Group LOCAL WATER MANAGEMENT STRATEGY NORTH BALDIVIS	Figure 4
Drawn: R. Epworth	Date: 15 Dec 2011	**ADJACENT LAND USES**	
Job: SPABAL06	Revision: A		

SPABAL06-f04.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

N

0 50 100 150 200m

SCALE 1 : 5 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Topographic Contour
- Groundwater Contour (mAHD)

Depth to Groundwater

- <1m
- <2m
- <3m
- <4m
- <5m
- <6m
- <7m
- <8m
- <9m
- <10m
- <11m
- <12m
- <13m

Lot 313
Lot 312
Lot 2
Lot 4
Lot 5
Lot 7
Lot 8

FIFTY ROAD
MCDONALD ROAD
EIGHTY ROAD
INGRAM ROAD
BALDIVIS ROAD

6 425 000mN
6 424 500mN
6 424 000mN
387 500mE
388 000mE
388 500mE
389 000mE

CONTOUR SOURCE: Landgate, March 2011.
CADASTRAL SOURCE: Landgate, December 2010.
GROUNDWATER CONTOURS SOURCE: DoW, May 2003.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown December 2010.

SPABAL06-f05.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

COTERRA ENVIRONMENT

Spatial Property Group
LOCAL WATER MANAGEMENT STRATEGY
NORTH BALDIVIS

Drawn: R. Epworth | Date: 21 Mar 2012
Job: SPABAL06 | Revision: A

PREDEVELOPMENT SEPARATION DISTANCES TO GROUNDWATER

Figure 5

N

0 50 100 150 200m

SCALE 1 : 5 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Topographic Contour

Geomorphic Wetlands

- Conservation Category Wetland
- Multiple Use Wetland
- 6400 Wetland UFI Number

FIFTY ROAD
MCDONALD ROAD
EIGHTY ROAD
ROAD
INGRAM ROAD
BALDIVIS ROAD
Lot 313
Lot 312
Lot 2
Lot 4
Lot 5
Lot 7
Lot 8
6400
6622
15591
8001
387 500mE
388 000mE
388 500mE
389 000mE
6 425 000mN
6 424 500mN
6 424 000mN

WETLANDS SOURCE: DEC, June 2010.
CONTOUR SOURCE: Landgate, March 2011.
CADASTRAL SOURCE: Landgate, December 2010.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown December 2010.

COTERRA ENVIRONMENT

Spatial Property Group
LOCAL WATER MANAGEMENT STRATEGY
NORTH BALDIVIS

Drawn: R. Epworth	Date: 15 Dec 2011
Job: SPABAL06	Revision: A

WETLAND MAPPING

Figure 6

SPABAL06-f06.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

N

0 50 100 150 200m

SCALE 1 : 5 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Topographic Contour

Environmental Geology

- **Cps** PEATY CLAY - dark grey and black, soft, variable organic content, some quartz sand in places, of lacustrine origin
- **Ls1** LIMESTONE - pale yellowish brown, fine to coarse-grained, sub-angular to well rounded, quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin
- **M4** SILT - very pale brown silt, soft when moist, firm when dry, low clay content, of alluvial origin
- **S7** SAND - pale yellowish brown, medium to coarse-grained, sub-angular to well-rounded quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin
- **S8** SAND - very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted, of eolian origin as relatively thin veneer over C2, M4 and Mc2

CADASTRAL SOURCE: Landgate, December 2010.
CONTOUR SOURCE: Landgate, March 2011.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown December 2010.
GEOLOGY SOURCE: Geological Survey of WA, 1 : 50 000 Environmental Geology.

COTERRA ENVIRONMENT

Spatial Property Group
LOCAL WATER MANAGEMENT STRATEGY
NORTH BALDIVIS

Drawn: R. Epworth	Date: 15 Dec 2011
Job: SPABAL06	Revision: A

TOPOGRAPHY, SOILS AND LANDFORMS

Figure 7

SPABAL06-f07.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

N

0 50 100 150 200m

SCALE 1 : 5 000 at A3 (MGA)

Legend

Site Boundary

Cadastral Boundary

Acid Sulfate Soils

No Known Risk

Moderate to Low Risk

High to Moderate Risk

6 425 000mN

6 424 500mN

6 424 000mN

387 500mE

388 000mE

388 500mE

389 000mE

FIFTY ROAD

MCDONALD ROAD

ROAD

EIGHTY

INGRAM ROAD

BALDIVIS ROAD

Lot 313

Lot 312

Lot 2

Lot 4

Lot 5

Lot 8

Lot 7

6400

6622

15591

ACID SULFATE SOILS SOURCE: DPI, 2007.
CADASTRAL SOURCE: Landgate, December 2010.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown December 2010.

SPABAL06-f08.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

COTERRA ENVIRONMENT

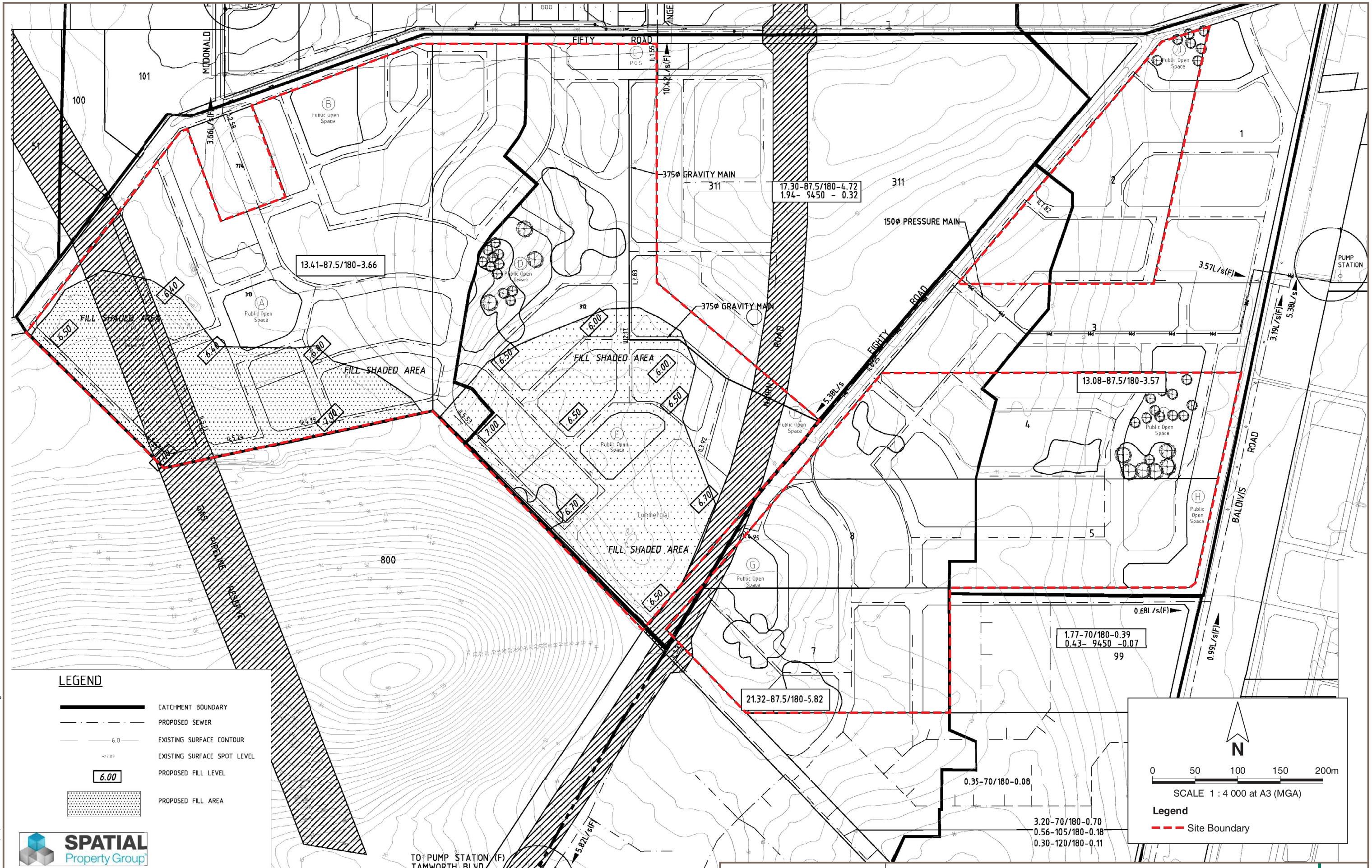
Spatial Property Group
LOCAL WATER MANAGEMENT STRATEGY
NORTH BALDIVIS

Drawn: R. Epworth | Date: 16 Dec 2011

Job: SPABAL06 | Revision: A

ACID SULFATE SOIL MAPPING

Figure 8



LEGEND

- CATCHMENT BOUNDARY
- PROPOSED SEWER
- 6.0 EXISTING SURFACE CONTOUR
- +27.89 EXISTING SURFACE SPOT LEVEL
- 6.00 PROPOSED FILL LEVEL
- PROPOSED FILL AREA

SPATIAL Property Group

DEVELOPMENT ENGINEERING CONSULTANTS

SOURCE: Development Engineering Consultants, Dwg No. BDVCAN10 S100 Rev C, 21-03-12.

COTERRA ENVIRONMENT	Spatial Property Group LOCAL WATER MANAGEMENT STRATEGY NORTH BALDIVIS
Drawn: R. Epworth	Date: 21 Mar 2012
Job: SPABAL06	Revision: A
SEWER STRATEGY PLAN	Figure 9

SPABAL06-109.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

CATCHMENT 10B BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.99ha
100yr STORAGE REQUIRED	215m³
AREA AT TWL (100yr)	2392m²
RL (TWL) (100yr)	5.60m AHD
5yr STORAGE REQUIRED	982m³
AREA AT TWL (5yr)	1607m²
RL (TWL) (5yr)	5.01m AHD
1yr STORAGE REQUIRED	494m³
AREA AT TWL (1yr)	1188m²
RL (TWL) (1yr)	4.66m AHD
PEAK OUTFLOW (100yr)	25 l/s
LWL	4.10m AHD

CATCHMENT 9 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.40ha
100yr STORAGE REQUIRED	1511m³
AREA AT TWL (100yr)	1682m²
RL (TWL) (100yr)	8.50m AHD
5yr STORAGE REQUIRED	668m³
AREA AT TWL (5yr)	1099m²
RL (TWL) (5yr)	7.89m AHD
1yr STORAGE REQUIRED	334m³
AREA AT TWL (1yr)	812m²
RL (TWL) (1yr)	7.54m AHD
PEAK OUTFLOW (100yr)	31 l/s
LWL	7.00m AHD

CATCHMENT 8 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.07ha
100yr STORAGE REQUIRED	1181m³
AREA AT TWL (100yr)	1372m²
RL (TWL) (100yr)	6.50m AHD
5yr STORAGE REQUIRED	531m³
AREA AT TWL (5yr)	885m²
RL (TWL) (5yr)	5.92m AHD
1yr STORAGE REQUIRED	266m³
AREA AT TWL (1yr)	637m²
RL (TWL) (1yr)	5.57m AHD
PEAK OUTFLOW (100yr)	11 l/s
LWL	5.00m AHD

CATCHMENT 11 BASIN DETAILS

TOTAL IMPERVIOUS AREA	0.58ha
100yr STORAGE REQUIRED	725m³
AREA AT TWL (100yr)	924m²
RL (TWL) (100yr)	6.50m AHD
5yr STORAGE REQUIRED	302m³
AREA AT TWL (5yr)	548m²
RL (TWL) (5yr)	5.92m AHD
1yr STORAGE REQUIRED	151m³
AREA AT TWL (1yr)	377m²
RL (TWL) (1yr)	5.59m AHD
PEAK OUTFLOW (100yr)	6 l/s
LWL	5.00m AHD

LEGEND

- DRAINAGE CATCHMENT BOUNDARY
- TREES
- INDICATIVE LOCATION OF COMPENSATING BASIN (SHOWING ~ 1 IN 5 YEAR FLOOD AREA)
- 2.50 AAMGL CONTOURS PER 2003 PERTH GROUNDWATER LEVEL ATLAS
- MONITORING BORES
- STORAGE - 1 IN 100 YEAR LEVEL
- STORAGE - 1 IN 10 YEAR LEVEL
- STORAGE - 1 IN 5 YEAR LEVEL
- STORAGE - 1 IN 1 YEAR LEVEL

CATCHMENT 2 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.50ha
100yr STORAGE REQUIRED	1562m³
AREA AT TWL (100yr)	1680m²
RL (TWL) (100yr)	6.60m AHD
5yr STORAGE REQUIRED	689m³
AREA AT TWL (5yr)	1110m²
RL (TWL) (5yr)	5.97m AHD
1yr STORAGE REQUIRED	348m³
AREA AT TWL (1yr)	842m²
RL (TWL) (1yr)	5.62m AHD
PEAK OUTFLOW (100yr)	34 l/s
LWL	5.10m AHD

CATCHMENT 1 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.95ha
100yr STORAGE REQUIRED	2009m³
AREA AT TWL (100yr)	2050m²
RL (TWL) (100yr)	6.00m AHD
5yr STORAGE REQUIRED	838m³
AREA AT TWL (5yr)	1365m²
RL (TWL) (5yr)	5.31m AHD
1yr STORAGE REQUIRED	424m³
AREA AT TWL (1yr)	1078m²
RL (TWL) (1yr)	4.97m AHD
PEAK OUTFLOW (100yr)	44 l/s
LWL	4.50m AHD

CATCHMENT 3 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.18ha
100yr STORAGE REQUIRED	1341m³
AREA AT TWL (100yr)	1560m²
RL (TWL) (100yr)	7.00m AHD
5yr STORAGE REQUIRED	590m³
AREA AT TWL (5yr)	1001m²
RL (TWL) (5yr)	6.41m AHD
1yr STORAGE REQUIRED	298m³
AREA AT TWL (1yr)	725m²
RL (TWL) (1yr)	6.07m AHD
PEAK OUTFLOW (100yr)	12 l/s
LWL	5.50m AHD

CATCHMENT 4 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.40ha
100yr STORAGE REQUIRED	1466m³
AREA AT TWL (100yr)	1598m²
RL (TWL) (100yr)	7.20m AHD
5yr STORAGE REQUIRED	650m³
AREA AT TWL (5yr)	1051m²
RL (TWL) (5yr)	6.58m AHD
1yr STORAGE REQUIRED	329m³
AREA AT TWL (1yr)	791m²
RL (TWL) (1yr)	6.23m AHD
PEAK OUTFLOW (100yr)	31 l/s
LWL	5.70m AHD

CATCHMENT 5 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.46ha
100yr STORAGE REQUIRED	1529m³
AREA AT TWL (100yr)	1740m²
RL (TWL) (100yr)	6.50m AHD
5yr STORAGE REQUIRED	955m³
AREA AT TWL (5yr)	1169m²
RL (TWL) (5yr)	5.85m AHD
1yr STORAGE REQUIRED	435m³
AREA AT TWL (1yr)	819m²
RL (TWL) (1yr)	5.51m AHD
PEAK OUTFLOW (100yr)	33 l/s
LWL	5.00m AHD

CATCHMENT 10A BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.34ha
100yr STORAGE REQUIRED	1437m³
AREA AT TWL (100yr)	1624m²
RL (TWL) (100yr)	5.80m AHD
5yr STORAGE REQUIRED	659m³
AREA AT TWL (5yr)	1074m²
RL (TWL) (5yr)	5.22m AHD
1yr STORAGE REQUIRED	327m³
AREA AT TWL (1yr)	781m²
RL (TWL) (1yr)	5.86m AHD
PEAK OUTFLOW (100yr)	14 l/s
LWL	5.30m AHD

CATCHMENT 7 BASIN DETAILS

TOTAL IMPERVIOUS AREA	3.34ha
100yr STORAGE REQUIRED	3284m³
AREA AT TWL (100yr)	3080m²
RL (TWL) (100yr)	5.80m AHD
5yr STORAGE REQUIRED	1328m³
AREA AT TWL (5yr)	2162m²
RL (TWL) (5yr)	5.05m AHD
1yr STORAGE REQUIRED	673m³
AREA AT TWL (1yr)	1809m²
RL (TWL) (1yr)	4.72m AHD
PEAK OUTFLOW (100yr)	75 l/s
LWL	4.30m AHD

CATCHMENT 6 BASIN DETAILS

TOTAL IMPERVIOUS AREA	2.52ha
100yr STORAGE REQUIRED	2549m³
AREA AT TWL (100yr)	2491m²
RL (TWL) (100yr)	4.50m AHD
5yr STORAGE REQUIRED	1048m³
AREA AT TWL (5yr)	1702m²
RL (TWL) (5yr)	3.78m AHD
1yr STORAGE REQUIRED	525m³
AREA AT TWL (1yr)	1381m²
RL (TWL) (1yr)	3.55m AHD
PEAK OUTFLOW (100yr)	57 l/s
LWL	3.00m AHD

CATCHMENT AREA INFORMATION

CATCHMENT	TOTAL AREA	LOT AREA	ROAD RESERVE AREA	POS AREA
1	50853m²	23589m²	22700m²	4564m²
2	49038m²	28547m²	17538m²	2953m²
3	43314m²	27871m²	13660m²	1783m²
4	58750m²	34098m²	16305m²	8347m²
5	61892m²	39916m²	16951m²	5025m²
6	72129m²	76016m²	40522m²	5591m²
7	139854m²	88911m²	39101m²	11842m²
8	40310m²	23754m²	12386m²	4170m²
9	61149m²	38787m²	16315m²	6047m²
10A	53842m²	31822m²	15558m²	6462m²
10B	71824m²	36328m²	23141m²	12355m²
11	23374m²	15502m²	6742m²	1130m²

DEVELOPMENT ENGINEERING CONSULTANTS

Legend
- Site Boundary
- Public Open Space

N

0 50 100 150 200m

SCALE 1 : 4 000 at A3 (MGA)

SOURCE: Development Engineering Consultants, Dwg No. BDVCAN10 LW04 Rev C, 21-02-12.

SPABAL06-f10.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

COTERRA ENVIRONMENT

Spatial Property Group
LOCAL WATER MANAGEMENT STRATEGY
NORTH BALDIVIS

Drawn: R. Epworth | Date: 29 Mar 2012
Job: SPABAL06 | Revision: A

STORMWATER CATCHMENT PLAN AND POS LOCATIONS

Figure 10

CATCHMENT 10B BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.99ha
100yr STORAGE REQUIRED	215m^3
AREA AT TWL (100yr)	2392m^2
RL (TWL) (100yr)	5.60m AHD
5yr STORAGE REQUIRED	982m^3
AREA AT TWL (5yr)	1607m^2
RL (TWL) (5yr)	5.01m AHD
1yr STORAGE REQUIRED	494m^3
AREA AT TWL (1yr)	1188m^2
RL (TWL) (1yr)	4.66m AHD
PEAK OUTFLOW (100yr)	25 l/s
LWL	4.10m AHD

CATCHMENT 9 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.40ha
100yr STORAGE REQUIRED	1511m^3
AREA AT TWL (100yr)	1682m^2
RL (TWL) (100yr)	8.50m AHD
5yr STORAGE REQUIRED	668m^3
AREA AT TWL (5yr)	1099m^2
RL (TWL) (5yr)	7.89m AHD
1yr STORAGE REQUIRED	334m^3
AREA AT TWL (1yr)	812m^2
RL (TWL) (1yr)	7.54m AHD
PEAK OUTFLOW (100yr)	31 l/s
LWL	7.00m AHD

CATCHMENT 8 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.07ha
100yr STORAGE REQUIRED	1181m^3
AREA AT TWL (100yr)	1372m^2
RL (TWL) (100yr)	6.50m AHD
5yr STORAGE REQUIRED	531m^3
AREA AT TWL (5yr)	885m^2
RL (TWL) (5yr)	5.92m AHD
1yr STORAGE REQUIRED	266m^3
AREA AT TWL (1yr)	637m^2
RL (TWL) (1yr)	5.57m AHD
PEAK OUTFLOW (100yr)	11 l/s
LWL	5.00m AHD

CATCHMENT 11 BASIN DETAILS

TOTAL IMPERVIOUS AREA	0.58ha
100yr STORAGE REQUIRED	725m^3
AREA AT TWL (100yr)	924m^2
RL (TWL) (100yr)	6.50m AHD
5yr STORAGE REQUIRED	302m^3
AREA AT TWL (5yr)	548m^2
RL (TWL) (5yr)	5.92m AHD
1yr STORAGE REQUIRED	151m^3
AREA AT TWL (1yr)	377m^2
RL (TWL) (1yr)	5.59m AHD
PEAK OUTFLOW (100yr)	6 l/s
LWL	5.00m AHD

LEGEND

- DRAINAGE CATCHMENT BOUNDARY
- TREES
- INDICATIVE LOCATION OF COMPENSATING BASIN (SHOWING ~ 1 IN 5 YEAR FLOOD AREA)
- 2.50 AAMGL CONTOURS PER 2003 PERTH GROUNDWATER LEVEL ATLAS
- MONITORING BORES
- STORAGE - 1 IN 100 YEAR LEVEL
- STORAGE - 1 IN 10 YEAR LEVEL
- STORAGE - 1 IN 5 YEAR LEVEL
- STORAGE - 1 IN 1 YEAR LEVEL

CATCHMENT 2 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.50ha
100yr STORAGE REQUIRED	1562m^3
AREA AT TWL (100yr)	1680m^2
RL (TWL) (100yr)	6.60m AHD
5yr STORAGE REQUIRED	689m^3
AREA AT TWL (5yr)	1110m^2
RL (TWL) (5yr)	5.97m AHD
1yr STORAGE REQUIRED	348m^3
AREA AT TWL (1yr)	842m^2
RL (TWL) (1yr)	5.62m AHD
PEAK OUTFLOW (100yr)	34 l/s
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CATCHMENT 1 BASIN DETAILS

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1yr STORAGE REQUIRED	424m
AREA AT TWL (1yr)	1078m
RL (TWL) (1yr)	4.97m AHD
PEAK OUTFLOW (100yr)	44 l/s
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CATCHMENT 3 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.18ha
100yr STORAGE REQUIRED	1341m^3
AREA AT TWL (100yr)	1560m^2
RL (TWL) (100yr)	7.00m AHD
5yr STORAGE REQUIRED	590m^3
AREA AT TWL (5yr)	1001m^2
RL (TWL) (5yr)	6.41m AHD
1yr STORAGE REQUIRED	298m^3
AREA AT TWL (1yr)	725m^2
RL (TWL) (1yr)	6.07m AHD
PEAK OUTFLOW (100yr)	12 l/s
LWL	5.50m AHD

CATCHMENT 4 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.40ha
100yr STORAGE REQUIRED	1466m^3
AREA AT TWL (100yr)	1598m^2
RL (TWL) (100yr)	7.20m AHD
5yr STORAGE REQUIRED	650m^3
AREA AT TWL (5yr)	1051m^2
RL (TWL) (5yr)	6.58m AHD
1yr STORAGE REQUIRED	329m^3
AREA AT TWL (1yr)	791m^2
RL (TWL) (1yr)	6.23m AHD
PEAK OUTFLOW (100yr)	31 l/s
LWL	5.70m AHD

CATCHMENT 5 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.46ha
100yr STORAGE REQUIRED	1529m^3
AREA AT TWL (100yr)	1640m^2
RL (TWL) (100yr)	6.50m AHD
5yr STORAGE REQUIRED	655m^3
AREA AT TWL (5yr)	1169m^2
RL (TWL) (5yr)	5.85m AHD
1yr STORAGE REQUIRED	335m^3
AREA AT TWL (1yr)	819m^2
RL (TWL) (1yr)	5.51m AHD
PEAK OUTFLOW (100yr)	33 l/s
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CATCHMENT 10A BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.34ha
100yr STORAGE REQUIRED	1437m^3
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RL (TWL) (100yr)	5.80m AHD
5yr STORAGE REQUIRED	659m^3
AREA AT TWL (5yr)	1074m^2
RL (TWL) (5yr)	5.22m AHD
1yr STORAGE REQUIRED	327m^3
AREA AT TWL (1yr)	781m^2
RL (TWL) (1yr)	5.86m AHD
PEAK OUTFLOW (100yr)	14 l/s
LWL	5.30m AHD

CATCHMENT 7 BASIN DETAILS

TOTAL IMPERVIOUS AREA	3.34ha
100yr STORAGE REQUIRED	3284m^3
AREA AT TWL (100yr)	3080m^2
RL (TWL) (100yr)	5.80m AHD
5yr STORAGE REQUIRED	1328m^3
AREA AT TWL (5yr)	2162m^2
RL (TWL) (5yr)	5.05m AHD
1yr STORAGE REQUIRED	673m^3
AREA AT TWL (1yr)	1809m^2
RL (TWL) (1yr)	4.72m AHD
PEAK OUTFLOW (100yr)	75 l/s
LWL	4.30m AHD

CATCHMENT 6 BASIN DETAILS

TOTAL IMPERVIOUS AREA	2.52ha
100yr STORAGE REQUIRED	2549m^3
AREA AT TWL (100yr)	2491m^2
RL (TWL) (100yr)	4.50m AHD
5yr STORAGE REQUIRED	1048m^3
AREA AT TWL (5yr)	1702m^2
RL (TWL) (5yr)	3.78m AHD
1yr STORAGE REQUIRED	525m^3
AREA AT TWL (1yr)	1381m^2
RL (TWL) (1yr)	3.55m AHD
PEAK OUTFLOW (100yr)	57 l/s
LWL	3.00m AHD

CATCHMENT AREA INFORMATION

CATCHMENT	TOTAL AREA	LOT AREA	ROAD RESERVE AREA	POS AREA
1	50853m^2	23589m^2	22700m^2	4564m^2
2	49038m^2	28547m^2	17538m^2	2953m^2
3	43314m^2	27871m^2	13660m^2	1783m^2
4	58750m^2	34098m^2	16305m^2	8347m^2
5	61892m^2	39916m^2	16951m^2	5025m^2
6	72179m^2	26016m^2	40522m^2	5591m^2
7	139854m^2	88911m^2	39101m^2	11842m^2
8	40310m^2	23754m^2	12386m^2	4170m^2
9	61149m^2	38787m^2	16315m^2	6047m^2
10A	53842m^2	31822m^2	15558m^2	6462m^2
10B	71824m^2	36328m^2	23141m^2	12355m^2
11	23374m^2	15502m^2	6742m^2	1130m^2

DEVELOPMENT ENGINEERING CONSULTANTS

Legend
- Site Boundary
- Fill Areas

N

0 50 100 150 200m

SCALE 1 : 4 000 at A3 (MGA)

SOURCE: Development Engineering Consultants, Dwg No. BDVCAN10 LW04, 21-10-11.

PINPOINT CARTOGRAPHICS (08) 9562 7136 SPABAL06-f11.dgn

COTERRA ENVIRONMENT

Spatial Property Group
LOCAL WATER MANAGEMENT STRATEGY
NORTH BALDIVIS

Drawn: R. Epworth | Date: 29 Mar 2012
Job: SPABAL06 | Revision: A

STORMWATER BASIN REQUIREMENTS AND FILL MANAGEMENT

Figure 11

APPENDIX A – DoW CORRESPONDENCE

Rebecca Epworth

From: DUNN Brett [Brett.Dunn@water.wa.gov.au]
Sent: Monday, 11 April 2011 8:22 AM
To: Rebecca Epworth
Subject: RE: North Baldivis monitoring

Hi Rebecca,

Thankyou for your e-mail. The Department of Water would not object to the method you have proposed for the protection and monitoring of groundwater resources for Lots 2, 4, 8, 7 Eighty Road and Lots 312 and 313 Fifty Road, Baldivis.

Kind Regards,

Brett Dunn
A/Program Manager ï Urban Water Management
Department of Water
Kwinana Peel Region
Ph: (08) 9550 4202
Email: brettdunn@water.wa.gov.au

From: Rebecca Epworth [mailto:rebecca.epworth@coterra.com.au]
Sent: Friday, 8 April 2011 2:18 PM
To: DUNN Brett
Subject: North Baldivis monitoring

Hi Brett,

Thanks for discussing the groundwater monitoring requirements for our North Baldivis site (Lots 2, 4, 8, 7 Eighty Road, Lots 312 and 313 Fifty Road). As discussed, there are significant separation distances to groundwater across the majority of the site however there are some areas with less than 5m to groundwater. There are no wetlands on the site.

The lower areas are identified in the attached figure. As mentioned, at LSP stage the site will be undergoing cut and fill and as such, the lower areas will be filled. However, at present the exact final levels (and therefore final separation distances) are unknown.

Given the DoW's approach to groundwater monitoring requirements for areas above 5m to groundwater, we therefore propose the following monitoring strategy for the site and respectfully request your approval of the approach;

- Should the LSP and LWMS identify that post development levels are over 5m to groundwater when compared to regional contours, then no site specific monitoring will be required at LWMS or UWMP stage.
- Should the LSP and LWMS identify that post development levels still have some pockets with less than 5m to groundwater when compared to regional contours, then some site specific monitoring will be required in the lower areas at the UWMP stage (for the UWMPs that address the lower lying areas).
- In summary – no site specific monitoring will be required at LWMS stage, however should proposed post development levels indicate that some areas will have less than 5m to groundwater, then site specific monitoring will be done for the appropriate UWMPs at subdivision stage.

Could you please confirm that DoW would be satisfied with this approach?

Thanks so much for your help.

Cheers, Bec

Rebecca Epworth
Director

COTERRA
ENVIRONMENT

Ph: 9381 5513 | Fax: 9381 5514 | Mobile: 0437 707 472
19/336 Churchill Avenue, SUBIACO WA 6008 | www.coterra.com.au

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Appendix **Six** – Transport Assessment

SPIRES ESTATE LOCAL STRUCTURE PLAN, BALDIVIS

TRANSPORT ASSESSMENT (REVISED APRIL 2014)

transport planning • traffic engineering • project management

Spires Estate
Local Structure Plan,
Baldivis

Transport Assessment

Prepared for:
Carcione Nominees Pty Ltd
C/- Spatial Property Group

Revised April 2014

Prepared by:
TRANSCORE PTY LTD
61 York Street, Subiaco WA 6008
PO Box 42, Subiaco WA 6904
Telephone (08) 9382 4199
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Document history and status

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R White	r01a		16 June 2012	Draft
R White	r01b	B Bordbar	3 July 2012	Final
R White	r02	B Bordbar	28 April 2014	Revised

File name: t12.089.rw.r02.doc

Author: Robin White

Project manager: Behnam Bordbar

Client: Carcione Nominees Pty Ltd
C/- Spatial Property Group

Name of project: Baldivis LSP

Document revision: r02

Project number: t12.089

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Appendix A. Spires Estate Local Structure Plan

Appendix B. SIDRA Intersection Analysis

1 Introduction

This Transport Assessment has been prepared by Transcore on behalf of Carcione Nominees Pty Ltd. The subject of this report is the proposed Spires Estate Local Structure Plan (LSP) in the City of Rockingham.

The LSP area includes various lots east and west of Eighty Road in Baldivis, south of Fifty Road and west of Baldivis Road, as shown in Figure 1.

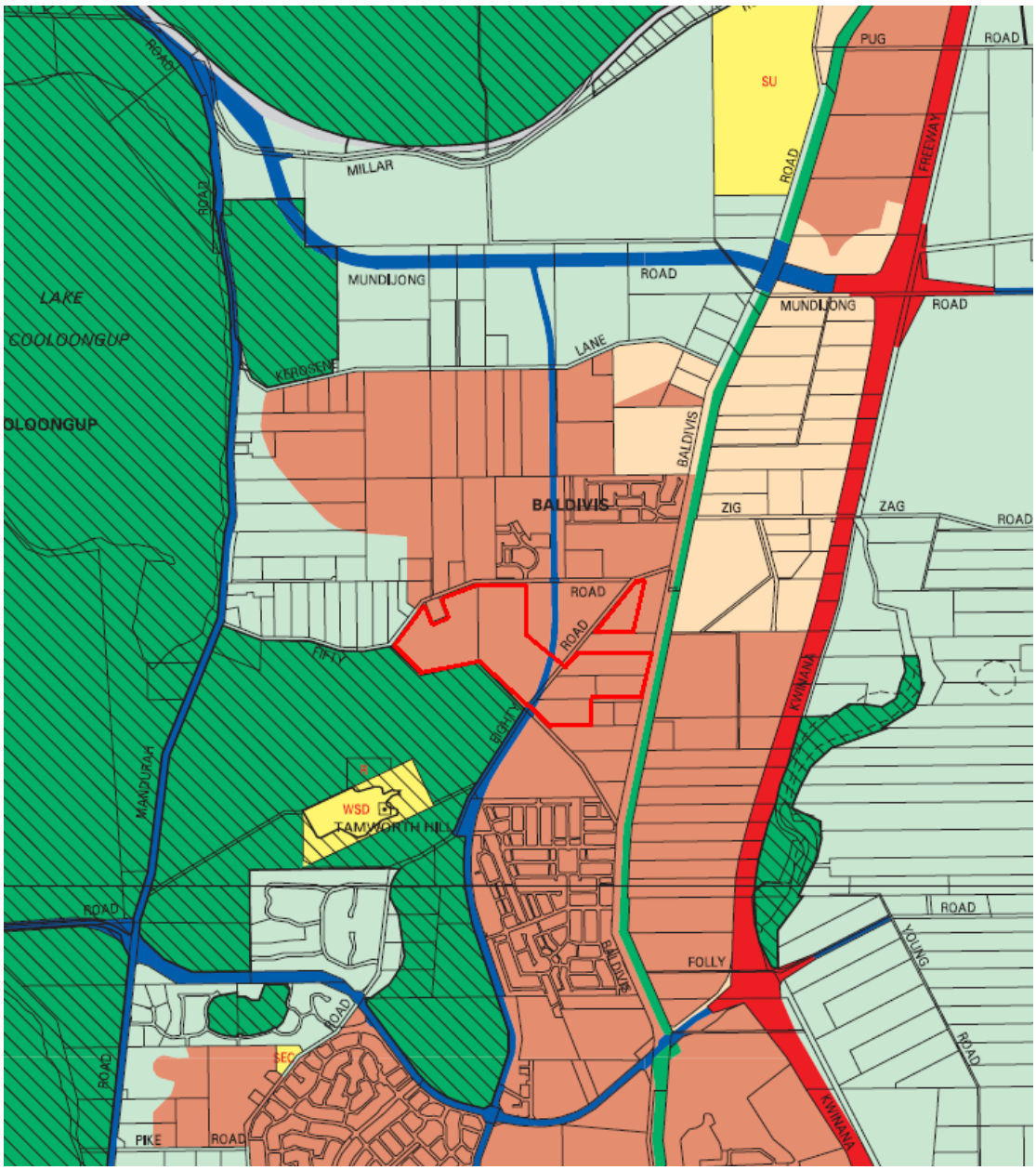


Figure 1. Site location

2 Proposed Local Structure Plan

The proposed Spires Estate Local Structure Plan (LSP) is shown in Figure 2 and a larger copy is included at Appendix A.

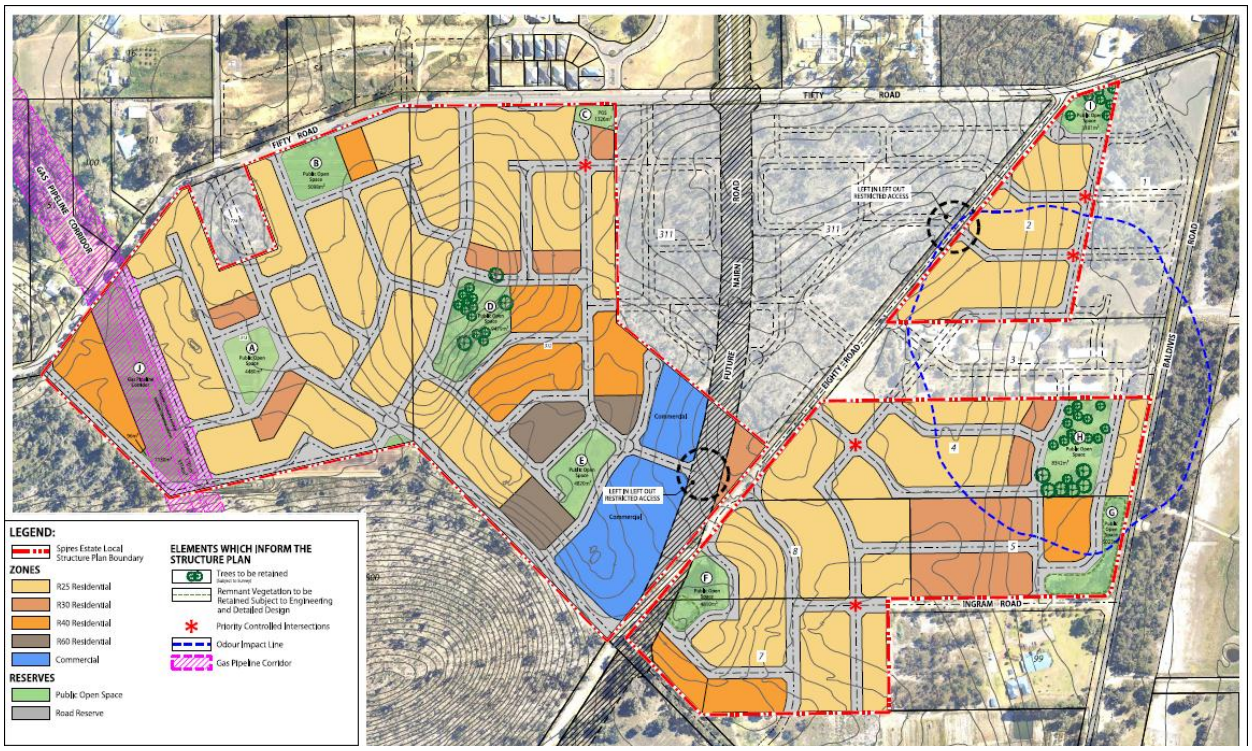


Figure 2. Spires Estate Local Structure Plan

As shown on the LSP plan the LSP proposes residential land ranging from R25 to R60 density with a neighbourhood centre located at the centre of the LSP area adjacent to Eighty Road.

The LSP area is anticipated to accommodate up to approximately 800 dwellings (on single residential lots and grouped housing lots) and a neighbourhood activity centre incorporating a shopping centre of approximately 4500m^2 net lettable floor area (NLA) and another smaller commercial use such as a child care centre.

3 Existing Situation

3.1 Existing Land Use

Existing land uses in the LSP area are predominantly rural. This includes market gardens at the western end of the site and a poultry farm in the east as well as farm lands on most of the site.

Lot 311, the property immediately southwest of the Fifty Rd / Eighty Rd intersection, is still covered by native vegetation and is not included in this LSP area.

Adjacent land uses on the north side of Fifty Road include the Baldivis Hall and playing fields within the Baldivis Nature Reserve, a primary school and new residential subdivisions although some land holdings are still rural. Southwest of the site is the Rockingham Lakes Regional Park (west of Eighty Road) and to the

east of Eighty Road, south of Ingram Road is an existing church and new residential subdivisions currently being developed. East of Baldivis Road the existing land use is still rural at present.

3.2 Existing Road Network

Baldivis Road is constructed as a single carriageway, two-lane, rural road providing north south access through Baldivis for connections to the Kwinana Freeway at Mundijong Road, Safety Bay Road and Karnup Road. Baldivis Road has a 70km/h speed limit between Safety Bay Road and the LSP area. The speed limit changes to 80km/h about 500m north of the LSP area.

Baldivis Road south of the LSP area (or more specifically, south of the church south of the LSP area) has been upgraded to a 12m-wide seal width between kerbs and marked as two 1.5m cycle lanes, two 3.5m traffic lanes and a 2m painted median with raised traffic islands.

Main Roads WA recorded weekday traffic flows of approximately 6,500 vehicles per day (vpd) on Baldivis Road north of Safety Bay Road in October 2012.

Fifty Road provides an east west connection from Eighty Road west to Mandurah Road and is classified as a local distributor road. It is a single carriageway, unkerbed two-lane rural road at the western end of the LSP area but has been upgraded to a kerbed two-lane boulevard adjacent to the existing North Baldivis subdivision. It is a kerbed two-lane road adjacent to the primary school with embayed parking for the primary school on the northern side. Fifty Road has a 70km/h speed limit but a 40km/h school zone (7.30-9am and 2.30-4pm on school days) applies adjacent to the primary school.

Main Roads WA recorded weekday traffic flows of approximately 3,040 vpd on Fifty Road west of Eighty Road in November 2013.

Eighty Road connects from Baldivis Road and Fifty Road in the northeast to Safety Bay Road in the south. It is a single carriageway, two-lane, rural road and is classified as an access road in this area. It has a 70km/h speed limit within the LSP area. No existing traffic count information is available on this section of Eighty Road.

Ingram Road is constructed westward from Baldivis Road for approximately 300m and forms the southern boundary of the LSP area in that location. The eastern half abutting the existing church site is a single carriageway, two-lane, rural road but the newer section west of the church driveway is constructed as a kerbed and sealed 6m carriageway. It is classified as an access road.

Existing intersections of these roads in the study area are all priority-controlled T-junctions.

Amazon Drive connects from Baldivis Road to Eighty Road and forms the southern boundary of the LSP area from Eighty Road to Cervantes Avenue. It has

roundabouts at the Baldivis Rd/Amazon Dr and Amazon Dr/Cervantes Ave/Everest Way intersections. The Amazon Drive approach to the Eighty Rd intersection is widened to provide separate left and right turn lanes and Eighty Road has also been widened through this intersection to provide left and right turn lanes approximately 60m long.

3.3 *Public Transport*

The closest existing bus route to the LSP area is Bus Route No. 568 from Warnbro Train Station, which currently terminates at Nairn Drive / Kingaroy Drive (about 700m south of the LSP area), as shown in Figure 3.

Bus route 568 provides an hourly service Monday to Friday between 5.30am and 9pm (with more frequent service in the peak direction in AM and PM peak periods) and hourly on Saturday and Sunday from 7 or 8am to 7pm, approximately.

A deviation of route 568 links to the Stockland Baldivis Shopping Centre on Safety Bay Road, with this deviation operating from approximately 8.30am to 4pm on weekdays, 8am to 5pm on Saturdays and 11am to 5pm on Sundays.

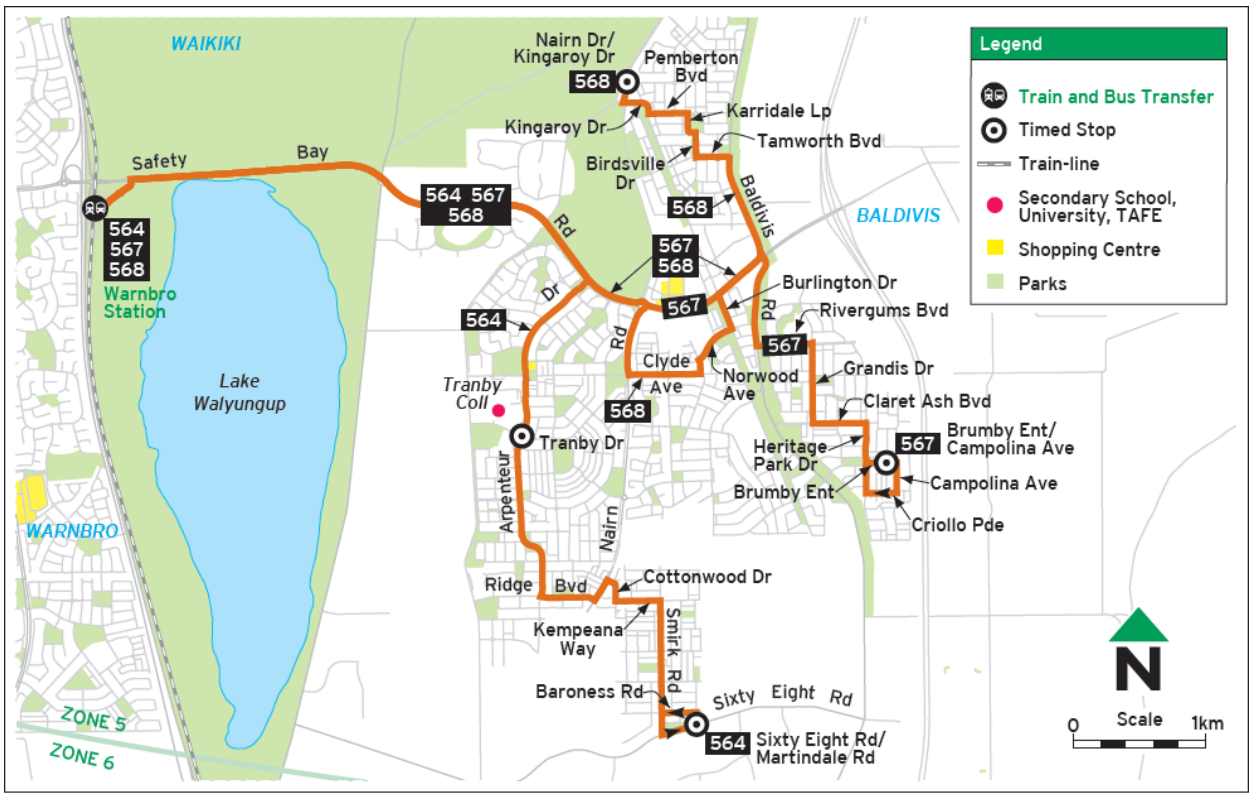


Figure 3. Existing bus routes

3.4 *Pedestrian and Cyclist Facilities*

The entirely rural section of Fifty Road at the western end of the LSP area has no existing footpaths or cycle facilities but a 2m shared path has been provided on

the northern side of Fifty Rd adjacent to North Baldivis residential subdivision and linking to the primary school. There is a similar shared path on the north side of the east west section of Eighty Rd from the school to Baldivis Rd. There are no existing footpaths or cycle facilities on the north south section of Eighty Road or Baldivis Road within the LSP area. However there is a shared path on the west side of Baldivis Road immediately north of Eighty Road and on the west side of Baldivis Road south of the church south of the LSP area.

The Department of Transport's Perth Bike Map series (see Figure 4) shows that Baldivis Road, Eighty Road and Fifty Road were all considered a good road riding environment. That map was prepared in 2009 and does not show the shared paths mentioned above, which have been constructed as part of recent subdivisional development in this area. It does show the Principal Shared Path on the western side of the Kwinana Freeway in this area.

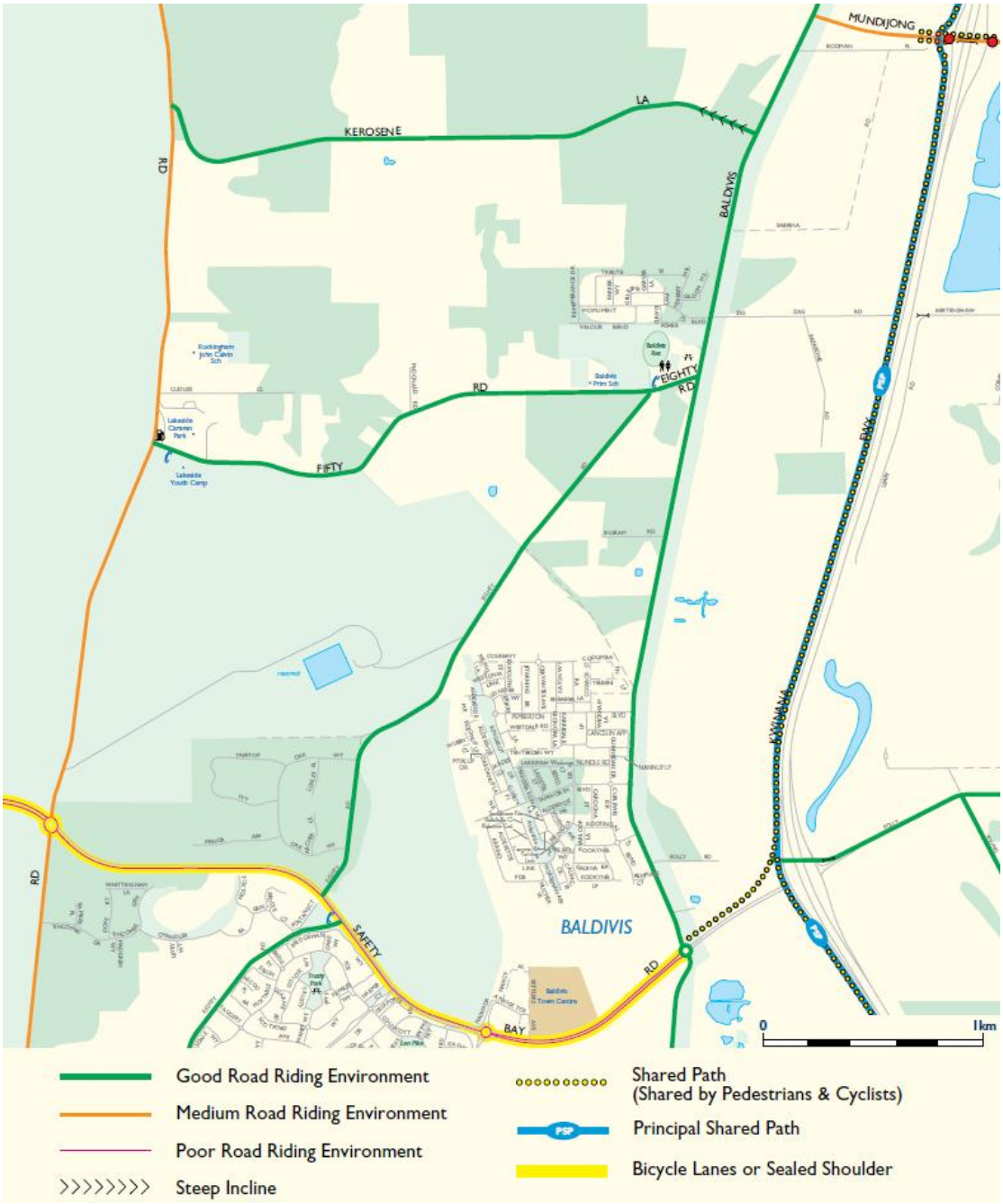


Figure 4. Bike map

3.5 Changes to Surrounding Road Network

Long-term road network planning for this part of the Metropolitan Region includes the future extension of Nairn Drive as the main north south district distributor road through Baldivis and Karnup. The alignment of this planned Other Regional Road (also referred to as a blue road) in the Metropolitan Region Scheme (MRS) is shown in Figure 1 and this alignment is also indicated through the middle of the LSP area on the LSP plan at Figure 2. This will include a four-way intersection at the southern boundary of the LSP area and a four-way

intersection at Fifty Road. (Fifty Road is the northern boundary of the LSP area but the lot directly affected by this intersection is not part of the LSP area.)

Other local structure plans for urban development east of Baldivis Road include future road connections to Baldivis Road that will create 4-way intersections at Fifty Road, Ingram Road and Amazon Drive. Baldivis Rd/Amazon Dr is already constructed as a 3-way roundabout and the Baldivis Rd/Ingram Rd and Baldivis Rd/Fifty Rd intersections are also anticipated to be upgraded to roundabouts as part of construction of the new road connections on the eastern side of Baldivis Road.

3.6 Public Transport Network Planning

The *City of Rockingham Baldivis Road Needs Study Update Traffic and Infrastructure Report* (draft, January 2012) includes a Transperth service development plan prepared by the Public Transport Authority (see Figure 5 below).

Advice has also been obtained from the PTA for preparation of this transport assessment report. PTA have indicated that their current plan is for the northwestern route to continue up Nairn Drive in the longer term and turn west before Kerosene Lane to initially reach a terminus towards the western edge of the development (i.e. in north Baldivis) and perhaps in the even longer term continue to Rockingham Station.

In the shorter term it is likely that that the bus will terminate somewhere around the neighbourhood centre proposed for Spires Estate, or continue to a temporary terminus along Eighty Road. This will however depend on staging of residential development, the road network and the availability of resources.

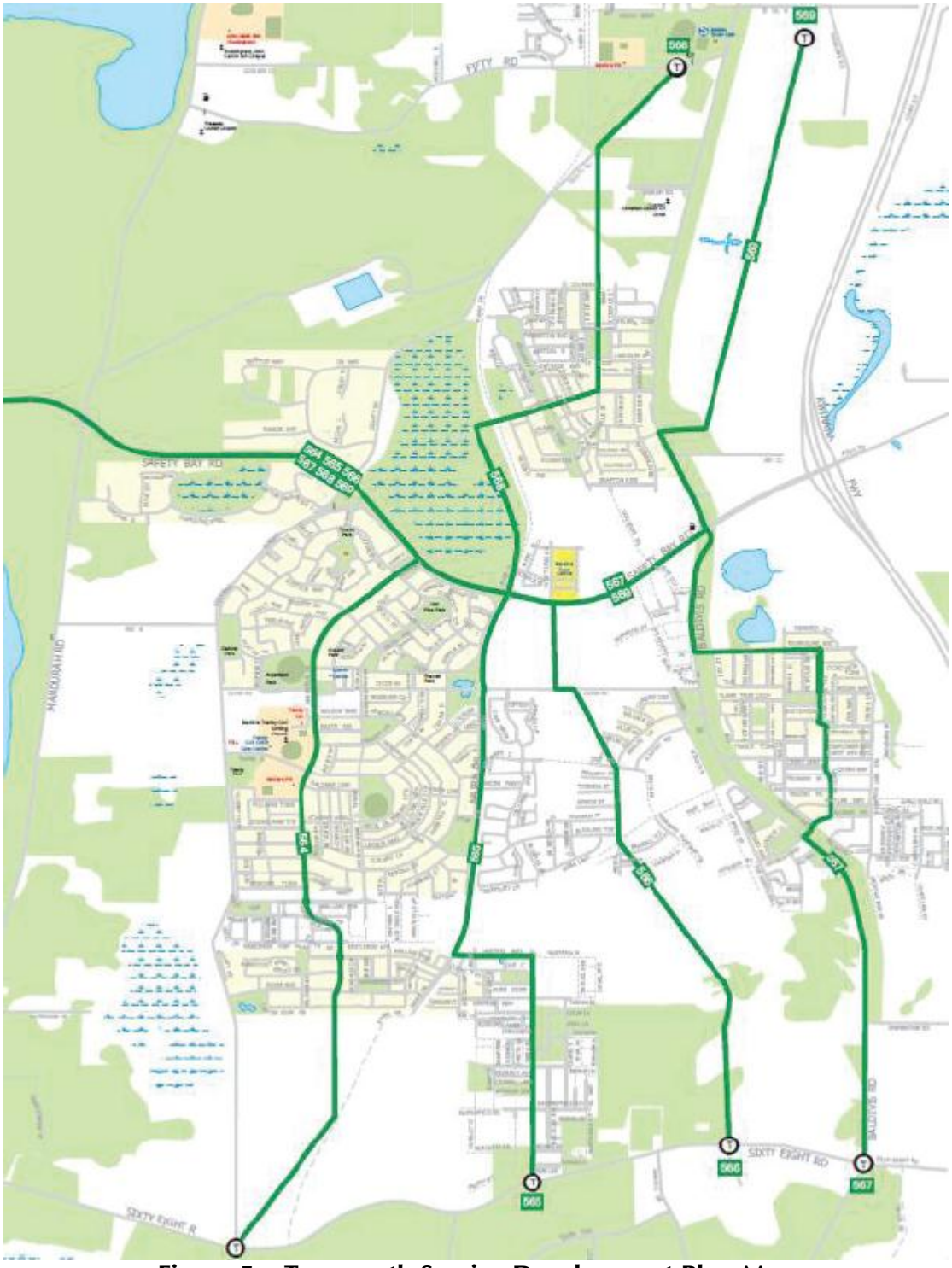


Figure 5. Transperth Service Development Plan Map

4 Proposed Transport Network

4.1 Road Hierarchy

The hierarchy of roads within the LSP area is illustrated in Figure 6 using the road hierarchy defined in *Liveable Neighbourhoods (2007)*.

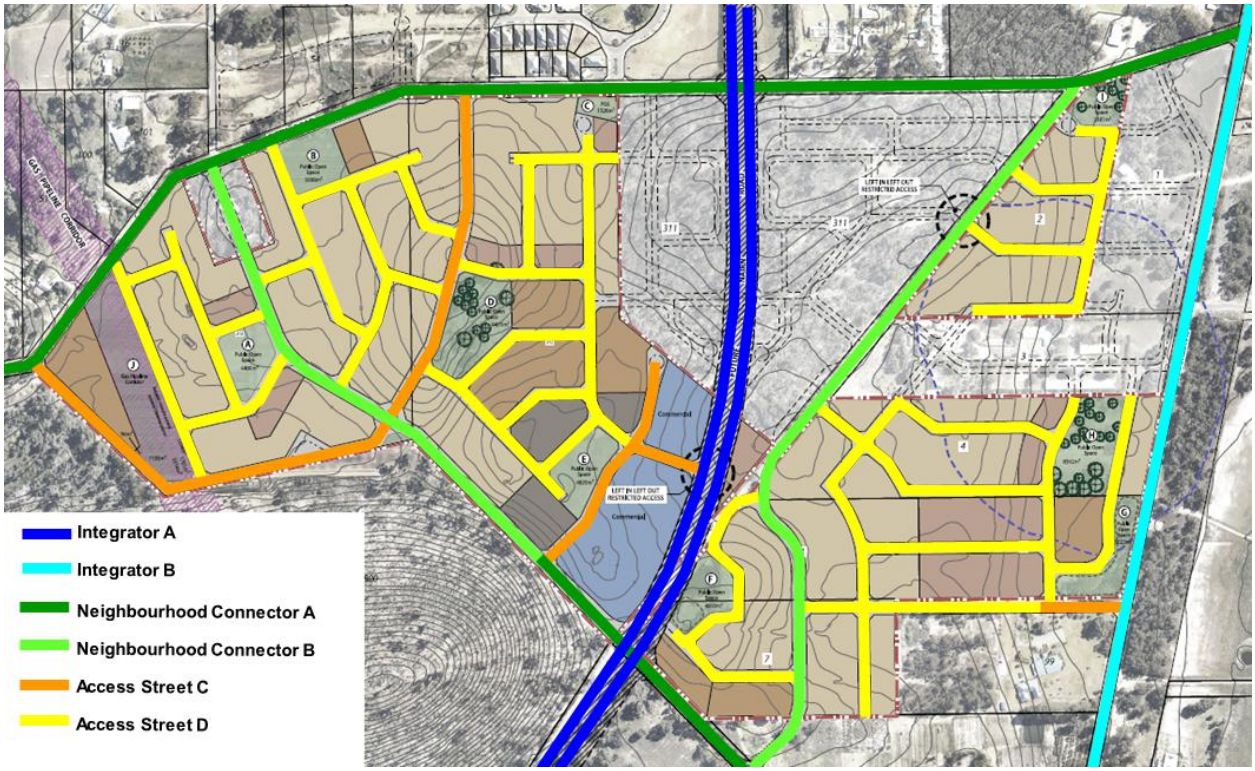


Figure 6. Road Hierarchy

Some key characteristics of the relevant road classifications have been summarised in Table 1 below. These are generally based on Liveable Neighbourhoods guidelines although the proposed widths do vary slightly from the standard Liveable Neighbourhoods cross-section diagrams.

Table 1. Road Hierarchy

Road Classification	Indicative upper volume (vpd)	Indicative road reserve width (m)	Indicative road pavement width (m)
Integrator A	35,000	40m	2 x 8.5m (incl. cycle lanes), 6m median and embayed parking
Integrator B	15,000	29m	2 x 5m (incl. cycle lanes), 6m median and embayed parking
Neighbourhood Connector A	7,000	23m	2 x 5m (incl. cycle lanes), 2m median and embayed parking
Neighbourhood Connector B	3,000	20m (18m min)	7.4m (plus embayed parking)
Access Street C	3,000	16m	6m (plus embayed parking) or 7.2m (with no embayed parking
Access Street D	1,000	15m	6m
Laneway	300	6m	6m typical

It should be noted that these reserve widths are indicative and may be subject to further adjustment in consultation with the Department of Planning and City of Rockingham during detailed subdivision design.

Nairn Drive
The road reserve for Nairn Drive is established by the Other Regional Roads reservation. Nairn Drive is equivalent to an Integrator A. The 40m road reserve allows for future construction to dual carriageway, two lanes each way, when required. It is anticipated that one 2-lane carriageway would initially be constructed (as in existing sections south of Safety Bay Road) with the second carriageway to be constructed in future when required.

Nairn Drive is anticipated to be assigned a 70km/h speed limit. A 40km/h school zone would be required before and after school on school days on the section immediately north of Fifty Road, which is outside of this LSP area.

Baldivis Road
Baldivis Road will be an Integrator B road in the Liveable Neighbourhoods road hierarchy. The existing upgraded section south of the church south of the LSP area demonstrates the road cross section that has been considered appropriate adjacent to those other subdivision areas. It involves two 5m carriageways and a 2m median.

Eighty Road
It is proposed that Eighty Road within the LSP area be upgraded to a fully kerbed and drained, 7.4m wide, single carriageway Neighbourhood Connector B standard. It is anticipated that the speed limit will be reduced to 60km/h adjacent to the LSP area as has already happened on sections of Eighty Road south of Safety Bay Road.

Fifty Road
The future standard of Fifty Road is already demonstrated by the upgraded sections adjacent to the new North Baldivis subdivision development to the north. This is a Neighbourhood Connector A standard road cross section with two 5m carriageways and a 2m median.

It is recommended that the existing 70km/h speed limit on Fifty Road should ultimately be reduced to 50 or 60km/h as is normal for a neighbourhood connector road.

Other Neighbourhood Connectors
There is one other Neighbourhood Connector road indicated on Figure 6. This is Amazon Drive, the road that crosses Nairn Drive south of the neighbourhood centre then bends northward through the LSP area to connect to Fifty Road. Traffic volumes on this road will be highest around the neighbourhood centre and will be classified as a Neighbourhood Connector A either side of Nairn Drive. Traffic volumes will be substantially lower west of the neighbourhood centre and the western section will be a Neighbourhood Connector B. The type B is proposed as 18m wide road reserve as the minimum permitted in Liveable

Neighbourhoods, with a standard 7.4m carriageway (two 3.7m traffic lanes) and a typical verge width of 5.3m including embayed parking where appropriate for adjacent development.

The verge width on the southwest side of Amazon Drive adjacent to the Rockingham Lakes Regional Park is proposed to be reduced to 2.5m width as it will not need to accommodate underground services for adjacent development.

Access Streets
The basic standard of access street proposed in this subdivision is a 6m wide carriageway in a 15m road reserve. This *Access Street D* results in 4.5m verges on both sides, with embayed parking accommodated in the verges where required, such as to provide visitor parking for lots serviced by rear laneways. This road standard is proposed where the future total traffic volumes are less than 1000 vpd.

Access Streets with a future traffic volume up to 3000 vpd will be designed as an Access Street C. This is based on a 16m road reserve width and either a 7.2m carriageway width or 6m plus embayed parking where required.

On access streets abutting public open space (POS) the verge adjacent to the POS may be reduced to 2.5m. This is proposed on the Access Street B around the southwest corner of the LSP area adjacent to the Rockingham Lakes Regional Park.

Laneways
The proposed road reserve width of the laneways is 6.0 metres. These would typically be designed with flush kerbing (i.e. at the same level as the laneway pavement) and central drainage, and can accommodate two-way vehicle movement and rubbish collection. Details relating to the design of these laneways will be addressed in more detail during the subdivision planning stages.

Visitor car parking is to be constructed in the road reserve adjacent to proposed lots serviced by laneways at a minimum rate of one bay per every two dwellings.

4.2 Public Transport

Existing bus services in this area are described in section 3.3 of this report and current planning by the Public Transport Authority is discussed in section 3.6.

Current planning anticipates a future bus route through this LSP area, initially on Baldivis Road and ultimately on Nairn Drive within the LSP area.

4.3 Pedestrian and Cyclist Facilities

A highly permeable road network within the LSP area creates excellent opportunities for the provision of good pedestrian and cyclist facilities that maximise use of non-motorised transport modes.

Figure 7 outlines the proposed pedestrian and cyclist network for the LSP Update area.

In accordance with current practice adopted by the City of Rockingham it is proposed to construct all paths to a minimum width of two metres so that they can all be designated as shared paths for pedestrians and cyclists. A 2.5m width is proposed in high pedestrian-traffic locations such as adjacent to the primary school and bordering the neighbourhood centre.

Paths will be provided on at least one side of all roads. There would be paths on both sides of roads adjacent to the primary school site and on both sides on all the Integrator Arterial and Neighbourhood Connector roads, except where there will only be urban development on one side of the road.

Paths on the southern verge of Fifty Rd and the western verge of Eighty Rd abutting Lot 311 would not be provided while Lot 311 remains undeveloped. Lot 311 is not part of this LSP area and it is understood that development of this lot may not occur for some time, if at all.

Laneway lots are to have footpath access to visitor parking bays provided in a nearby road reserve.

On-street cycle lanes will be included on the Integrator A, Integrator B and Neighbourhood Connector A roads, as indicated in the details of the road hierarchy listed in Table 1.

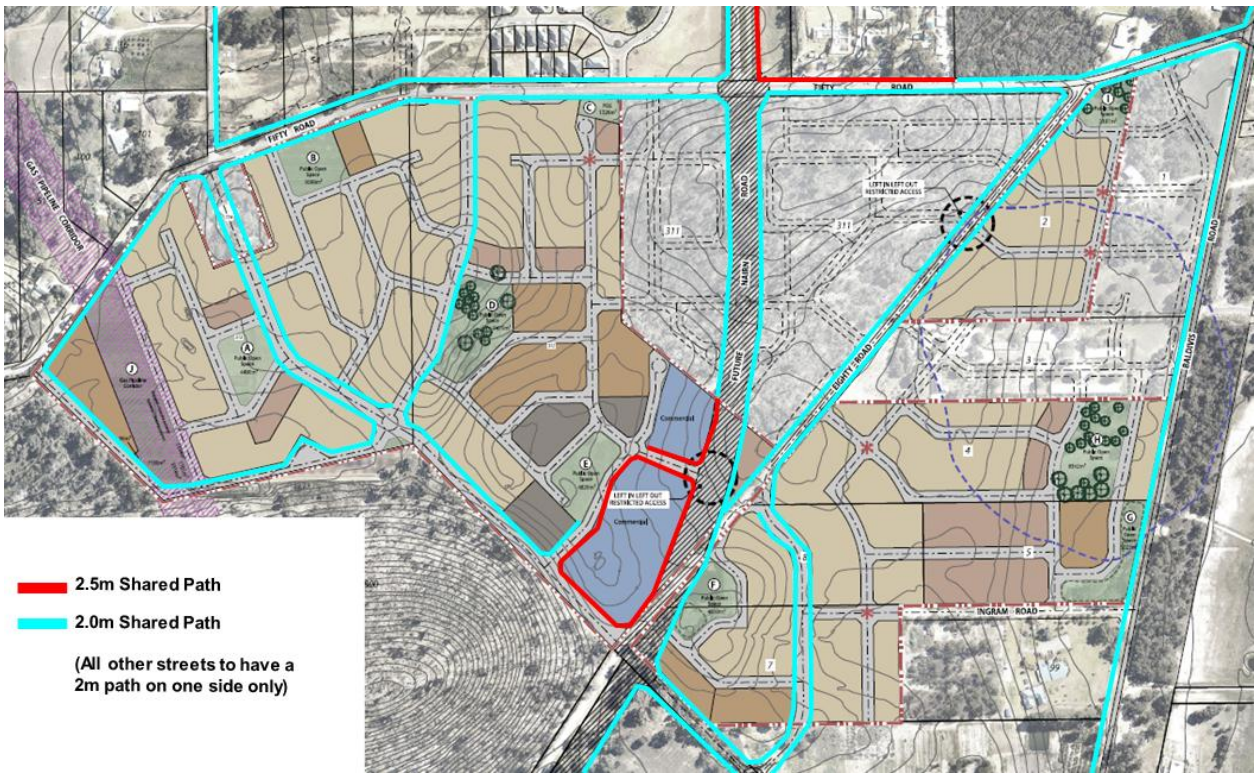


Figure 7. Pedestrian and cyclist facilities

5 Integration with Surrounding Area

The road network of the LSP area will connect to the surrounding road network at a number of locations.

This will include several intersections onto Fifty Road. One of these is proposed opposite McDonald Road and will create a 4-way intersection at that location, which will require appropriate treatment. The property through which this road connection would be created in future is currently not part of this LSP area, so this intersection is not part of the LSP area either.

Connection to Eighty Road opposite the Baldivis Hall and playing fields will also require appropriate treatment as this will represent a potential destination for trips from the LSP area including pedestrians and cyclists.

Planning for the East Baldivis area east of Baldivis Road indicates future connections on Baldivis Road opposite the Ingram Road and Fifty Road intersections. As noted in section 3.5 these future 4-way intersections are anticipated to be controlled by roundabouts but as Ingram Road and Fifty Road are existing roads the responsibility will mainly rest with the developers east of Baldivis Road that will create these 4-way intersections.

To the south there will be several connections to the new subdivision currently being constructed and this has been planned accordingly in this LSP.

The LSP path network will also connect with the existing streets and integrate with the path networks of the adjoining estates.

6 Analysis of the Transport Network

6.1 Assessment Period

The assessment year that has been adopted for this analysis is 2031, with full development of Baldivis as envisaged in the Western Australian Planning Commission's *Directions 2031 and Beyond* planning framework (Aug 2010) and *Outer Metropolitan Perth and Peel Sub-regional Strategy* (draft, Aug 2010).

6.2 Traffic generation and distribution

Transcore has developed a subregional traffic model of weekday traffic flows for the Mandurah-Rockingham area using the EMME transport modelling software package. This model has been developed in more detail for various projects in the Karnup-Baldivis area in this proposed LSP. Overall, the future scenario modelled in this area reflects the land use aspirations of *Directions 2031* as detailed in the *Outer Metropolitan Perth and Peel Sub-regional Strategy*.

The daily traffic generation rate used in the LSP area for this transport assessment is 8 vehicle trips per day (vpd) per dwelling, which corresponds to peak hour trip generation rates recommended in the Western Australian Planning Commission (WAPC) *Transport Assessment Guidelines for Development* (2006).

The anticipated 800 dwellings of the LSP area will therefore generate approximately 6400 vpd.

The neighbourhood centre is anticipated to be approximately 4500m^2 NLA plus a smaller commercial component (eg. childcare centre) and the daily traffic attraction by this neighbourhood centre is estimated at approximately 5600 vpd in the traffic model.

It should be noted that some of these traffic generation figures represent two ends of the same trips.

The distribution of these trips is determined by the traffic model in proportion to the location of trip productions and attractors for work trips, education trips and other trips (shopping, social, recreational, etc.) among all the land uses in the traffic model. The distribution of trips to and from the ODP area is summarised in Table 2. Note that this includes traffic from the surrounding catchment to the neighbourhood shopping centre in the LSP area.

Table 2. External trip distribution

External node	Proportion of Trips
Baldivis Road (north)	7%
Nairn Drive (north)	28%
McDonald Road and subdivision roads (north)	5%
Fifty Road (west)	12%
Nairn Drive (south)	29%
Subdivision roads (south)	2%
Baldivis Road (south)	10%
East of Baldivis Road (future subdivision)	7%

6.3 Traffic Flow Forecasts

The future total daily traffic flows on the road network in and around the LSP area has been modelled for the future scenario of full development of this area as discussed above.

Figure 8 illustrates future total daily traffic flows anticipated on the road network of the LSP area and also shows how much of this traffic is associated with the land uses proposed in the LSP area.

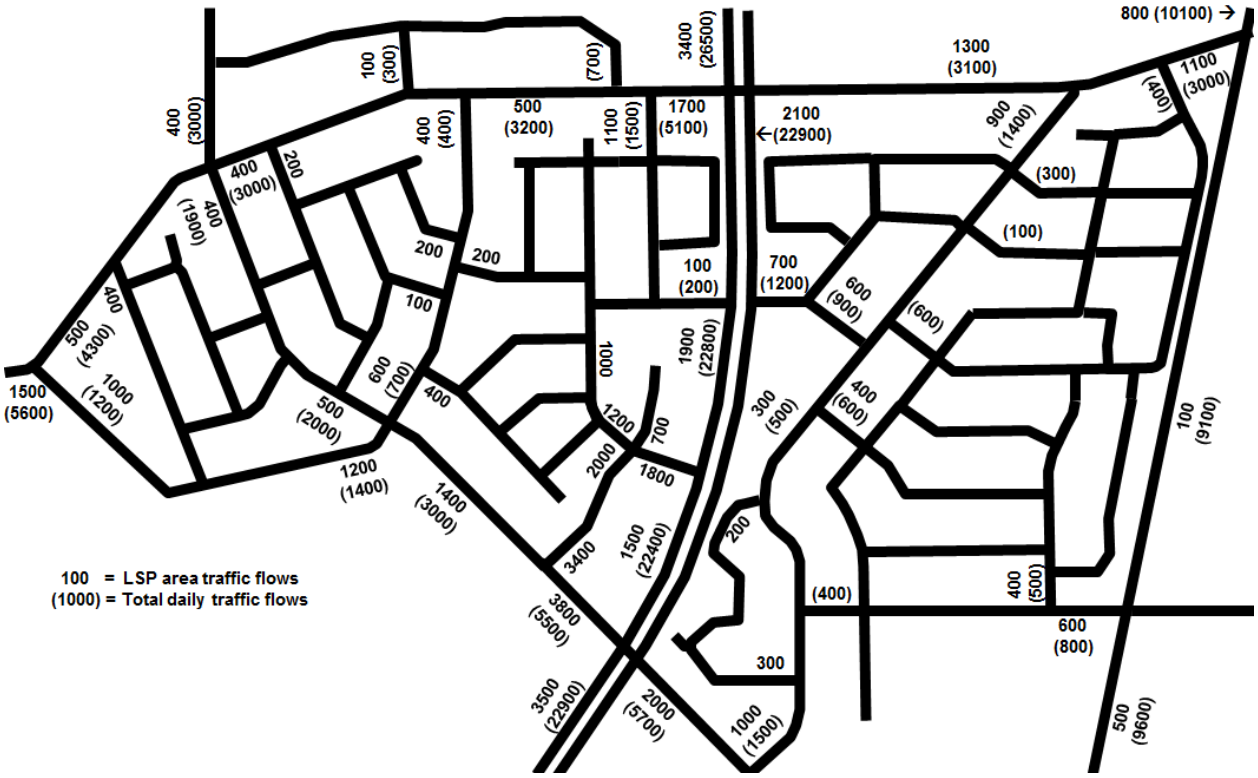


Figure 8. Future Daily Traffic Volumes

6.4 Roads and Intersections

The proposed road network to accommodate these traffic volumes has been detailed in section 5 of this transport assessment, including the details of the proposed road hierarchy in section 5.1.

Figure 9 details the proposed intersection controls for intersections within the LSP area.

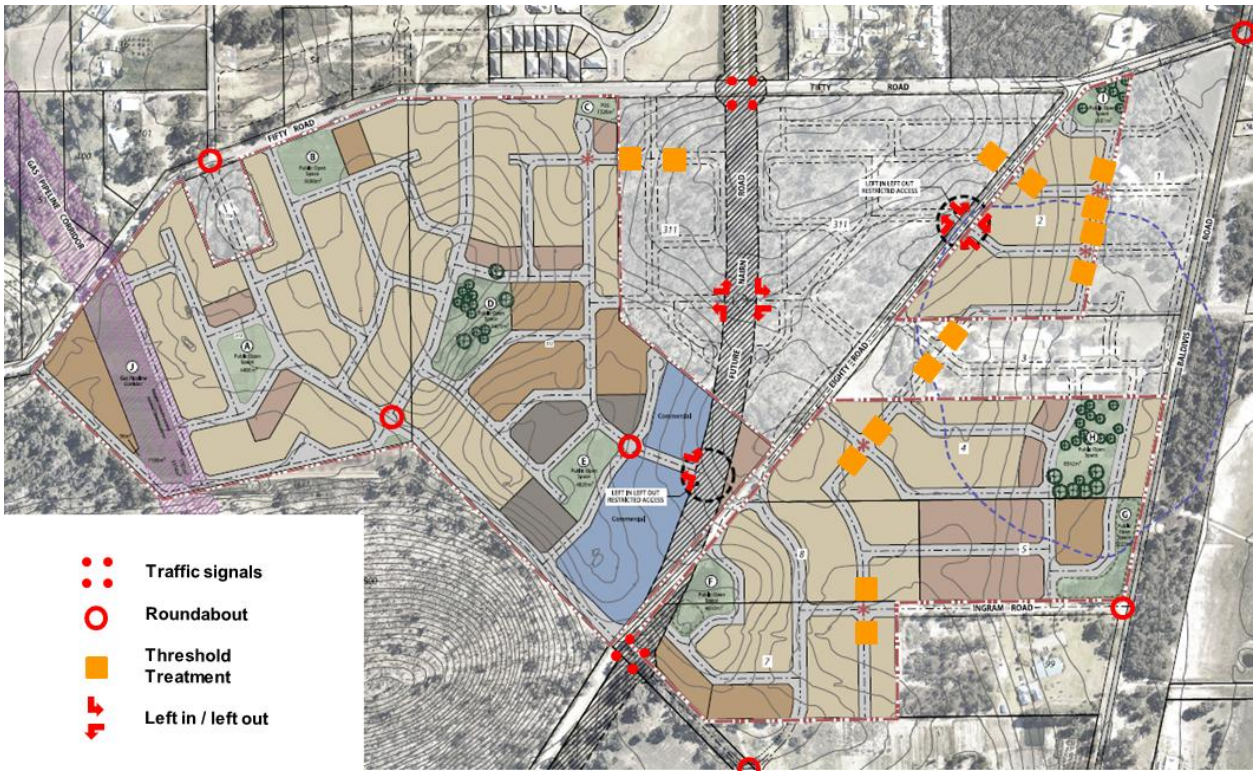


Figure 9. Intersection treatments

Nairn Drive Intersections

Access to the LSP area will be provided by two main 4-way intersections on Nairn Drive, at Fifty Road and at Amazon Drive south of the proposed neighbourhood centre. Other 4-way intersections along Nairn Drive have been constructed as two-lane roundabouts but these two 4-way intersections will potentially have significant pedestrian demand because of the adjacent primary school and neighbourhood centre, respectively. Traffic signals provide better opportunities for pedestrians and cyclists to cross such intersections, so traffic signals would be an alternative intersection treatment that could be considered at these two intersections. If they are constructed as roundabouts it would be recommended that additional facilities should be provided to assist pedestrians and cyclists to cross Nairn Drive at the neighbourhood centre and primary school. At the neighbourhood centre, within the Spires Estate LSP area, this would at least require appropriate pram ramps and grab rails at a suitable location adjacent to the neighbourhood centre, and this facility could be upgraded to a signalised pedestrian crossing in future if/when warranted by the volume of pedestrian movements and future traffic flow.

At this stage of structure planning the future access to the proposed neighbourhood centre has not been considered in detail although it is assumed there would be access from the roads on the south and west sides, as well as the left in / left out access intersection onto Nairn Drive as shown on the LSP plan.

Baldivis Road Intersections

The future planning for Baldivis Road assumes it will be upgraded to a two-lane boulevard (i.e. one lane each way with a central median island, which is the

typical cross-section identified in Liveable Neighbourhoods for Integrator B or Neighbourhood Connector A roads) as has already been constructed on some sections south of the LSP area. The future traffic volume of 9,000 – 10,000 vpd adjacent to the LSP area modelled in this transport assessment is consistent with this road standard.

There are only two intersections proposed onto Baldivis Road from the LSP area. These are the existing T-junctions on Nairn Drive at Fifty Road and Ingram Road. Initially these will function satisfactorily as priority-controlled T-junctions.

Recent planning for future urban development east of Baldivis Road indicates that both the Baldivis Road / Ingram Road and Baldivis Road / Eighty Road intersections will become 4-way intersections with new neighbourhood connector road connections on the eastern side to provide access for development in that area. It is anticipated that the creation of 4-way intersections at both these locations will be the trigger requiring intersection upgrades at these two intersections. Current planning for development in Baldivis East indicates that both these intersections would be upgraded to a roundabout when they become 4-way intersections.

Fifty Road Intersections
The LSP proposes several new intersections along Fifty Road. Most will be T-junctions and will operate satisfactorily as priority-controlled T-junctions (i.e. Stop or Give Way sign control). However, the proposed 4-way intersection at McDonald Street is recommended to be constructed as a single-lane roundabout.

Internal Intersections
Within the structure plan area there are a number of proposed four-way intersections. One of these on Amazon Drive and another on the northwest boundary of the neighbourhood centre are recommended to be constructed as roundabouts, as shown in Figure 9. This will help manage crossing traffic flows and assist with speed management on the neighbourhood connector road.

There are also several four-way intersections formed on other low-traffic-volume access streets, as shown in Figure 9. These are recommended to be constructed as priority-controlled intersections with give way signs on the minor road approaches as suggested in *Liveable Neighbourhoods* (LN Element 2 pages 31-33). Appropriate entry treatments will be provided on the side roads to help to alert drivers to the presence of the intersection and that traffic on the major road has priority. Existing threshold treatments on side roads crossing Amazon Drive west of Baldivis Road are a suitable example of the type of treatment that could be implemented at these 4-way intersections.

Three other 4-way intersections are indicated on the LSP plan as a result of the conceptual layout indicated for future development of other landholdings that are not part of this LSP area. Two are located on Eighty Road and one on Nairn Drive, as shown in Figure 9. As a result of consultation with planning authorities during the approval process for this LSP one of these intersections on Eighty

Road has been identified as a future left in / left out intersection. The other 4-way intersection on Eighty Road is therefore recommended to be recommended to be constructed as a priority-controlled intersection with give way signs and appropriate threshold treatments on the minor road approaches.

The other potential 4-way intersection north of the LSP area boundary is anticipated to be restricted to left in / left out access as it is considered unlikely that a roundabout or another signalised intersection would be approved at that location between the future signalised intersections of Nairn Drive with Amazon Drive and Fifty Road.

6.5 Intersection Analysis

Intersection capacity analysis has been undertaken for key intersections on Nairn Drive and Baldivis Road for the AM and PM peak hour flows that correspond to the modelled 2031 daily traffic flows in Figure 8.

The four locations analysed are:

- Nairn Drive / Amazon Drive intersection
- Nairn Drive / Fifty Road intersection
- Baldivis Road / Eighty Road intersection
- Baldivis Road / Ingram Road intersection

Capacity analysis of these intersections has been undertaken using the SIDRA computer software package. SIDRA is an intersection modelling tool commonly used by traffic engineers for all types of intersections. SIDRA outputs are presented in the form of Degree of Saturation, Level of Service, Average Delay and 95% Queue. These characteristics are defined as follows:

- Degree of Saturation is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The Degree of Saturation ranges from close to zero for infrequent traffic flow up to one for saturated flow or capacity.
- Level of Service is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. In general, there are 6 levels of service, designated from A to F, with Level of Service A representing the best operating condition (i.e. free flow) and Level of Service F the worst (i.e. forced or breakdown flow).
- Average Delay is the average of all travel time delays for vehicles through the intersection.
- 95% Queue is the queue length below which 95% of all observed queue lengths fall**.**

The results of the SIDRA analysis are summarised in Appendix B and the diagrams in Appendix B indicate the type of intersection treatments required at each of these locations to achieve the modelled intersection operation.

6.6 Access to Frontage Properties

The WAPC *Liveable Neighbourhoods* requires that "Development along integrator B and neighbourhood connector streets with ultimate vehicle volumes over 5000 vehicles per day should be designed either so vehicles entering the street can do so travelling forward, or are provided with alternative forms of vehicle access. Wider lots with paired driveways and protected reversing areas in the parking lane may be used on streets with up to 7000 vehicles per day."

Future traffic volumes are modelled as greater than 5000 vpd only on Nairn Drive, Baldivis Road, some sections of Fifty Road and short sections of Amazon Drive either side of Nairn Drive.

There will be no direct driveway access from abutting residential development on Nairn Drive and Baldivis Road.

On Fifty Road development on the northern side has already been addressed by CAP roads (Controlled Access Places or service roads) to provide access to abutting lots but in the LSP area the design ensures that all lots will have alternative access from other roads at the side or rear instead.

One street block on Amazon Drive south of Nairn Drive is indicated as having traffic flows of 5700 vpd in future. Lots abutting this section will require special consideration of driveway access arrangements, such as a rear laneway or other treatments mentioned above in the first paragraph of this section.

6.7 Pedestrian / Cycle Networks

The proposed network of shared paths for pedestrians and cyclists is described in section 4.3 of this transport assessment. This network of paths will provide an excellent level of accessibility and permeability for pedestrians and cyclists within the LSP area, and connections to neighbouring precincts at strategic locations.

There are some locations where there is anticipated to be strong demand for pedestrian and cyclist movements crossing the road network, which warrant further consideration. In particular these are around the school site and the proposed neighbourhood centre on Nairn Drive.

The WAPC *Transport Assessment Guidelines for Developments* (2006) provides guidance on the levels of traffic volumes that are likely to affect the ability for pedestrians to cross various types of road. Based on that guidance an undivided two-lane road should be acceptable for pedestrians crossing traffic volumes of up to approximately 11,000 vpd and this threshold can be increased to around 28,000 vpd by adding a central median or pedestrian refuge islands. On a four-lane road, because of its greater carriageway width, this threshold is lower; even with a median island the threshold is only around 16,000 vpd.

The section of Nairn Drive adjacent to the primary school and neighbourhood centre is expected to carry up to 22,000 - 26,000 vpd when this area is fully

developed. The proposed traffic signals recommended in section 7.4 at the Nairn Drive / Fifty Road and Nairn Drive / Amazon Drive intersections will provide the necessary assistance for pedestrians and cyclists to cross safely at these locations.

Future traffic volumes on Baldivis Road could also potentially be up to 9,000 - 10,000 vpd adjacent to the LSP area but in this area the pedestrian demand should not be particularly significant. If Baldivis Road is designed as a two-lane boulevard (i.e. one lane each way with a central median) as has been constructed on some sections further south this would satisfy the guidance in the Transport Assessment Guidelines.

On Fifty Road at the primary school and on Eighty Road at the Baldivis Hall and playing fields 2m wide traffic islands should be provided at suitable pedestrian crossing locations to assist these movements.

6.8 *Access to Public Transport*

At this stage of the structure planning process neither bus stop locations nor subdivision lot layout are known. However, in these circumstances the WAPC *Transport Assessment Guidelines for Developments* (2006) suggest that it is desirable for at least 90 per cent of dwellings to be within 400m straight line distance of a bus route.

The future bus route shown on Eighty Road on Figure 5 (or a single bus route on Nairn Drive in the longer term as discussed in section 3.6) would only satisfy this 400m straight line distance requirement for about half of this LSP area. However, Amazon Drive offers a suitable alignment for a potential additional bus route in future, as shown in Figure 10, either from the south like the other route on Fifty Road or from the north as an extension of bus routes that will serve the other northwest parts of Baldivis in future.

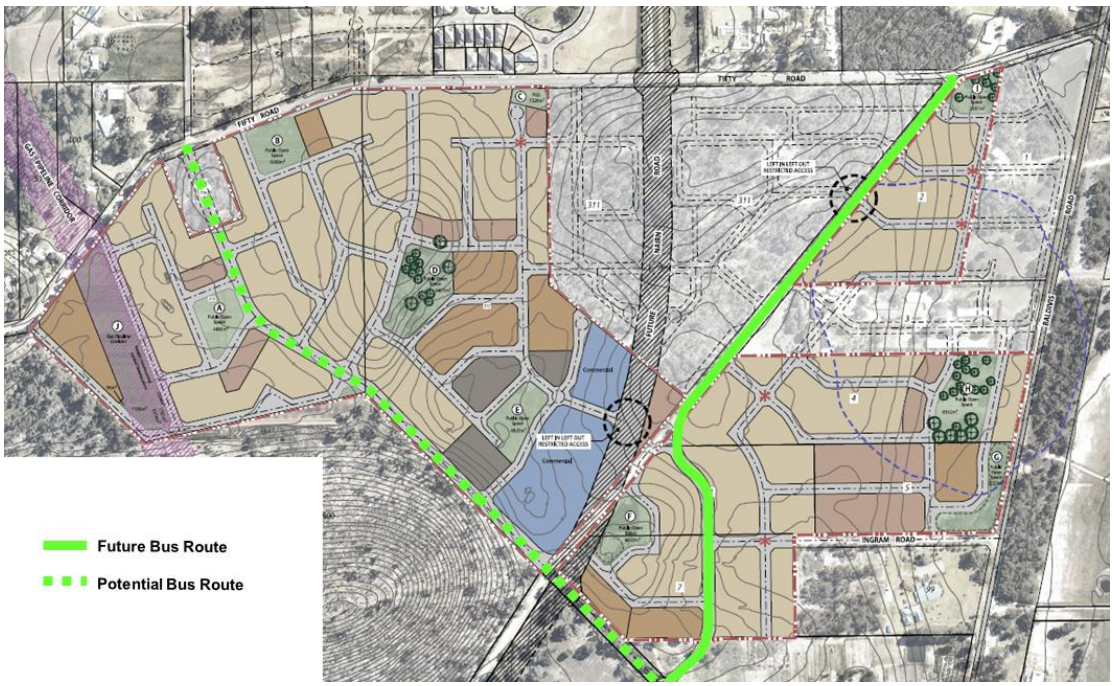


Figure 10. Potential future bus routes

Therefore it is concluded that the neighbourhood connector roads proposed in the LSP will be able to accommodate potential future bus routes to satisfy the guideline of 90% of the dwellings in the LSP area to be within 400m straight line distance of a bus route, although the number and alignment of bus routes provided in future will depend on the decisions of state government authorities.

7 Conclusions

The main findings of the transport assessment for the West Baldivis (Spires Estate) Local Structure Plan are outlined below.

The LSP area is anticipated to accommodate approximately 800 dwellings and a proposed neighbourhood centre.

The residential component is anticipated to generate traffic flows of approximately 6400 vpd, including some of the 5600 vpd attracted to the neighbourhood centre.

The road network of the LSP area has been designed based on WAPC *Liveable Neighbourhoods* guidelines to accommodate the future traffic flows that will be generated in this area.

Access to the LSP area will be served by four-way intersections on the future Nairn Drive (an Other Regional Road in the Metropolitan Region Scheme) at Fifty Road (outside of the LSP area) and at Amazon Drive in the LSP area. Baldivis Road and Fifty Road also provide access to the LSP area. These two 4-way intersections on Nairn Drive will need to be either signalised intersections or roundabouts.

The future planning for Baldivis Road assumes it will be upgraded to a two-lane boulevard and the future traffic volumes adjacent to the LSP area modelled in this transport assessment are consistent with this road standard. The Baldivis Rd / Ingram Rd intersection will be able to operate as a priority-controlled (give-way) T-junction when the Spires LSP area is developed but when it becomes a 4-way intersection to provide access to future development east of Baldivis Road, it would be recommended to be upgraded to a roundabout.

The Baldivis Road / Eighty Road intersection is also recommended to be upgraded to a roundabout in future when it becomes a 4-way intersection to provide access to future development east of Baldivis Road.

Similarly a roundabout would be recommended at the existing Fifty Road / McDonald Road intersection when it becomes a 4-way intersection in future, although that particular intersection is not within or adjacent to the LSP area and the new road connection forming the fourth leg at that intersection will occur as a result of development outside the LSP area.

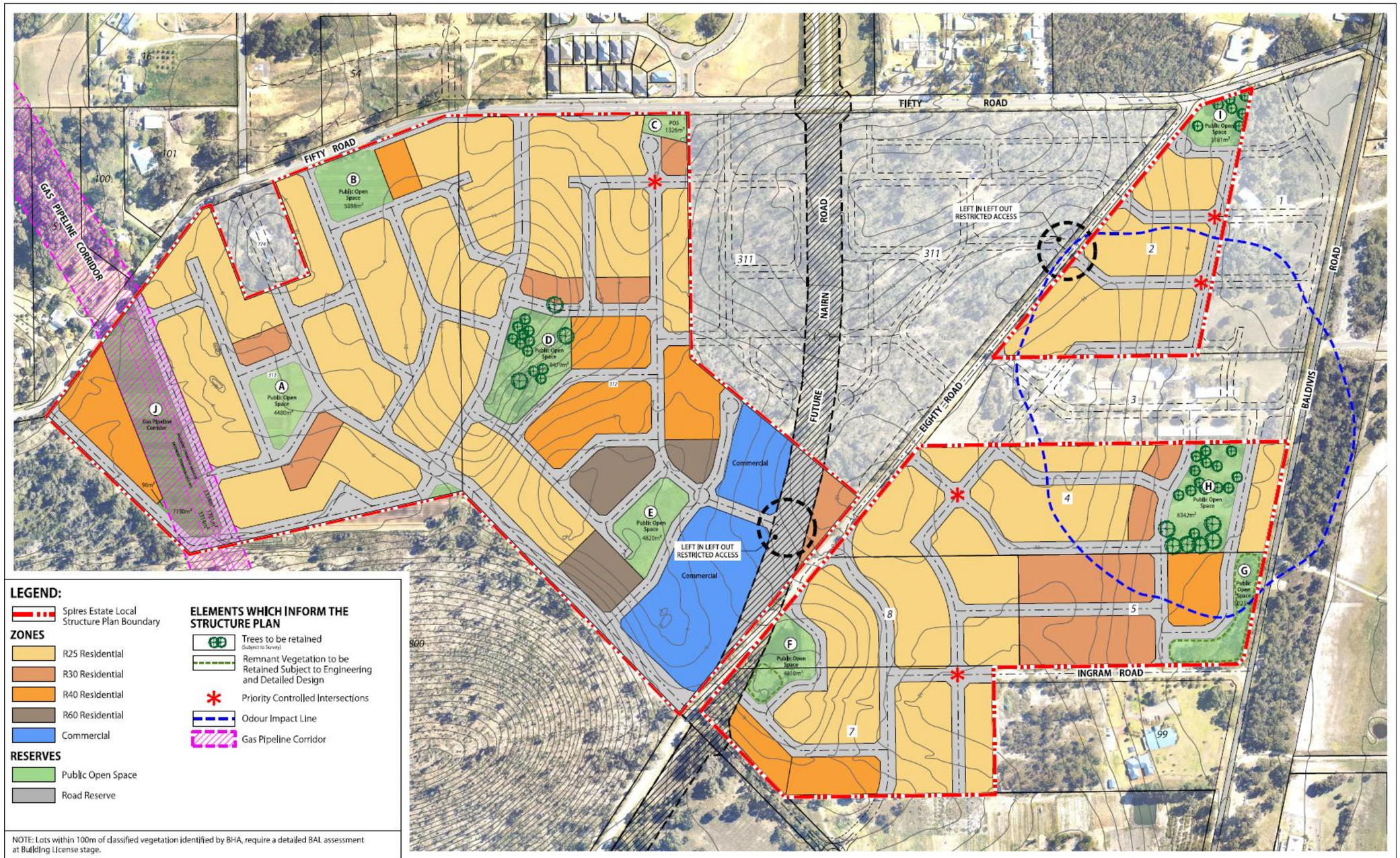
Roundabouts are also recommended at two other 4-way intersections in the LSP area.

The proposed road network provides for a planned future bus route along Eighty Road and is also able to accommodate another potential bus route on Amazon Drive through the LSP area west of Nairn Drive to provide satisfactory public transport access in future.

The proposed LSP also provides for a comprehensive network of shared paths and footpaths to encourage and facilitate non-motorised travel as well.

APPENDIX A

SPIRES ESTATE
LOCAL STRUCTURE PLAN



PLAN 1 - Spires Estate Local Structure Plan

Various Lots Fifty and Eighty Road, BALDIVIS

for: Spatial Property Group

SPATIAL Property Group™

NOTES:

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NORTH

Scale 1: 4000 @ A3 | 1:2000 @ A1

0 25 50 75 100 125 150 metres

COMPILED: DPS		DRAWN BY:	RF
DATE:	15/02/2012	REVISED:	24/03/2014
GRID:	MGA 50	DATUM:	AHD
DRAWING NUMBER:	CARBD-2-001e	JOBCODE:	CARBDLSP
FILE ID:	M:\CARBD\Base\Structure Plans\CARBD-2-001e.dgn		

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APPENDIX B

SIDRA INTERSECTION ANALYSIS

Nairn Drive / Amazon Drive intersection (traffic signals)

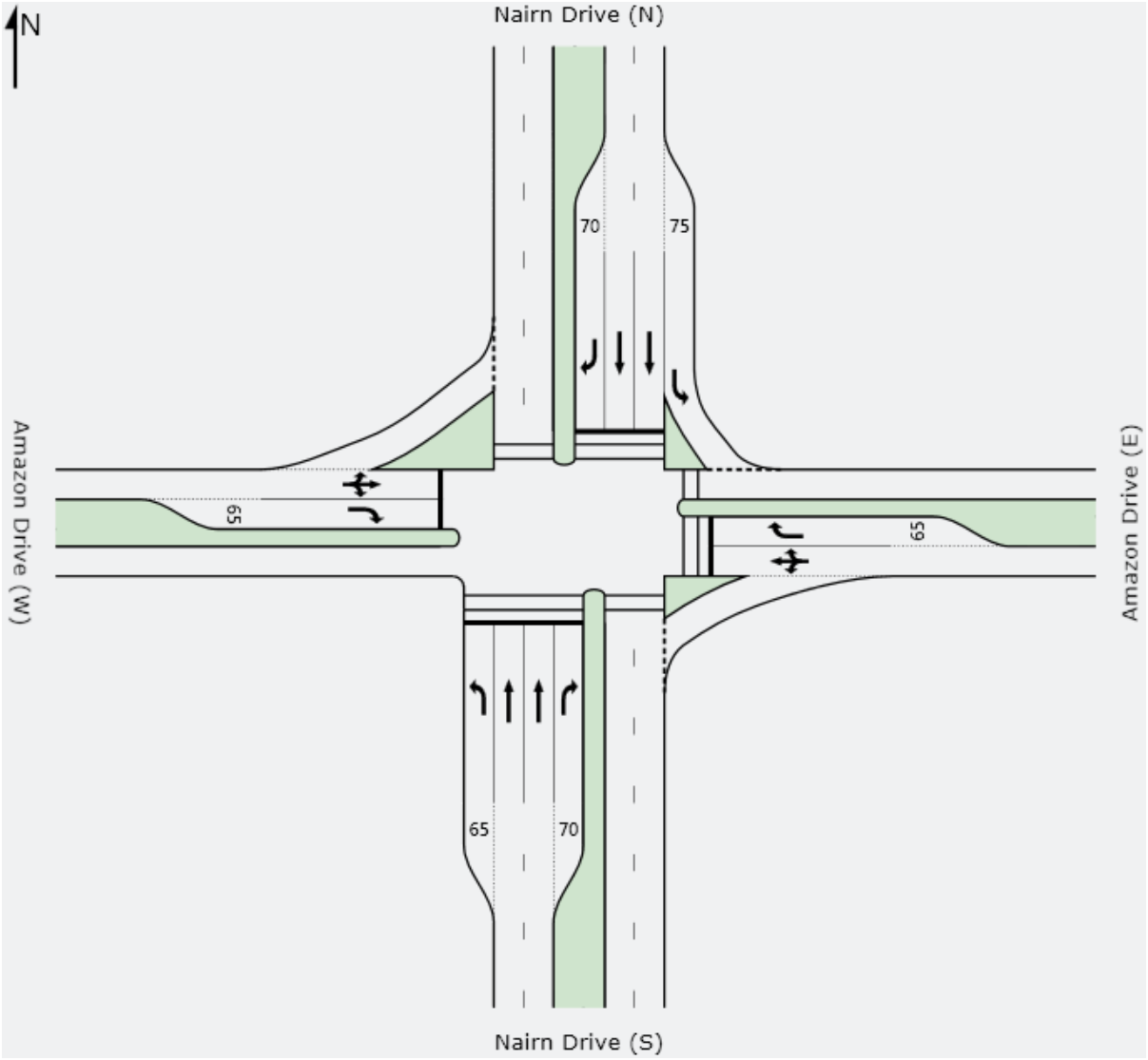


Figure B1a. Nairn Drive / Amazon Drive intersection layout analysed in SIDRA

Table B1a. SIDRA results – Nairn Drive / Amazon Drive signalised intersection – 2031 weekday AM peak with full development

Signals - Fixed Time Cycle Time = 130 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Nairn Drive (S)								
4	L	221	2.0	0.669	36.7	LOS D	9.4	66.9
5	T	1362	2.0	0.859	43.1	LOS D	42.3	301.1
6	R	46	2.0	0.359	73.8	LOS E	2.9	20.8
Approach		1629	2.0	0.859	43.1	LOS D	42.3	301.1
East: Amazon Drive (E)								
7	L	29	2.0	0.401	14.0	LOS B	5.1	36.4
8	T	74	2.0	0.401	6.6	LOS A	5.1	36.4
9	R	318	2.0	0.401	27.2	LOS C	5.5	38.9
Approach		421	2.0	0.401	22.7	LOS C	5.5	38.9
North: Nairn Drive (N)								
10	L	69	2.0	0.059	8.7	LOS A	0.3	2.4
11	T	532	2.0	0.356	30.3	LOS C	11.9	84.6
12	R	21	2.0	0.246	77.2	LOS E	1.4	9.7
Approach		622	2.0	0.356	29.5	LOS C	11.9	84.6
West: Amazon Drive (W)								
1	L	1	2.0	0.269	30.3	LOS C	4.1	29.5
2	T	82	2.0	0.269	23.0	LOS C	4.1	29.5
3	R	119	2.0	0.269	45.5	LOS D	4.1	29.5
Approach		202	2.0	0.269	36.3	LOS D	4.1	29.5
All Vehicles		2874	2.0	0.859	36.7	LOS D	42.3	301.1

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m
P3	Across S approach	50	59.1	LOS E	0.2	0.2
P5	Across E approach	50	31.2	LOS D	0.1	0.1
P7	Across N approach	50	59.1	LOS E	0.2	0.2
All Pedestrians		150	49.8	LOS E		

Phase Timing Results

Phase	A	B	C	D	E
Green Time (sec)	6	0	50	22	25
Yellow Time (sec)	4	4	4	4	4
All-Red Time (sec)	2	2	2	2	2
Phase Time (sec)	12	3	56	28	31
Phase Split	9 %	2 %	43 %	22 %	24 %

Table B1b. SIDRA results – Nairn Drive / Amazon Drive signalised intersection – 2031 weekday PM peak with full development

Signals - Fixed Time Cycle Time = 120 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Nairn Drive (S)								
4	L	95	2.0	0.291	37.2	LOS D	3.8	26.8
5	T	636	2.0	0.467	32.4	LOS C	14.4	102.4
6	R	46	2.0	0.497	72.9	LOS E	2.8	20.1
Approach		777	2.0	0.497	35.4	LOS D	14.4	102.4
East: Amazon Drive (E)								
7	L	29	2.0	0.209	22.2	LOS C	5.5	39.0
8	T	74	2.0	0.209	14.8	LOS B	5.5	39.0
9	R	136	2.0	0.209	33.6	LOS C	5.5	39.0
Approach		239	2.0	0.209	26.4	LOS C	5.5	39.0
North: Nairn Drive (N)								
10	L	160	2.0	0.147	8.9	LOS A	0.9	6.7
11	T	1242	2.0	0.891	50.1	LOS D	39.6	281.6
12	R	49	2.0	0.454	71.3	LOS E	3.0	21.1
Approach		1451	2.0	0.891	46.3	LOS D	39.6	281.6
West: Amazon Drive (W)								
1	L	1	2.0	0.420	23.3	LOS C	6.9	48.8
2	T	82	2.0	0.420	16.0	LOS B	6.9	48.8
3	R	277	2.0	0.420	35.5	LOS D	6.9	48.8
Approach		360	2.0	0.420	31.0	LOS C	6.9	48.8
All Vehicles		2827	2.0	0.891	39.7	LOS D	39.6	281.6

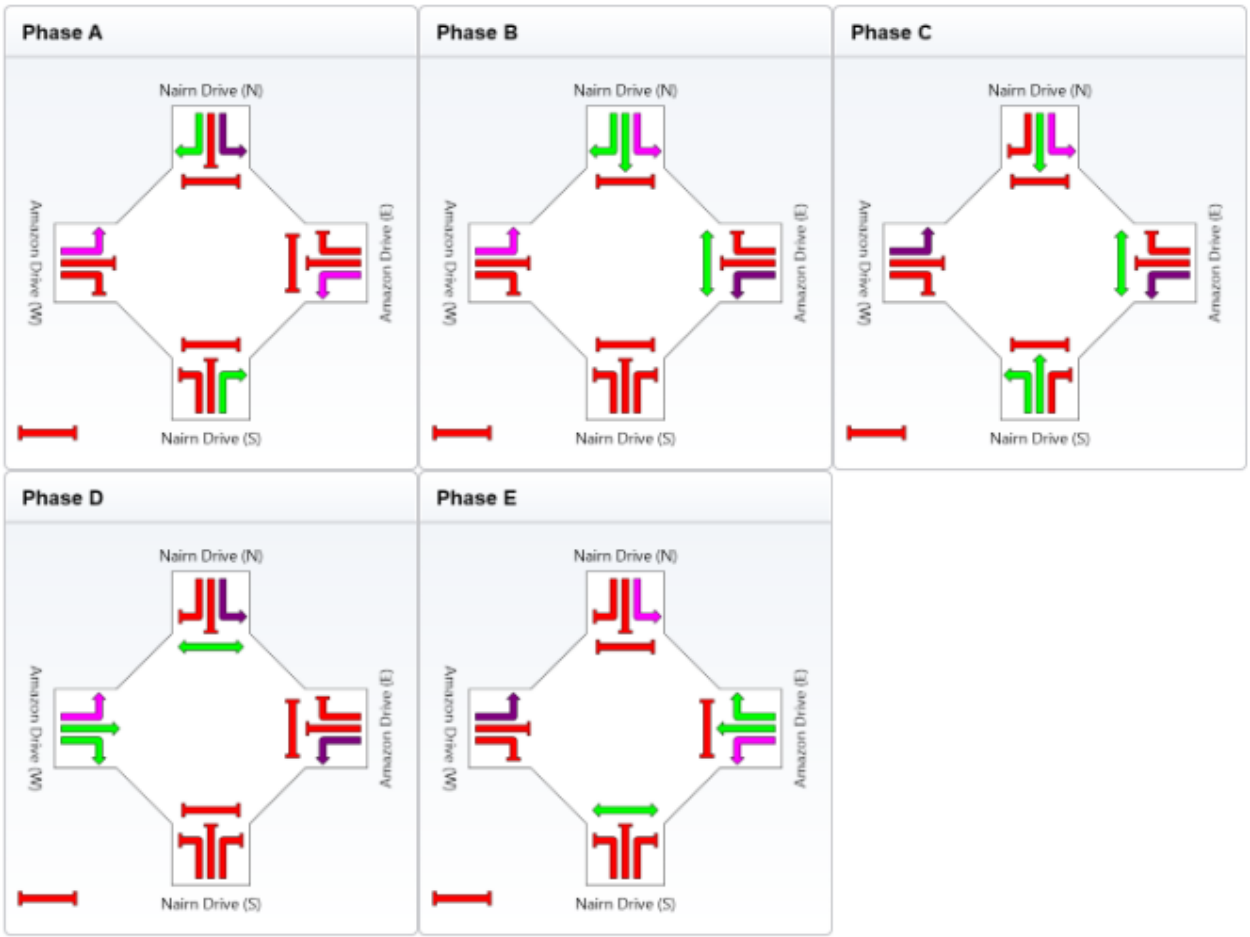
Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m
P3	Across S approach	50	54.2	LOS E	0.2	0.2
P5	Across E approach	50	31.5	LOS D	0.1	0.1
P7	Across N approach	50	54.2	LOS E	0.2	0.2
All Pedestrians		150	46.6	LOS E		

Phase Timing Results

Phase	A	B	C	D	E
Green Time (sec)	6	0	42	22	25
Yellow Time (sec)	4	4	4	4	4
All-Red Time (sec)	2	2	2	2	2
Phase Time (sec)	12	1	48	28	31
Phase Split	10 %	1 %	40 %	23 %	26 %



Nairn Drive / Fifty Road intersection (traffic signals)

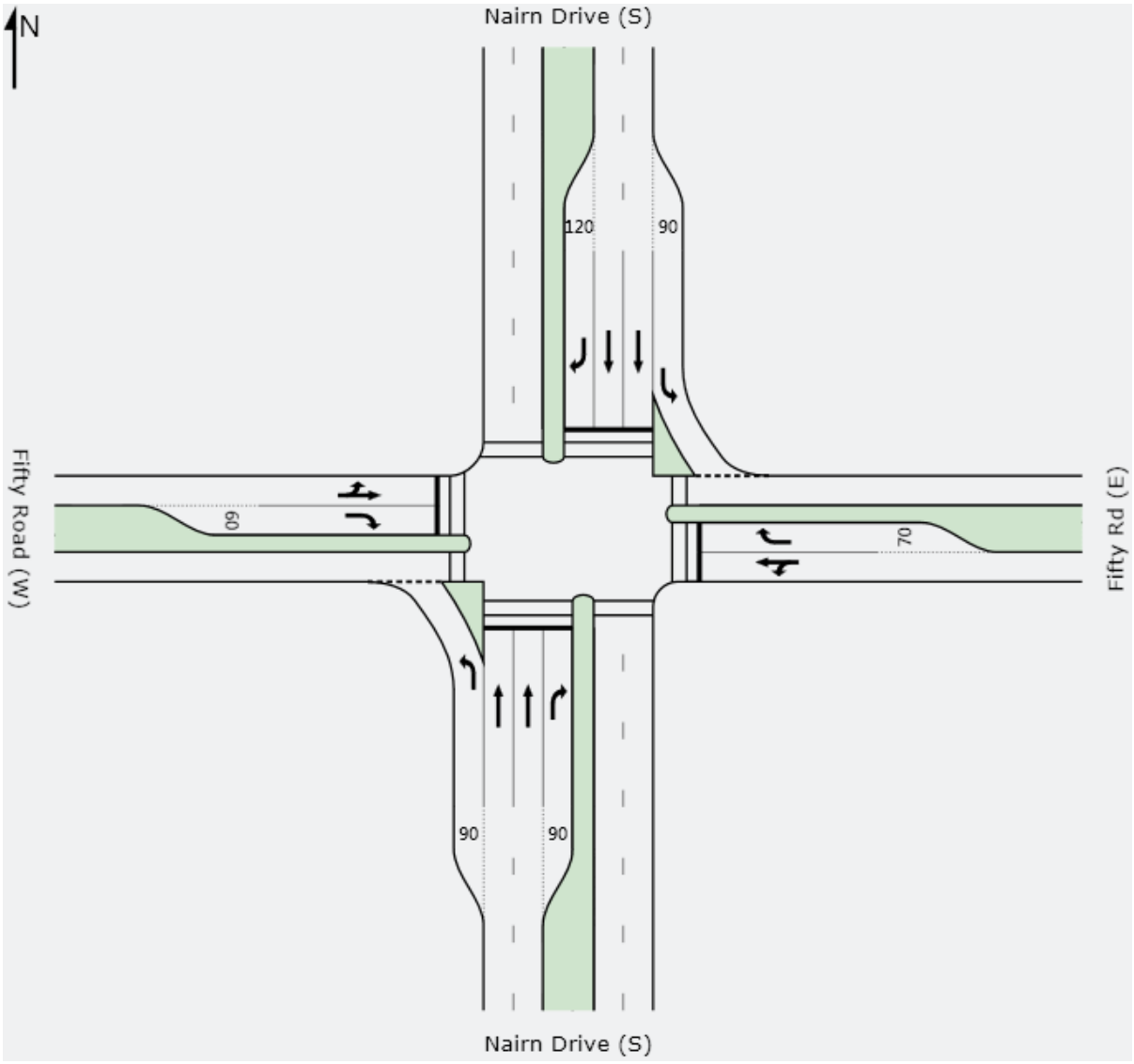


Figure B2. Nairn Drive / Fifty Road intersection layout analysed in SIDRA

Table B2a. SIDRA results – Nairn Drive / Fifty Road signalised intersection – 2031 weekday AM peak with full development

Signals - Fixed Time Cycle Time = 120 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Nairn Drive (S)								
4	L	20	2.0	0.019	9.1	LOS A	0.1	1.0
5	T	1635	2.0	0.885	39.0	LOS D	48.7	346.7
6	R	83	2.0	0.489	66.9	LOS E	4.8	34.3
Approach		1738	2.0	0.885	40.0	LOS D	48.7	346.7
East: Fifty Rd (E)								
7	L	22	2.0	0.157	52.3	LOS D	2.7	19.4
8	T	33	2.0	0.157	44.6	LOS D	2.7	19.4
9	R	138	2.0	0.895	78.9	LOS E	9.3	66.1
Approach		193	2.0	0.895	70.0	LOS E	9.3	66.1
North: Nairn Drive (S)								
10	L	15	2.0	0.013	8.8	LOS A	0.1	0.6
11	T	581	2.0	0.314	20.6	LOS C	10.3	73.6
12	R	145	2.0	0.855	75.7	LOS E	9.4	67.0
Approach		741	2.0	0.855	31.1	LOS C	10.3	73.6
West: Fifty Road (W)								
1	L	205	2.0	0.686	58.4	LOS E	13.1	93.6
2	T	29	2.0	0.686	50.7	LOS D	13.1	93.6
3	R	26	2.0	0.169	64.4	LOS E	1.5	10.4
Approach		260	2.0	0.686	58.2	LOS E	13.1	93.6
All Vehicles		2932	2.0	0.895	41.3	LOS D	48.7	346.7

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m
P3	Across S approach	50	54.2	LOS E	0.2	0.2
P5	Across E approach	50	22.2	LOS C	0.1	0.1
P7	Across N approach	50	54.2	LOS E	0.2	0.2
P1	Across W approach	50	22.2	LOS C	0.1	0.1
All Pedestrians		200	38.2	LOS D		

Phase Timing Results

Phase	A	C	D	F
Green Time (sec)	11	57	10	22
Yellow Time (sec)	3	3	3	3
All-Red Time (sec)	2	2	2	2
Phase Time (sec)	16	62	15	27
Phase Split	13 %	52 %	13 %	23 %

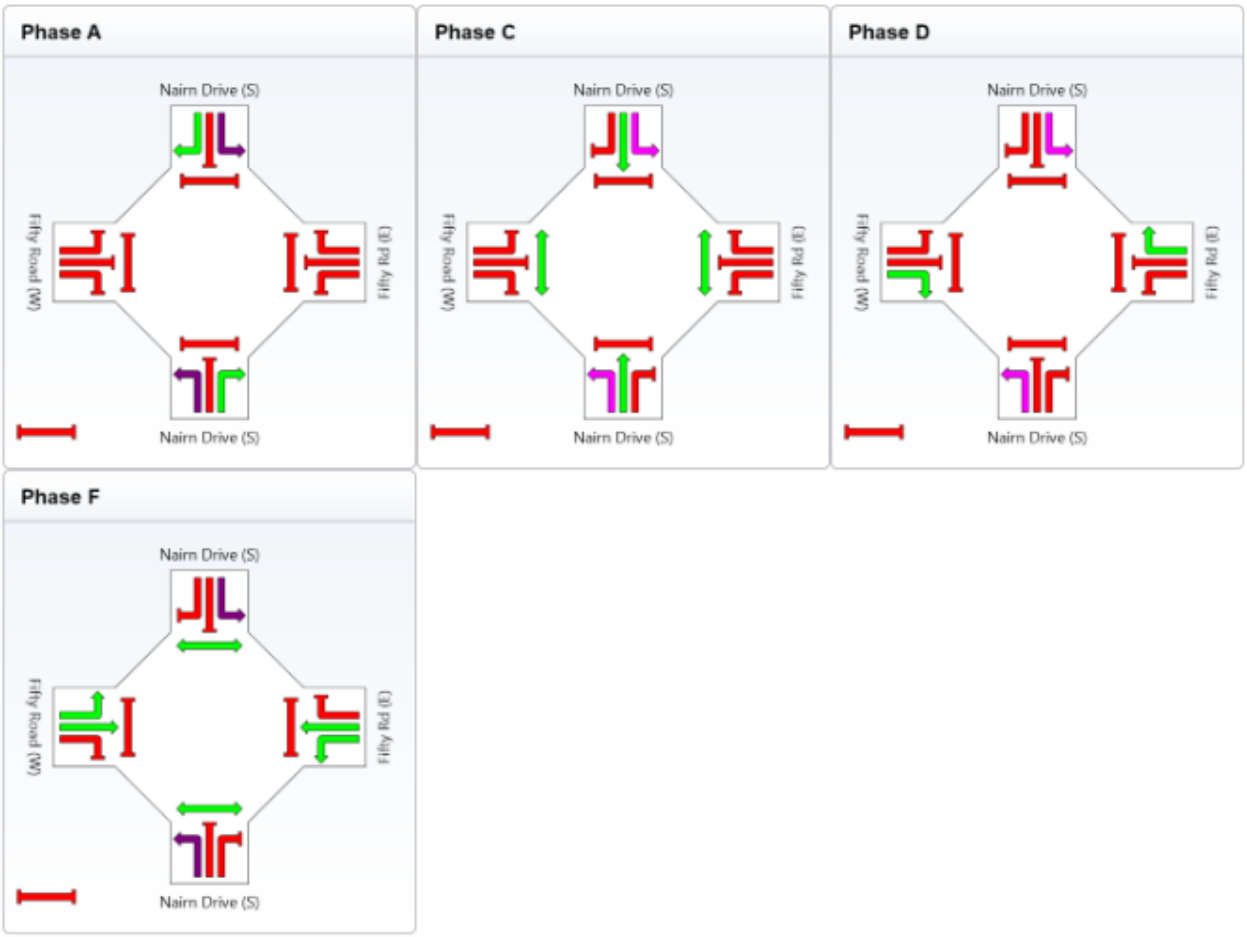


Table B2b. SIDRA results – Nairn Drive / Fifty Road signalised intersection – 2031 weekday PM peak with full development

Signals - Fixed Time Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Nairn Drive (S)								
4	L	9	2.0	0.010	10.9	LOS B	0.1	0.7
5	T	701	2.0	0.772	38.1	LOS D	15.5	110.1
6	R	36	2.0	0.292	54.8	LOS D	1.6	11.5
Approach		746	2.0	0.772	38.5	LOS D	15.5	110.1
East: Fifty Rd (E)								
7	L	51	2.0	0.182	36.9	LOS D	2.9	21.0
8	T	33	2.0	0.182	29.2	LOS C	2.9	21.0
9	R	59	2.0	0.478	54.4	LOS D	2.7	19.2
Approach		143	2.0	0.478	42.4	LOS D	2.9	21.0
North: Nairn Drive (S)								
10	L	35	2.0	0.027	8.6	LOS A	0.1	0.9
11	T	1356	2.0	0.871	35.7	LOS D	32.2	229.3
12	R	339	2.0	0.785	47.6	LOS D	15.2	108.4
Approach		1730	2.0	0.871	37.4	LOS D	32.2	229.3
West: Fifty Road (W)								
1	L	88	2.0	0.256	37.6	LOS D	4.2	29.8
2	T	29	2.0	0.256	29.9	LOS C	4.2	29.8
3	R	61	2.0	0.495	54.5	LOS D	2.8	19.9
Approach		178	2.0	0.495	42.1	LOS D	4.2	29.8
All Vehicles		2797	2.0	0.871	38.3	LOS D	32.2	229.3

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m
P3	Across S approach	50	39.2	LOS D	0.1	0.1
P5	Across E approach	50	22.8	LOS C	0.1	0.1
P7	Across N approach	50	39.2	LOS D	0.1	0.1
P1	Across W approach	50	34.7	LOS D	0.1	0.1
All Pedestrians		200	34.0	LOS D		

Phase Timing Results

Phase	A	B1	C	D	F
Green Time (sec)	6	10	21	6	22
Yellow Time (sec)	3	3	3	3	3
All-Red Time (sec)	2	2	2	2	2
Phase Time (sec)	11	15	26	11	27
Phase Split	12 %	17 %	29 %	12 %	30 %

Baldivis Road / Eighty Road intersection

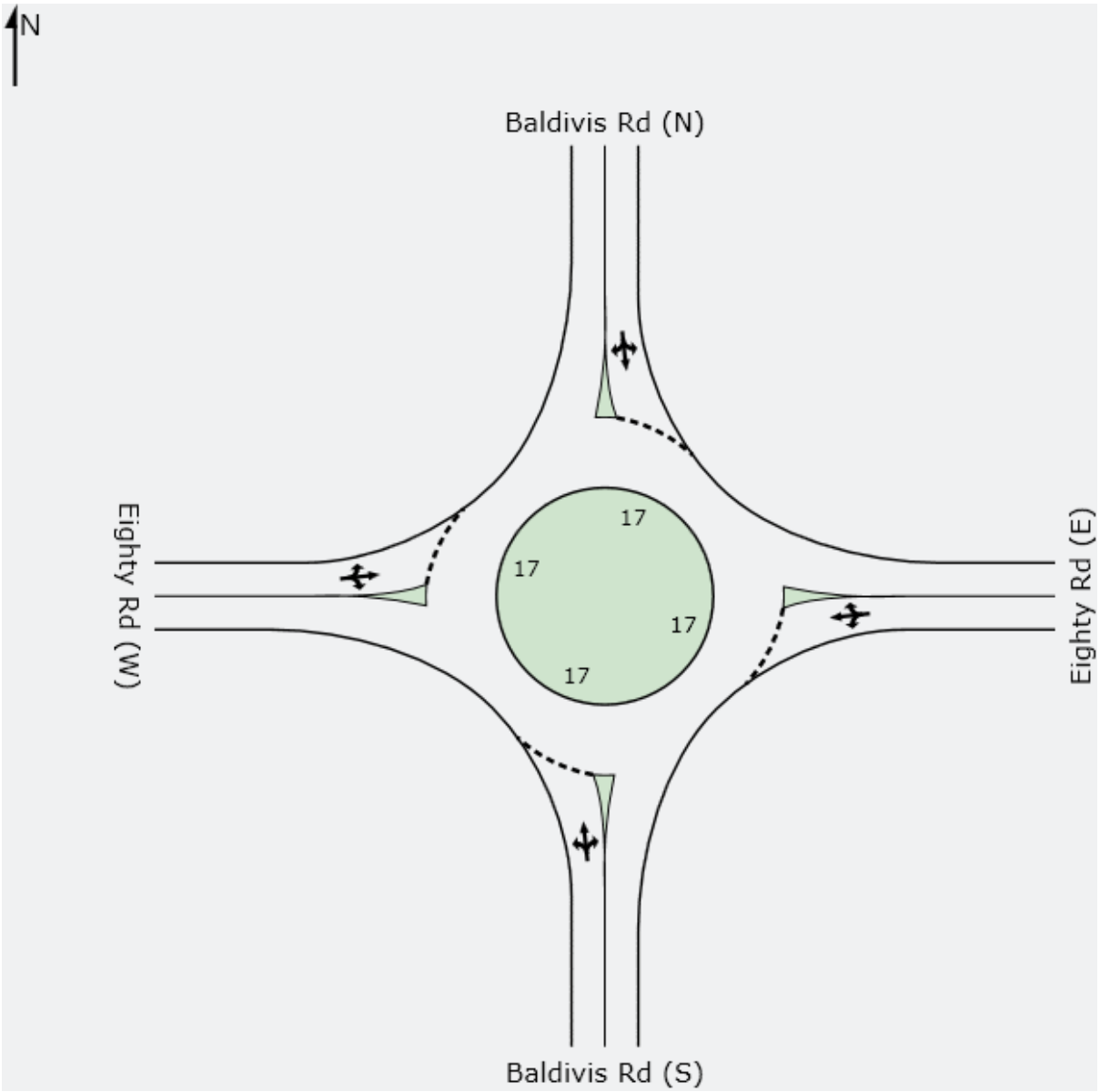


Figure B3. Baldivis Road / Eighty Road roundabout layout analysed in SIDRA

Table B3a. SIDRA results – Baldivis Road / Eighty Road intersection – 2031 weekday AM peak with development east of Baldivis Road

Movement Performance - Vehicles								
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m
South: Baldivis Rd (S)								
1	L	22	2.0	0.400	8.0	LOS A	2.7	19.5
2	T	417	2.0	0.400	7.1	LOS A	2.7	19.5
3	R	22	1.0	0.400	12.4	LOS B	2.7	19.5
Approach		461	2.0	0.400	7.4	LOS A	2.7	19.5
East: Eighty Rd (E)								
4	L	7	1.0	0.153	8.9	LOS A	0.8	5.9
5	T	51	1.0	0.153	8.1	LOS A	0.8	5.9
6	R	85	1.0	0.153	13.4	LOS B	0.8	5.9
Approach		143	1.0	0.153	11.3	LOS B	0.8	5.9
North: Baldivis Rd (N)								
7	L	31	1.0	0.329	7.1	LOS A	2.2	15.9
8	T	353	2.0	0.329	6.2	LOS A	2.2	15.9
9	R	67	2.0	0.329	11.5	LOS B	2.2	15.9
Approach		451	1.9	0.329	7.0	LOS A	2.2	15.9
West: Eighty Rd (W)								
10	L	92	2.0	0.170	9.7	LOS A	1.0	7.0
11	T	50	1.0	0.170	8.8	LOS A	1.0	7.0
12	R	1	2.0	0.170	14.1	LOS B	1.0	7.0
Approach		143	1.7	0.170	9.4	LOS A	1.0	7.0
All Vehicles		1198	1.8	0.400	8.0	LOS A	2.7	19.5

Table B3b. SIDRA results – Baldivis Road / Eighty Road intersection – 2031 weekday PM peak with development east of Baldivis Road

Movement Performance - Vehicles								
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m
South: Baldivis Rd (S)								
1	L	9	2.0	0.183	8.0	LOS A	1.0	7.2
2	T	179	2.0	0.183	7.1	LOS A	1.0	7.2
3	R	9	1.0	0.183	12.4	LOS B	1.0	7.2
Approach		197	2.0	0.183	7.4	LOS A	1.0	7.2
East: Eighty Rd (E)								
4	L	17	1.0	0.202	14.8	LOS B	1.3	9.4
5	T	51	1.0	0.202	13.9	LOS B	1.3	9.4
6	R	36	1.0	0.202	19.2	LOS B	1.3	9.4
Approach		104	1.0	0.202	15.9	LOS B	1.3	9.4
North: Baldivis Rd (N)								
7	L	73	1.0	0.714	7.3	LOS A	9.0	63.8
8	T	824	2.0	0.714	6.5	LOS A	9.0	63.8
9	R	156	2.0	0.714	11.8	LOS B	9.0	63.8
Approach		1053	1.9	0.714	7.3	LOS A	9.0	63.8
West: Eighty Rd (W)								
10	L	39	2.0	0.085	7.8	LOS A	0.4	3.1
11	T	50	1.0	0.085	6.8	LOS A	0.4	3.1
12	R	3	2.0	0.085	12.1	LOS B	0.4	3.1
Approach		92	1.5	0.085	7.4	LOS A	0.4	3.1
All Vehicles		1446	1.8	0.714	7.9	LOS A	9.0	63.8

Baldivis Road / Ingram Road intersection

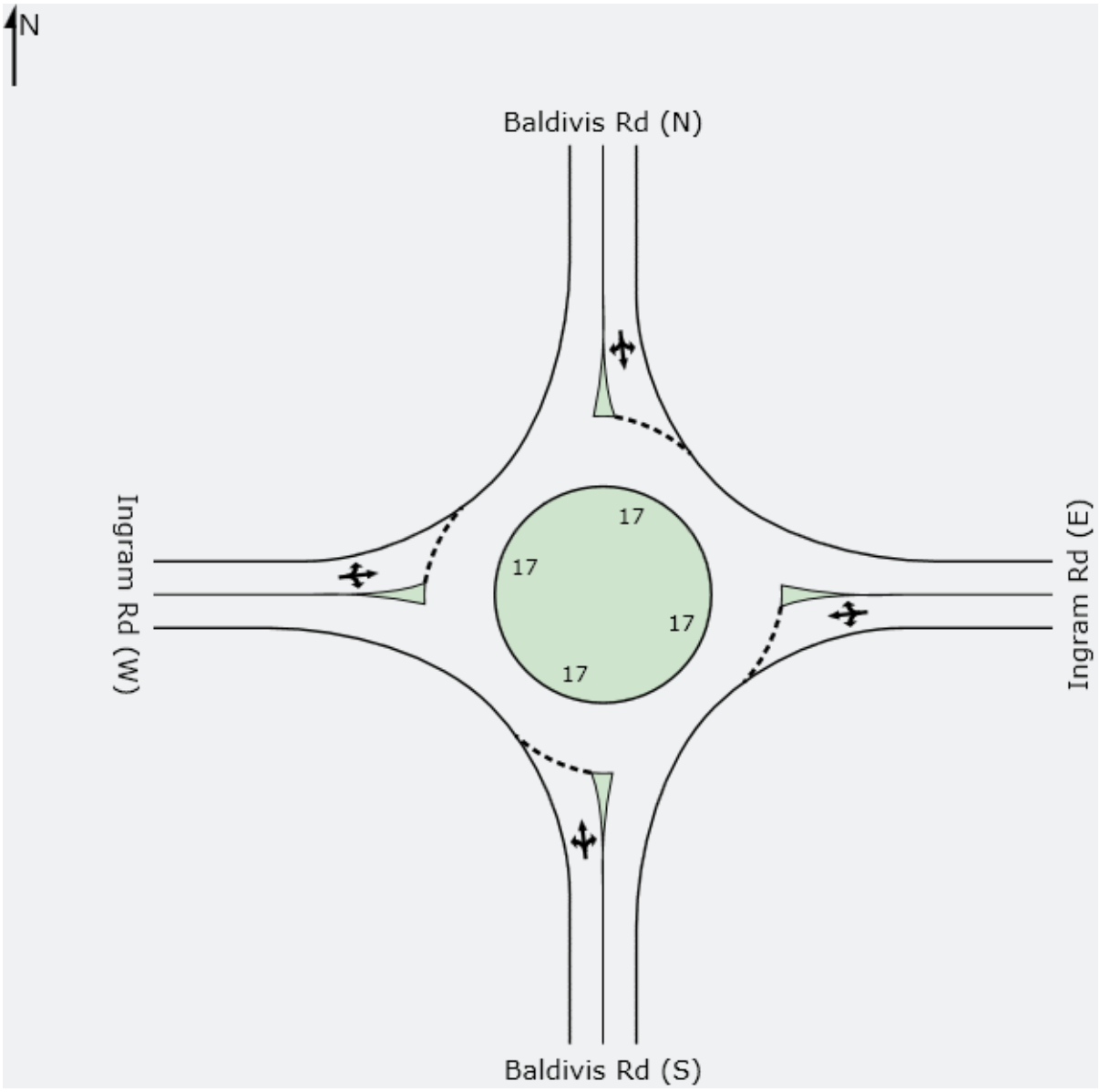


Figure B4. Baldivis Road / Ingram Road layout analysed in SIDRA

Table B4a. SIDRA results – Baldivis Road / Ingram Road roundabout – 2031 weekday AM peak with development east of Baldivis Road

Movement Performance - Vehicles								
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Baldivis Rd (S)								
1	L	46	1.0	0.342	7.2	LOS A	2.3	16.5
2	T	395	2.0	0.342	6.3	LOS A	2.3	16.5
3	R	16	1.0	0.342	11.6	LOS B	2.3	16.5
Approach		457	1.9	0.342	6.6	LOS A	2.3	16.5
East: Ingram Rd (E)								
4	L	18	1.0	0.095	8.5	LOS A	0.5	3.4
5	T	11	1.0	0.095	7.6	LOS A	0.5	3.4
6	R	65	1.0	0.095	13.0	LOS B	0.5	3.4
Approach		94	1.0	0.095	11.5	LOS B	0.5	3.4
North: Baldivis Rd (N)								
7	L	21	1.0	0.254	6.8	LOS A	1.5	11.0
8	T	340	2.0	0.254	5.9	LOS A	1.5	11.0
9	R	13	1.0	0.254	11.2	LOS B	1.5	11.0
Approach		374	1.9	0.254	6.2	LOS A	1.5	11.0
West: Ingram Rd (W)								
10	L	1	1.0	0.022	9.0	LOS A	0.1	0.8
11	T	8	1.0	0.022	8.1	LOS A	0.1	0.8
12	R	11	1.0	0.022	13.4	LOS B	0.1	0.8
Approach		20	1.0	0.022	11.1	LOS B	0.1	0.8
All Vehicles		945	1.8	0.342	7.0	LOS A	2.3	16.5

Table B4b. SIDRA results – Baldivis Road / Ingram Road roundabout – 2031 weekday PM peak without development east of Baldivis Road

Movement Performance - Vehicles								
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Baldivis Rd (S)								
1	L	20	1.0	0.159	6.8	LOS A	1.0	7.0
2	T	169	2.0	0.159	5.9	LOS A	1.0	7.0
3	R	38	1.0	0.159	11.2	LOS B	1.0	7.0
Approach		227	1.7	0.159	6.9	LOS A	1.0	7.0
East: Ingram Rd (E)								
4	L	8	1.0	0.065	11.9	LOS B	0.4	2.7
5	T	5	1.0	0.065	11.0	LOS B	0.4	2.7
6	R	28	1.0	0.065	16.4	LOS B	0.4	2.7
Approach		41	1.0	0.065	14.9	LOS B	0.4	2.7
North: Baldivis Rd (N)								
7	L	49	1.0	0.600	7.4	LOS A	5.6	40.0
8	T	793	2.0	0.600	6.5	LOS A	5.6	40.0
9	R	1	1.0	0.600	11.8	LOS B	5.6	40.0
Approach		843	1.9	0.600	6.6	LOS A	5.6	40.0
West: Ingram Rd (W)								
10	L	1	1.0	0.043	7.7	LOS A	0.2	1.5
11	T	20	1.0	0.043	6.8	LOS A	0.2	1.5
12	R	26	1.0	0.043	12.2	LOS B	0.2	1.5
Approach		47	1.0	0.043	9.8	LOS A	0.2	1.5
All Vehicles		1158	1.8	0.600	7.0	LOS A	5.6	40.0

Appendix **Seven** – Indicative Lot Levels

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No.	DATE	BY	REVISION	
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CLIENT: **CARCIONE NOMINEES PTY LTD**

DEVELOPMENT ENGINEERING CONSULTANTS
SUITE 3, 123A COLIN ST, WEST PERTH, 6005 WESTERN AUSTRALIA
Ph: (08) 9481 1900
Fax: (08) 9481 1700

PROJECT: **FIFTY ROAD, EIGHTY ROAD BALDIVIS**

W.A.P.C. No. -

DRAWING: **EARTHWORKS PRELIMINARY LOT LEVELS SHEET 1 OF 4**

CAD DRAWING DO NOT MANUALLY ALTER

SCALE	DRAWN	CHECK	REV No.
1:1000	JTH	SRA	A
DATE 29/06/12	DESIGNED JTH	APPROVED SRA	

PROJECT NUMBER **BDVCAN10 SK1**

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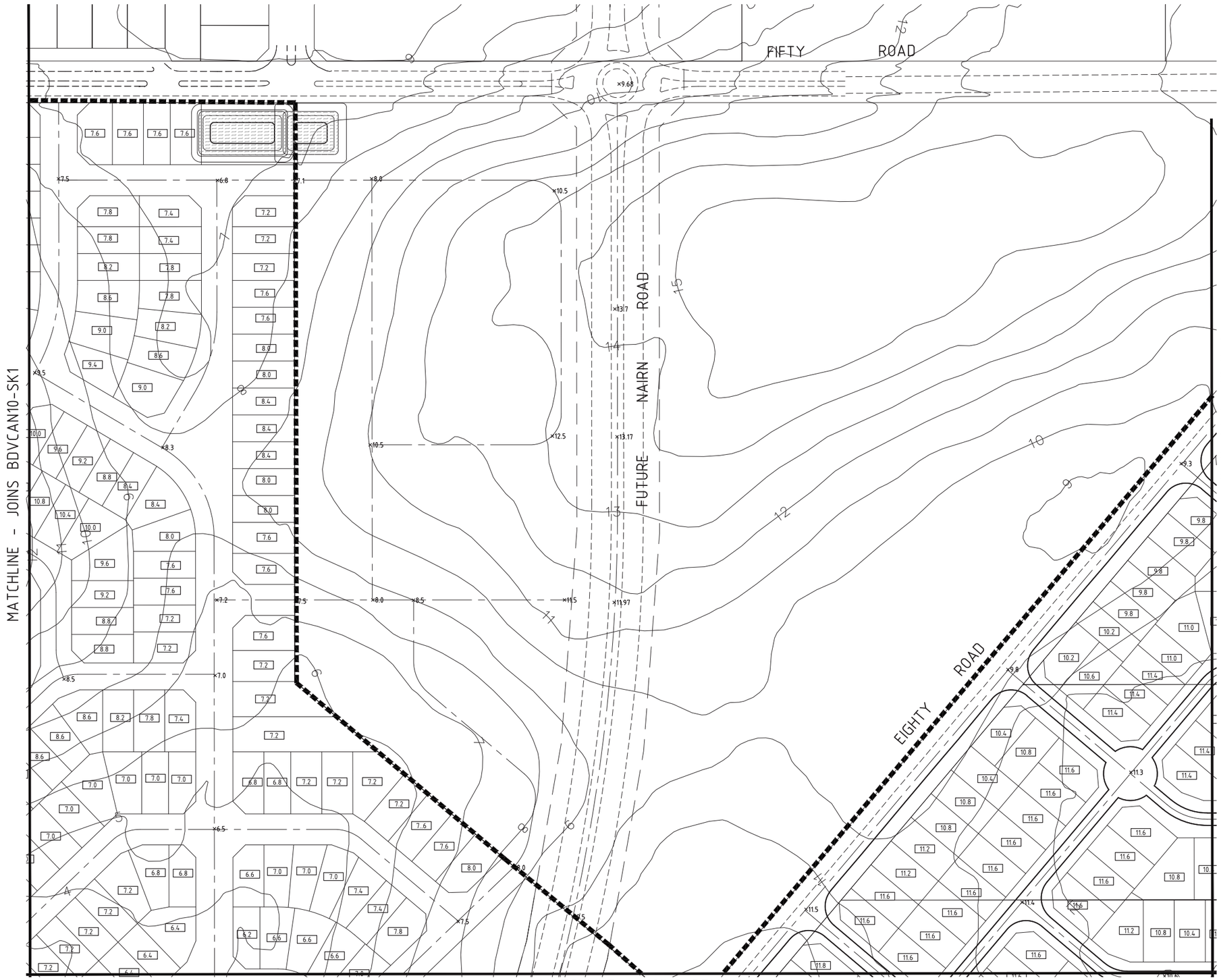

STRUCTURE PLAN BOUNDARY

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DEVELOPMENT ENGINEERING CONSULTANTS
SUITE 3, 123A COLIN ST, WEST PERTH, 6005
WESTERN AUSTRALIA
Ph: (08) 9481 1900
Fax: (08) 9481 1700

PROJECT: FIFTY ROAD, EIGHTY ROAD BALDIVIS

W.A.P.C. No. -

DRAWING: EARTHWORKS PRELIMINARY LOT LEVELS SHEET 2 OF 4

CAD DRAWING DO NOT MANUALLY ALTER

SCALE	DRAWN	CHECK	REV No.
1:1000	JTH	SRA	A
DATE 29/06/12	DESIGNED JTH	APPROVED SRA	

PROJECT NUMBER BDVCAN10 SK2

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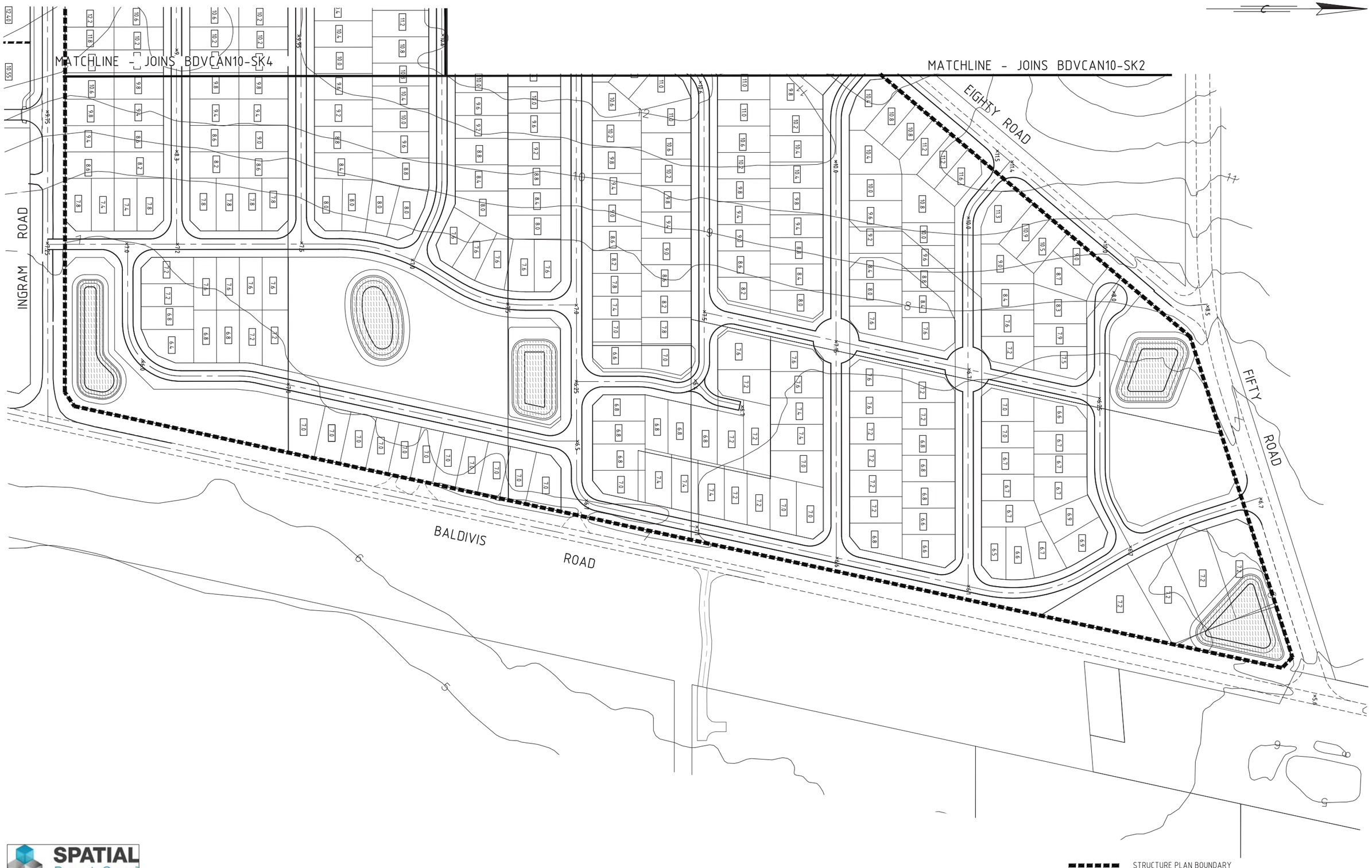

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DEVELOPMENT ENGINEERING CONSULTANTS
SUITE 3, 123A COLIN ST,
WEST PERTH, 6005
WESTERN AUSTRALIA
Ph: (08) 9481 1900
Fax: (08) 9481 1700

PROJECT:
FIFTY ROAD, EIGHTY ROAD BALDIVIS
W.A.P.C. No. -

DRAWING:
EARTHWORKS PRELIMINARY LOT LEVELS SHEET 3 OF 4
CAD DRAWING DO NOT MANUALLY ALTER

SCALE	DRAWN	CHECK	REV No.
1:1000	JTH	SRA	A
DATE	DESIGNED	APPROVED	
29/06/12	JTH	SRA	

PROJECT NUMBER
BDVCAN10 SK3
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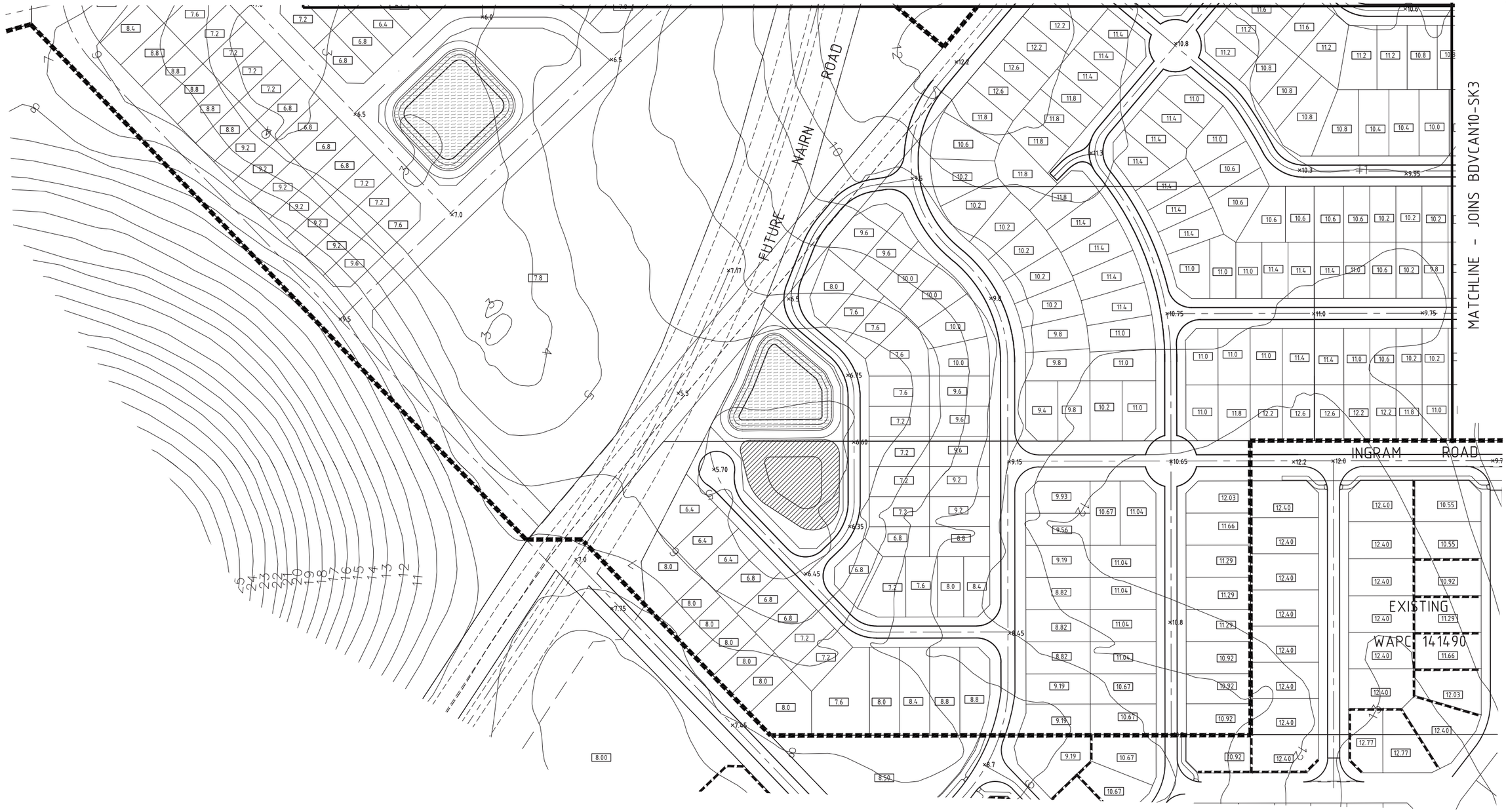

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DEVELOPMENT ENGINEERING CONSULTANTS
SUITE 3, 123A COLIN ST, WEST PERTH, 6005 WESTERN AUSTRALIA
Ph: (08) 9481 1900
Fax: (08) 9481 1700

PROJECT: FIFTY ROAD, EIGHTY ROAD BALDIVIS
W.A.P.C. No. -

DRAWING: EARTHWORKS PRELIMINARY LOT LEVELS SHEET 4 OF 4
CAD DRAWING DO NOT MANUALLY ALTER

SCALE	DRAWN	CHECK	REV No.
1:1000	JTH	SRA	A
DATE	DESIGNED	APPROVED	
29/06/12	JTH	SRA	

PROJECT NUMBER
BDVCAN10 SK4
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Appendix **Eight** – Certificates of Title

WESTERN AUSTRALIA

REGISTER NUMBER	
312/DP202704	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
1	6/10/2005

RECORD OF CERTIFICATE OF TITLE

VOLUME 38 FOLIO 2A

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 312 ON DEPOSITED PLAN 202704

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

PIPERPOINT PTY LTD OF 289 STOCK ROAD, O'CONNOR
(T J357946) REGISTERED 13 JULY 2005

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. J357947 MORTGAGE TO BANK OF WESTERN AUSTRALIA LTD REGISTERED 13.7.2005.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: 38-2A (312/DP202704).
PREVIOUS TITLE: 1146-966.
PROPERTY STREET ADDRESS: 61 EIGHTY RD, BALDIVIS.
LOCAL GOVERNMENT AREA: CITY OF ROCKINGHAM.

NOTE 1: A000001A LAND PARCEL IDENTIFIER OF PEEL ESTATE LOT 312 (OR THE PART THEREOF) ON SUPERSEDED PAPER CERTIFICATE OF TITLE CHANGED TO LOT 312 ON DEPOSITED PLAN 202704 ON 29-MAY-02 TO ENABLE ISSUE OF A DIGITAL CERTIFICATE OF TITLE.

NOTE 2: THE ABOVE NOTE MAY NOT BE SHOWN ON THE SUPERSEDED PAPER CERTIFICATE OF TITLE OR ON THE CURRENT EDITION OF DUPLICATE CERTIFICATE OF TITLE.

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WESTERN AUSTRALIA

REGISTER NUMBER	
313/DP202704	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
1	6/1/2003

RECORD OF CERTIFICATE OF TITLE

VOLUME 1955 FOLIO 395

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 313 ON DEPOSITED PLAN 202704

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

MAINDAY HOLDINGS PTY LTD OF 289 STOCK ROAD, O'CONNOR
(T I333571) REGISTERED 20 DECEMBER 2002

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. A405839 EASEMENT TO AMPOL EXPLORATION LTD., SHELL DEVELOPMENT (AUSTRALIA) PTY. LTD., TEXACO OVERSEAS PETROLEUM CO., AND CALIFORNIA ASIATIC OIL CO. SEE SKETCH ON VOL 1955 FOL 395. REGISTERED 3.6.1971.
   *K395712 NOTIFICATION. THE GRANTEES OF EASEMENT A405839 ARE NOW APT PARMELIA PTY LTD PURSUANT TO SECTION 20(5) OF THE PETROLEUM PIPELINES ACT 1969. REGISTERED 31.10.2007.
2. C263781 EASEMENT TO ALCOA OF AUSTRALIA (W.A.) LTD. SEE SKETCH ON VOL 1955 FOL 395. REGISTERED 2.12.1981.
3. I333572 MORTGAGE TO BANK OF WESTERN AUSTRALIA LTD REGISTERED 20.12.2002.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
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Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: 1955-395 (313/DP202704).
PREVIOUS TITLE: 354-84A.
PROPERTY STREET ADDRESS: 121 FIFTY RD, BALDIVIS.
LOCAL GOVERNMENT AREA: CITY OF ROCKINGHAM.

NOTE 1: A000001A LAND PARCEL IDENTIFIER OF PEEL ESTATE LOT 313 (OR THE PART THEREOF) ON SUPERSEDED PAPER CERTIFICATE OF TITLE CHANGED TO LOT 313 ON DEPOSITED PLAN 202704 ON 17-JUN-02 TO ENABLE ISSUE OF A DIGITAL CERTIFICATE OF TITLE.

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WESTERN AUSTRALIA

REGISTER NUMBER	
2/D29589	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
1	21/8/2004

RECORD OF CERTIFICATE OF TITLE

VOLUME 1282 FOLIO 475

UNDER THE TRANSFER OF LAND ACT 1893

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REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 2 ON DIAGRAM 29589

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

ARROWEST PTY LTD OF 289 STOCK ROAD, O'CONNOR
(T I975669) REGISTERED 5 AUGUST 2004

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. I975670 MORTGAGE TO BANK OF WESTERN AUSTRALIA LTD REGISTERED 5.8.2004.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
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Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

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SKETCH OF LAND: 1282-475 (2/D29589).
PREVIOUS TITLE: 1282-474.
PROPERTY STREET ADDRESS: LOT 2 EIGHTY RD, BALDIVIS.
LOCAL GOVERNMENT AREA: CITY OF ROCKINGHAM.

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WESTERN AUSTRALIA

REGISTER NUMBER	
4/D29589	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
3	6/1/2003

RECORD OF CERTIFICATE OF TITLE

VOLUME 1324 FOLIO 476

UNDER THE TRANSFER OF LAND ACT 1893

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REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 4 ON DIAGRAM 29589

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

ARROWEST PTY LTD OF 289 STOCK ROAD, O'CONNOR
(T I284768) REGISTERED 4 NOVEMBER 2002

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. I333573 MORTGAGE TO BANK OF WESTERN AUSTRALIA LTD REGISTERED 20.12.2002.

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SKETCH OF LAND:	1324-476 (4/D29589).
PREVIOUS TITLE:	1282-474.
PROPERTY STREET ADDRESS:	400 BALDIVIS RD, BALDIVIS.
LOCAL GOVERNMENT AREA:	CITY OF ROCKINGHAM.

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REGISTER NUMBER	
5/D47345	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
1	11/4/2006

WESTERN AUSTRALIA

RECORD OF CERTIFICATE OF TITLE

VOLUME 1388 FOLIO 918

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REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 5 ON DIAGRAM 47345

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

FINEPOINT INVESTMENTS PTY LTD OF 8 BARKER PLACE, KARRINYUP
(T J689276) REGISTERED 5 APRIL 2006

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

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SKETCH OF LAND:	1388-918 (5/D47345).
PREVIOUS TITLE:	1245-892.
PROPERTY STREET ADDRESS:	8 INGRAM RD, BALDIVIS.
LOCAL GOVERNMENT AREA:	CITY OF ROCKINGHAM.

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188B

REGISTER NUMBER	
7/D47817	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
3	13/7/2011

WESTERN AUSTRALIA

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VOLUME 2201 FOLIO 100

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REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 7 ON DIAGRAM 47817

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

ARROWEST PTY LTD OF 289 STOCK ROAD, O'CONNOR

(T L672730) REGISTERED 4 JULY 2011

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

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SKETCH OF LAND:	2201-100 (7/D47817).
PREVIOUS TITLE:	1411-707.
PROPERTY STREET ADDRESS:	29 INGRAM RD, BALDIVIS.
LOCAL GOVERNMENT AREA:	CITY OF ROCKINGHAM.

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WESTERN AUSTRALIA

REGISTER NUMBER	
8/D47817	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
2	12/7/2006

RECORD OF CERTIFICATE OF TITLE

VOLUME 1411 FOLIO 708

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REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 8 ON DIAGRAM 47817

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

ARROWEST PTY LTD OF 289 STOCK ROAD, O'CONNOR

(T J818486) REGISTERED 4 JULY 2006

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND:	1411-708 (8/D47817).
PREVIOUS TITLE:	1388-919.
PROPERTY STREET ADDRESS:	28 INGRAM RD, BALDIVIS.
LOCAL GOVERNMENT AREA:	CITY OF ROCKINGHAM.

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Appendix **Nine** – Acoustic Assessment

Rochdale Holdings Pty Ltd A.B.N. 85 009 049 067 trading as:
HERRING STORER ACOUSTICS
Suite 34, 11 Preston Street, Como, W.A. 6152
P.O. Box 219, Como, W.A. 6952
Telephone: (08) 9367 6200
Facsimile: (08) 9474 2579
Email: hsa@hsacoustics.com.au

SPIRES ESTATE
BALDIVIS

SPP 5.4 ACOUSTIC ASSESSMENT

APRIL 2014

OUR REFERENCE: 17756-1-14082

DOCUMENT CONTROL PAGE

ACOUSTIC ASSESSMENT

SPIRES ESTATE

Job No: 14082

Document Reference: 17756-1-14082

FOR

PLANNING DEVELOPMENT STRATEGIES

DOCUMENT INFORMATION			
Author:	Tim Reynolds	**Checked By:**	Paul Daly
Date of Issue :	29 April 2014		

REVISION HISTORY

Revision	Description	Date	Author	Checked

DOCUMENT DISTRIBUTION

Copy No.	Version No.	Destination	Hard Copy	Electronic Copy
1	1	DPS		✓

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APPENDICIES

A Local Structure Plan

B Extent of Fencing

C Figures C1 to C3 – $L_{Aeq\ (16hr)}$ Noise Contours for Nairn Road

D Figures D1 to D3 - $L_{Aeq(8hr)}$ Noise Contours for Baldivis Road

E Figure E1 – Lots Requiring "Quiet House" Design and Notifications
"Quiet House" Design – General Information

EXECUTIVE SUMMARY

Herring Storer Acoustics was commissioned by Development Planning Strategies to carry out a road traffic noise assessment for the proposed Spires Estate, Baldivis residential areas.

The purpose of this study was to assess noise received at future residences within the subdivision from vehicles travelling on Baldivis Road and the future Nairn Road and where applicable, comment on possible noise attenuation measures that could control noise intrusion to acceptable levels. The traffic noise assessment has been carried out in accordance with the new WAPC State Planning Policy 5.4 *"Road and Rail Transportation Noise and Freight Consideration in Land Use Planning"*. We note that under the Planning Policy, the appropriate acoustic criteria would be the "Noise Limits". Thus the acoustic criteria would be:

External

Day	Maximum of 60 dB(A) L_{Aeq}
Night	Maximum of 55 dB(A) L_{Aeq}

Internal

Living and Work Areas	$L_{Aeq(Day)}$ of 40 dB(A)
Bedrooms	$L_{Aeq(Night)}$ of 35 dB(A)

Noise received at an outdoor area, where practicable, should also achieve an L_{Aeq} of 50 dB(A) during the night period.

The noise modelling indicates that without any noise amelioration, noise received at the residence located adjacent Nairn Road would exceed the "Noise Limits". For this development a 2.2 metre high barrier located at the boundary of the Nairn Road reserve is recommended. With this barrier, the lots requiring "Quiet House" design and Notifications on Titles would be as shown on Figure E1 in Appendix E.

Modelling shows that noise received at the residence located adjacent to Baldivis Road would in the future marginally exceed the "Noise Targets". For these residences, our analysis indicates that compliance with the above internal noise levels would be achieved with standard construction. Hence, no upgrade in the construction is required for these residences. It is also recommended that for those residence that either back on to or side on to Baldivis Road, that a 1.8m high barrier be constructed, as shown on Figure B1 in Appendix B.

Finally, it is noted that under the policy, that for those residence where noise would exceed the "Noise Target", notification of vehicle noise will need to be stated on the titles. These residence are indicated on Figure E1, attached in Appendix E. Additionally, information on Packages A and B "Quiet House" design measures as contained in the Implementation Guidelines are also attached in Appendix E.

1. INTRODUCTION

Herring Storer Acoustics was commissioned by Development Planning Solutions to undertake an acoustical assessment of noise received within the proposed Spires Estate residential area. As part of the study, the following was carried out:

- Determine by noise modelling of the noise levels that would be received at residences within the development from vehicles travelling on the Baldivis Road and the future Nairn Road.
- Assess the predicted noise levels received at residence for compliance with the requirements of the WAPC State Planning Policy 5.4 *"Road and Rail Transportation Noise and Freight Consideration in Land Use Planning"* (SPP 5.4).
- If exceedances are predicted, comment on possible noise amelioration options for compliance with the appropriate criteria.

For information, the local structure plan is attached in Appendix A.

2. SUMMARY

Under the Western Australian Planning Commission (WAPC) Planning Policy 5.4 "Road and Rail Transport Noise and Freight Considerations in Land Use Planning", the appropriate acoustic criteria for this subdivision would be the "Noise Limits" as described below.

External

Day	Maximum of 60 dB(A) L_{Aeq}
Night	Maximum of 55 dB(A) L_{Aeq}

Noise received at an outdoor area, where practicable, should also achieve an L_{Aeq} of 50 dB(A) during the night period.

Additional to the above external noise levels, SPP 5.4 also lists the following internal acoustic criteria:

Internal

$L_{Aeq(day)}$ of 40 dB(A) in living and work areas; and
$L_{Aeq(night)}$ of 35 dB(A) in bedrooms.

Firstly, we note that from previous noise monitoring, for Baldivis Road the difference between the $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$ is less than 5 dB(A). Hence for noise received from Baldivis Road the critical period for compliance is the night period and if compliance with the night period is achieved, then compliance with the day period will also be achieved. However, with regard to the difference between the $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$ for Nairn Road, guidance is taken from the DEFRA publication and using this publication, the difference would be greater than 5 dB(A). Thus for Nairn Road, the critical period for compliance is the day period, for if compliance with the day period is achieved, then compliance with the night period would also be achieved.

With regards to Baldivis Road, the modelling shows that noise received at the adjacent residence comply with the "Noise Limits", but marginally exceed the "Noise Targets" as outlined in SPP 5.4. Our analysis indicates that compliance with the above internal noise levels would be achieved with standard construction. Hence, no upgrade in the construction is required for these residences. However, Notifications on Titles would still be required to the first row of residence located adjacent to Baldivis Road, as shown on Figure E1 in Appendix E. It is also recommended that for those residences that either back on to or are side on to Baldivis Road, that a 1.8m high barrier is constructed, as shown on Figure B1 in Appendix B.

The noise modelling indicates that without any noise amelioration, noise received at the residence located adjacent to the future Nairn Road would exceed the "Noise Limit" criteria by up to 3 dB(A). For this development a 2.2 metre high barrier located at the boundary of the Nairn Road reserve is to be constructed.

With the construction of a 2.2 metre high barrier to Nairn Road, noise received at these residences would, on the ground floor, comply with the "Noise Limits". However, noise received at any first floors would exceed the "Noise Limits" and to comply with SPP5.4, "Quiet House" design by way of Package B measures would be required. Additionally, if any back yards abutting Nairn Road, to comply with the requirements for outdoor areas, they should be designed with either a courtyard down the side of the residence or a separate outdoor area on the side of the residence opposite Nairn Road. The Lots requiring "Quiet House" design and/or Notification on Titles are shown on Figure E1 in Appendix E.

It is noted that under the policy, that for those residences where noise would exceed the "Noise Target", notification of vehicle noise will need to be stated on the titles. These residences are indicated on Figure E1, attached in Appendix E. Information on Packages A and B "Quiet House" design measures are also attached in Appendix E.

It is noted that the requirement for "Notification on Titles" are based on the noise that would be received at the first floor of a residence.

3. CRITERIA

3.1 STATE PLANNING POLICY 5.4

The Western Australian Planning Commission (WAPC) released on 22 September 2009 State Planning Policy 5.4 "Road and Rail Transport Noise and Freight Considerations In Land Use Planning". Section 5.3 – Noise Criteria, which outlines the acoustic criteria, states:

"5.3 - NOISE CRITERIA

Table 1 sets out the outdoor noise criteria that apply to proposals for new noise-sensitive development or new major roads and railways assessed under this policy.

These criteria do not apply to—

- *proposals for redevelopment of existing major roads or railways, which are dealt with by a separate approach as described in section 5.4.1; and*
- *proposals for new freight handling facilities, for which a separate approach is described in section 5.4.2.*

The outdoor noise criteria set out in Table 1 apply to the emission of road and rail transport noise as received at a noise-sensitive land use. These noise levels apply at the following locations—

- *for new road or rail infrastructure proposals, at 1 m from the most exposed, habitable façade of the building receiving the noise, at ground floor level only; and*
- *for new noise-sensitive development proposals, at 1 m from the most exposed, habitable façade of the proposed building, at each floor level, and within at least one outdoor living area on each residential lot.*

Further information is provided in the guidelines.

Table 1: Outdoor Noise Criteria

Time of day	*Noise Target*	*Noise Limit*
Day (6 am–10 pm)	$L_{Aeq(Day)}$ *= 55 dB(A)*	$L_{Aeq(Day)}$ *= 60 dB(A)*
Night (10 pm–6 am)	$L_{Aeq(Night)}$ *= 50 dB(A)*	$L_{Aeq(Night)}$ *= 55 dB(A)*

The 5 dB difference between the outdoor noise target and the outdoor noise limit, as prescribed in Table 1, represents an acceptable margin for compliance. In most situations in which either the noise-sensitive land use or the major road or railway already exists, it should be practicable to achieve outdoor noise levels within this acceptable margin. In relation to greenfield sites, however, there is an expectation that the design of the proposal will be consistent with the target ultimately being achieved.
Because the range of noise amelioration measures available for implementation is dependent upon the type of proposal being considered, the application of the noise criteria will vary slightly for each different type. Policy interpretation of the criteria for each type of proposal is outlined in sections 5.3.1 and 5.3.2.

The noise criteria were developed after consideration of road and rail transport noise criteria in Australia and overseas, and after a series of case studies to assess whether the levels were practicable. The noise criteria take into account the considerable body of research into the effects of noise on humans, particularly community annoyance, sleep disturbance, long-term effects on cardiovascular health, effects on children's learning performance, and impacts on vulnerable groups such as children and the elderly. Reference is made to the World Health Organization (WHO) recommendations for noise policies in their publications on community noise and the Night Noise Guidelines for Europe. See the policy guidelines for suggested further reading.

5.3.1 Interpretation and application for noise-sensitive development proposals

In the application of these outdoor noise criteria to new noise-sensitive developments, the objective of this policy is to achieve –

- *acceptable indoor noise levels in noise-sensitive areas (for example, bedrooms and living rooms of houses, and school classrooms); and*
- *a reasonable degree of acoustic amenity in at least one outdoor living area on each residential lot*[1].

1 For non residential noise-sensitive developments, (e.g. schools and child care centres) consideration should be given to providing a suitable outdoor area that achieves the noise target, where this is appropriate to the type of use.

If a noise-sensitive development takes place in an area where outdoor noise levels will meet the noise target, no further measures are required under this policy.

In areas where the noise target is likely to be exceeded, but noise levels are likely to be within the 5dB margin, mitigation measures should be implemented by the developer with a view to achieving the target levels in a least one outdoor living area on each residential lot[1]. Where indoor spaces are planned to be facing any outdoor area in the margin, noise mitigation measures should be implemented to achieve acceptable indoor noise levels in those spaces. In this case, compliance with this policy can be achieved for residential buildings through implementation of the deemed-to-comply measures detailed in the guidelines.

In areas where the outdoor noise limit is likely to be exceeded (i.e. above $L_{Aeq(Day)}$ of 60 dB(A) or $L_{Aeq(Night)}$ of 55 dB(A)), a detailed noise assessment in accordance with the guidelines should be undertaken by the developer. Customised noise mitigation measures should be implemented with a view to achieving the noise target in at least one outdoor living or recreation area on each noise-sensitive lot or, if this is not practicable, within the margin. Where indoor spaces will face outdoor areas that are above the noise limit, mitigation measures should be implemented to achieve acceptable indoor noise levels in those spaces, as specified in the following paragraphs.

For residential buildings, acceptable indoor noise levels are $L_{Aeq(Day)}$ of 40 dB(A) in living and work areas and $L_{Aeq(Night)}$ of 35 dB(A) in bedrooms[2]. For all other noise-sensitive buildings, acceptable indoor noise levels under this policy comprise noise levels that meet the recommended design sound levels in Table 1 of Australian Standard AS 2107:2000 Acoustics—Recommended design sound levels and reverberation times for building interiors.

These requirements also apply in the case of new noise-sensitive developments in the vicinity of a major transport corridor where there is no existing railway or major road (bearing in mind the policy's 15-20 year planning horizon). In these instances, the developer should engage in dialogue with the relevant infrastructure provider to develop a noise management plan to ascertain individual responsibilities, cost sharing arrangements and construction time frame.

If the policy objectives for noise-sensitive developments are not achievable, best practicable measures should be implemented, having regard to section 5.8 and the guidelines."

The Policy, under Section 5.7, also provides the following information regarding "Notifications on Titles":

2 For residential buildings, indoor noise levels are not set for utility spaces such as bathrooms. This policy encourages effective "quiet house" design, which positions these non-sensitive spaces to shield the more sensitive spaces from transport noise (see guidelines for further information).

"5.7 - NOTIFICATION ON TITLE

If the measures outlined previously cannot practicably achieve the target noise levels for new noise-sensitive developments, this should be notified on the certificate of title.

Notifications on certificates of title and/or advice to prospective purchasers advising of the potential for noise impacts from major road and rail corridors can be effective in warning people who are sensitive to the potential impacts of transport noise. Such advice can also bring to the attention of prospective developers the need to reduce the impact of noise through sensitive design and construction of buildings and the location of outdoor living areas.

The notification is to ensure that prospective purchasers are advised of –

- *the potential for transport noise impacts; and*
- *the potential for quiet house design requirements to minimise noise intrusion through house layout and noise insulation (see the guidelines).*

Notification should be provided to prospective purchasers and be required as a condition of subdivision (including strata subdivision) for the purposes of noise-sensitive development as well as planning approval involving noise-sensitive development, where noise levels are forecast or estimated to exceed the target outdoor noise criteria, regardless of proposed noise attenuation measures. The requirement for notification as a condition of subdivision and the land area over which the notification requirement applies, should be identified in the noise management plan in accordance with the guidelines.

An example of a standard form of wording for notifications is presented in the guidelines."

3.2 APPROPRIATE CRITERIA

Based on the above, the following criteria are proposed for this development:

External	
Day	Maximum of 60 dB(A) L_{Aeq}
Night	Maximum of 55 dB(A) L_{Aeq}
Internal	
Sleeping Areas	35 dB(A) $L_{Aeq(night)}$
Living Areas	40 dB(A) $L_{Aeq(day)}$

Additional to these criteria, noise received at an outdoor area, where practicable, should also achieve an L_{Aeq} of 50 dB(A) during the night period.

4. MONITORING

As part of previous assessments, noise monitoring of Baldivis Road has been carried out and the results of the monitoring are shown on Table 4.1.

TABLE 4.1 – SUMMARY OF 2005 MONITORING

Location	Measured Noise Level (dB(A))		
	$L_{10,18hour}$	$L_{eq,16hour}$	$L_{eq,8hour}$
Baldivis Road	52.6	51.1	47.1

The results of the noise monitoring are shown graphically in Appendix B.

Based on the noise monitoring results, the relationship between the $L_{A10(18\ hour)}$ and the $L_{Aeq(16hour)}$ and $L_{Aeq(8hour)}$ are as listed in Table 4.2.

TABLE 4.2 – RELATIONSHIP BETWEEN ACOUSTIC PARAMETERS

Road	Parameter	Measured Level dB(A)*	Difference between $L_{10(18hour)}$ and $L_{Aeq(parameter)}$ dB(A)
Baldivis Road	$L_{A10\ (18\ hour)}$	52.6	N/A
	$L_{Aeq,\ day\ (6am\ to\ 10pm)}$	51.1	= $L_{A10\ (18\ hour)}$ – 1.4
	$L_{Aeq,\ night\ (10pm\ to\ 6am)}$	47.1	= $L_{A10(18\ hour)}$ – 5.5

* It is normal practice to quote decibels to the nearest whole number. Fractions are retained here to minimise any cumulative rounding error.

With regards to the noise monitoring, we note that given the night period noise levels recorded adjacent to Baldivis Road, we believe that the night period L_{Aeq} of 47.1 dB was influenced by other environmental noises (such as wind in trees). Therefore, the assessment of noise received at residence located adjacent to Baldivis Road would be conservative.

5. MODELLING

Current and future road traffic volumes were based on information used in previous noise assessments or as supplied by the client. This and other information relevant to the calculations are shown below in Table 5.1.

TABLE 5.1 - NOISE MODELLING INPUT DATA

Parameter	Value	
	Current	Future
Traffic flows		
Nairn Road	-	20,400
Baldivis Road	2370	14,400
Heavy Vehicles (%)	8.0	

Other input data for the model included:

- Topographical data, with the ground level within the subdivision from information supplied by client;
- For future traffic, as listed in Table 5.1.
- A +2.5 dB adjustment to allow for façade reflection.

To determine the noise that would be received within the development from the surrounding road network, acoustic modelling was carried out using the computer program ‘SoundPlan’.

Apart from noise modelling of current road traffic flows to calibrate the noise model for Baldivis Road, the following future traffic flow scenarios were also modelled:

1. Without any noise amelioration.

2. With a 2.2m high barrier at boundary of the road reserve to Nairn Road and a standard 1.8m high side and rear fencing for those residences adjacent to Baldivis Road. The extent of fencing is shown in Appendix B on Figure B1.

We note that noise received at residence located adjacent to Baldivis Road, the difference between the $L_{Aeq(16hr)}$ and the $L_{Aeq(8hr)}$ would be less than 5 dB(A) and the night period is the critical period for compliance. However, as Nairn Road would be constructed sometime in the future as per the Implementation Guidelines for SPP 5.4, reference is made to the DEFRA publication. Thus based on the DEFRA publication, for Nairn Road the difference between the $L_{A10(18hr(}$ and the $L_{Aeq(8hr)}$ and the $L_{Aeq(16hr)}$ has been determined to be around 10 and 2 dB(A) respectively. Thus, for residence located adjacent to Nairn Road, the difference between the $L_{Aeq(16hr)}$ and the $L_{Aeq(8hr)}$ would be greater than 5 dB(A) and the day period is the critical period for compliance.

Based on the above, the noise contours for noise the above modelling scenarios are :

Nairn Road – Day period noise contours are attached in Appendix C.

Baldivis Road – Night period noise contours are attached in Appendix D.

Additional to the above, to determine the extent of residences requiring “Quiet House” design and/or Notifications, noise modelling was also undertaken for the noise received at the first floor. For this scenario, generic residence were included in the noise model and the day noise contours for Nairn Road attached in Appendix C as Figure C3, with the night noise contours for Baldivis Road attached in Appendix D as Figure D3.

6. DISCUSSION / RECOMMENDATION

Under the WAPC State Planning Policy 5.4, for this development, the "Noise Limits" as listed in Table 1 are the appropriate noise levels for to be achieved for this development. Under The SPP 5.4, the "Noise Limits" criteria which are applicable external to a residence are:

External

Day	Maximum of 60 dB(A) L_{Aeq}
Night	Maximum of 55 dB(A) L_{Aeq}

The policy states that the outdoor criteria applies to the ground floor level only, however, it also states that noise mitigation measures should be implemented with a view to achieving the “Noise Target” levels in least one outdoor living area. The Policy states the following acceptable internal noise levels:

Internal

Living and Work Areas	$L_{Aeq(Day)}$ of 40 dB(A)
Bedrooms	$L_{Aeq(Night)}$ of 35 dB(A)

From previous noise monitoring of Baldivis Road, the difference between the $L_{Aeq(16hr)}$ and the $L_{Aeq(8hr)}$ would be less than 5 dB(A) and for Baldivis Road the night period is the critical period for compliance. However, with Nairn Road still to be constructed, to determine the difference between the $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$, guidance is taken from the DEFRA publication and using this publication, the difference would be greater than 5 dB(A). Thus for Nairn Road, the critical period for compliance is the day period.

For this development, compliance with the requirements of SP 5.4, noise modelling and assessment are based on the day period for residence located adjacent to Nairn Road and the night period for these residence located adjacent to Baldivis Road.

The results of the acoustic assessment indicate that noise received at residences located adjacent to Nairn Road would exceed the "Noise Limits" as outlined in the Western Australian Planning Commission (WAPC) Planning Policy 5.4 "Road and Rail Transport Noise and Freight Considerations in Land Use Planning". To comply with the requirements of SPP 5.4 a 2.2 metre high barrier located at the boundary of the road reserve to Nairn Road be constructed.

With the construction of the barrier to Nairn Road, noise received at these residences would, on the ground floor, comply with the "Noise Limits". However, noise received at any first floors would exceed the "Noise Limits" and to comply with SPP5.4, "Quiet House" design by way of Package B measures would be required. Additionally, for residences with back yards abutting Nairn Road, to comply with the requirements for outdoor areas, they should be designed with either a courtyard down the side of the residence or a separate outdoor area on the western side of the residence.

We note that the requirement for "Notification on Titles" and "Quiet House" Design are based on the noise that would be received at the first floor of a residence, with the construction of a 2.2m high barrier and including the construction of residences.

With regards to Baldivis Road, the modelling shows that noise received at the adjacent residence would comply with the "Noise Limits", but marginally exceeds the "Noise Targets" as outlined in SPP 5.4. Our analysis indicates that for these residence adjacent to Baldivis Road, compliance with the above internal noise levels would be achieved with standard construction and no upgrade in constructions or "Quiet House" design would be required. However, as the noise levels exceed the "Target Noise" levels, Notifications on Titles are still required for this first row of residence. Thus, for residence located adjacent to Baldivis Road, it is recommended that :

- 1.8m high barriers be constructed for those residence that either back on to or are side on to Baldivis Road, as shown on Figure B1 in Appendix B; and

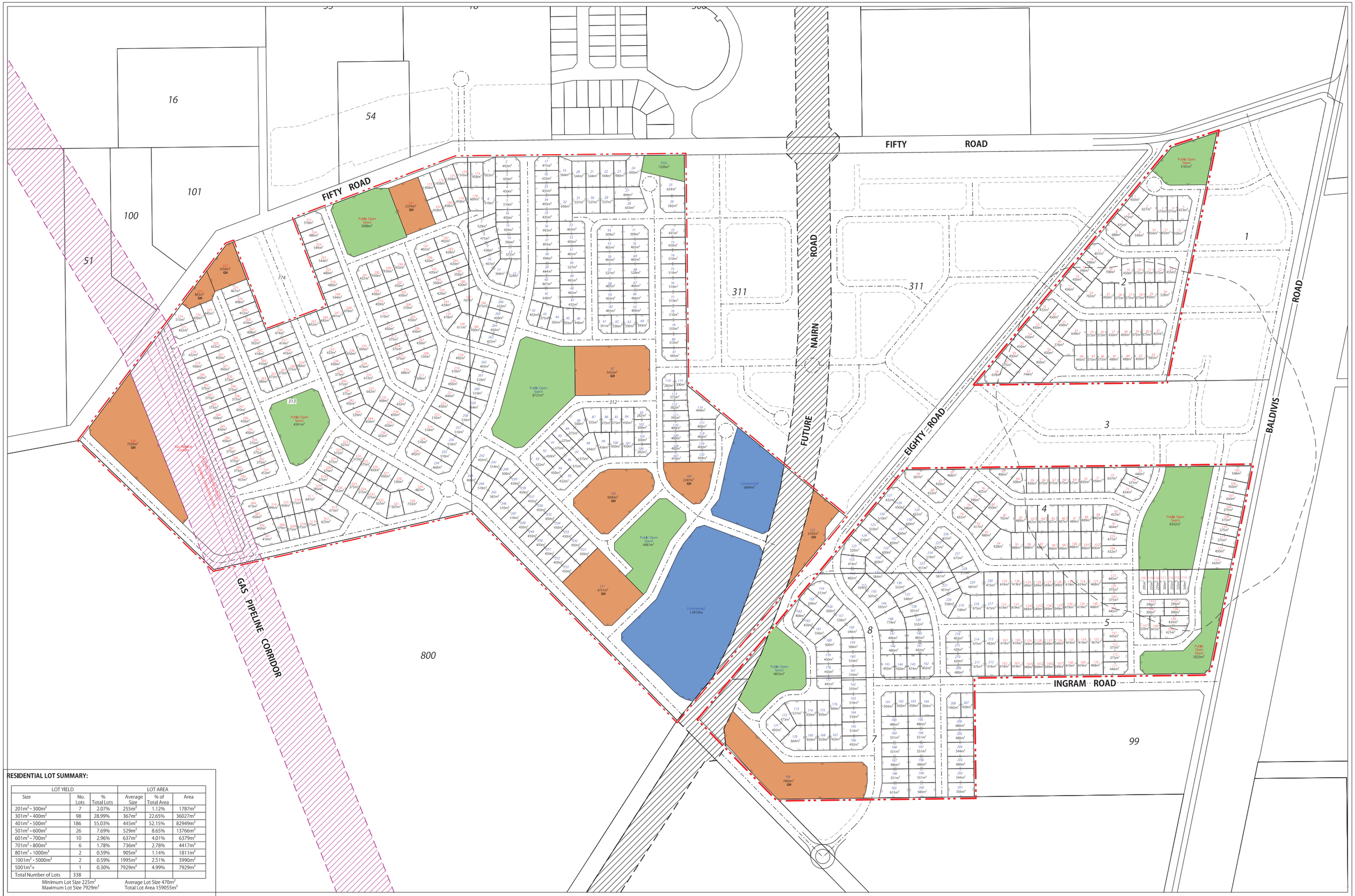
- Notification on Titles be placed on the Lots as shown on Figure E1 in Appendix E.

It is noted that the first rows of residences provide a significant barrier to those residence behind. Thus, without the inclusion of residence, as shown on Figures C2 and D2 in Appendices C and D, the extent of those residence that would appear to required "Quiet House" design and Notifications is significantly greater than is actually the case. Therefore, additional modelling, with the inclusion of residence has been undertaken. The results of this modelling are shown on Figures C3 and D3 in Appendices C and D. With the inclusion of the residence, the actual number of residence requiring "Quiet House" design and "Notification on Titles" does not extend as far into the development. Based on the above, the "Quiet House" Design and Notifications will be as shown on Figure E1 attached in Appendix E. Also attached in Appendix E, is some general information on the Packages construction requirements.

Note : Given the small noise reduction required to be achieved by the fences to Baldivis Road, standard fencing such as a colourbond fence would be acceptable.

APPENDIX A

LOCAL STRUCTURE PLAN



RESIDENTIAL LOT SUMMARY:

LOT YIELD			LOT AREA		
Size	No. Lots	% Total Lots	Average Size	% of Total Area	Area
201m² - 300m²	7	2.07%	255m²	1.12%	1787m²
301m² - 400m²	98	28.99%	367m²	22.65%	36027m²
401m² - 500m²	186	55.03%	445m²	52.15%	82949m²
501m² - 600m²	26	7.69%	529m²	8.65%	13766m²
601m² - 700m²	10	2.96%	637m²	4.01%	6379m²
701m² - 800m²	6	1.78%	736m²	2.78%	4417m²
801m² - 1000m²	2	0.59%	905m²	1.14%	1811m²
1001m² - 5000m²	2	0.59%	1995m²	2.51%	3990m²
5001m²+	1	0.30%	7929m²	4.99%	7929m²
Total Number of Lots	338				

Minimum Lot Size 225m²
Maximum Lot Size 7929m²

Average Lot Size 470m²
Total Lot Area 159055m²

CONCEPT LAYOUT PLAN

Spires Estate, Fifty and Eighty Road, BALDIVIS

for: Spatial Property Group

SPATIAL Property Group™

LEGEND:

- Spires Estate Local Structure Plan Boundary
- Buffer to Egg Farm
- Gas Pipeline Corridor
- Future Road Widening
- Surrounding Cell Layout
- Public Open Space
- Commercial

NOTES:

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NORTH

Scale 1: 2000 @ A1

0 20 40 60 80 100 metres

COMPILED: DPS		DRAWN BY:	RF
DATE:	13/01/2014	REVISED:	
GRID:	MGA 50	DATUM:	AHD
DRAWING NUMBER:	CARBD-1-016	JOBCODE:	CARBDLSP
FILE ID:	M:\CARBD\BASE\FEASIBILITY & CONCEPT\CARBD-1-016 STG1.DGN		

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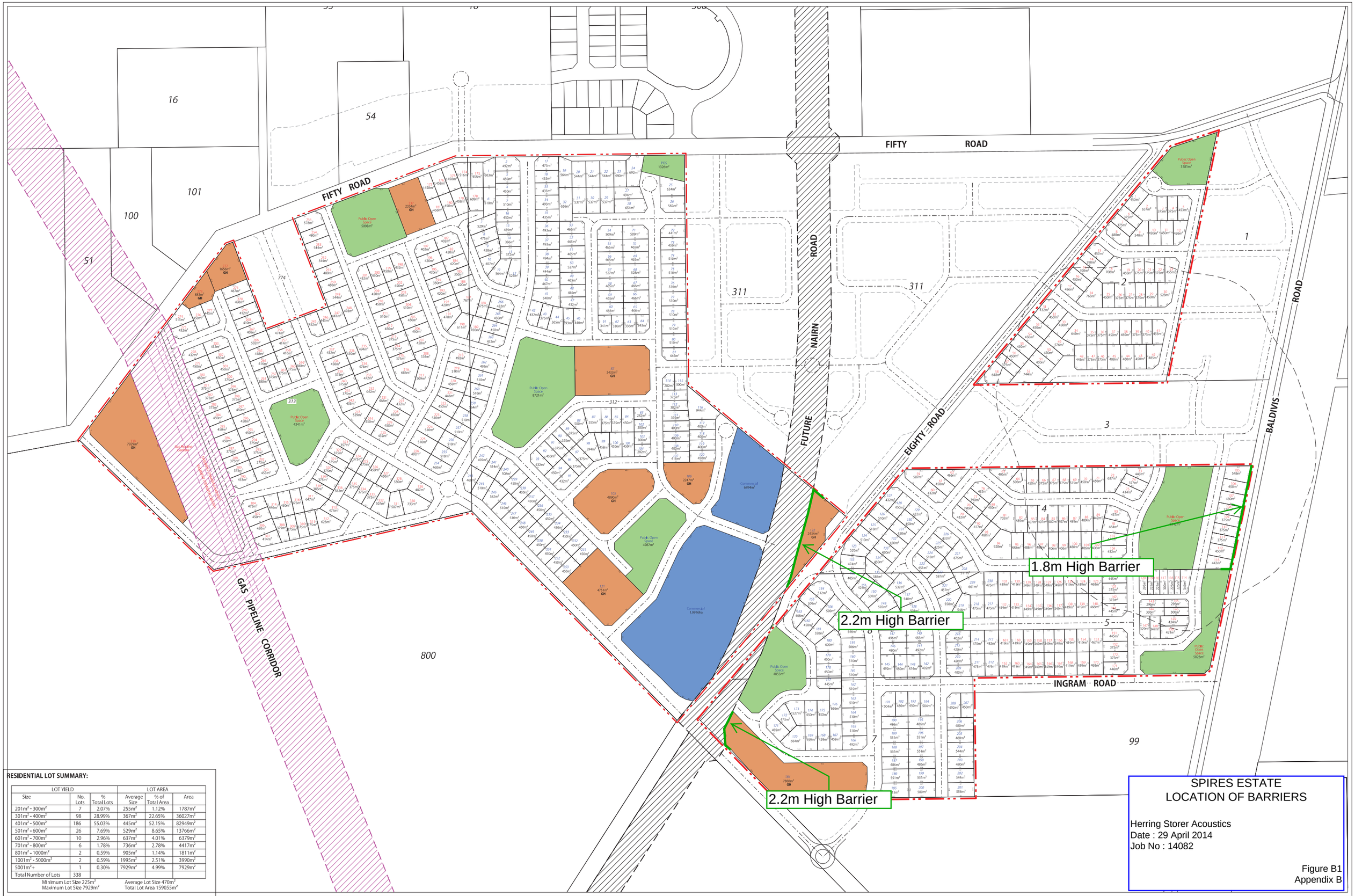
APPENDIX B

EXTENT OF FENCING



RESIDENTIAL LOT SUMMARY:

LOT YIELD			LOT AREA		
Size	No. Lots	% Total Lots	Average Size	% of Total Area	Area
201m² - 300m²	7	2.07%	255m²	1.12%	1787m²
301m² - 400m²	98	28.99%	367m²	22.65%	36027m²
401m² - 500m²	186	55.03%	445m²	52.15%	82949m²
501m² - 600m²	26	7.69%	529m²	8.65%	13766m²
601m² - 700m²	10	2.96%	637m²	4.01%	6379m²
701m² - 800m²	6	1.78%	736m²	2.78%	4417m²
801m² - 1000m²	2	0.59%	905m²	1.14%	1811m²
1001m² - 5000m²	2	0.59%	1995m²	2.51%	3990m²
5001m²+	1	0.30%	7929m²	4.99%	7929m²
Total Number of Lots	338				

Minimum Lot Size 225m² Average Lot Size 470m²
Maximum Lot Size 7929m² Total Lot Area 159055m²

SPIRES ESTATE
LOCATION OF BARRIERS

Herring Storer Acoustics
Date : 29 April 2014
Job No : 14082

Figure B1
Appendix B

CONCEPT LAYOUT PLAN

Spires Estate, Fifty and Eighty Road, BALDIVIS

for: Spatial Property Group

SPATIAL Property Group™

LEGEND:

- Spires Estate Local Structure Plan Boundary
- Buffer to Egg Farm
- Gas Pipeline Corridor
- Future Road Widening
- Surrounding Cell Layout
- Public Open Space
- Commercial

NOTES:

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NORTH

Scale 1: 2000 @ A1

0 20 40 60 80 100 metres

COMPILED: DPS		DRAWN BY:	RF
DATE:	13/01/2014	REVISED:	
GRID:	MGA 50	DATUM:	AHD
DRAWING NUMBER:	CARBD-1-016	JOBCODE:	CARBDLSP
FILE ID:	M:\CARBD\BASE\FEASIBILITY & CONCEPT\CARBD-1-016 STG1.DGN		

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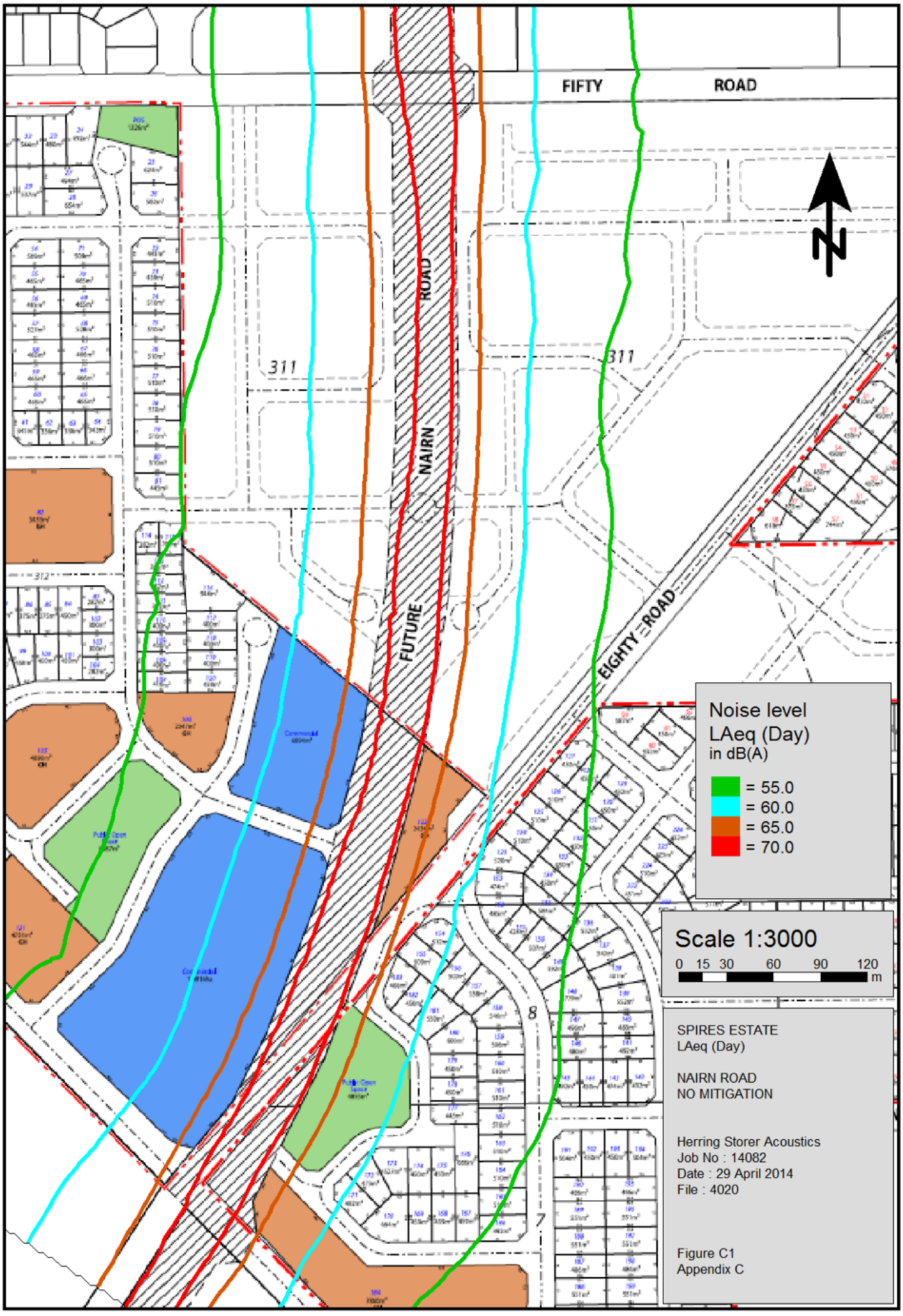
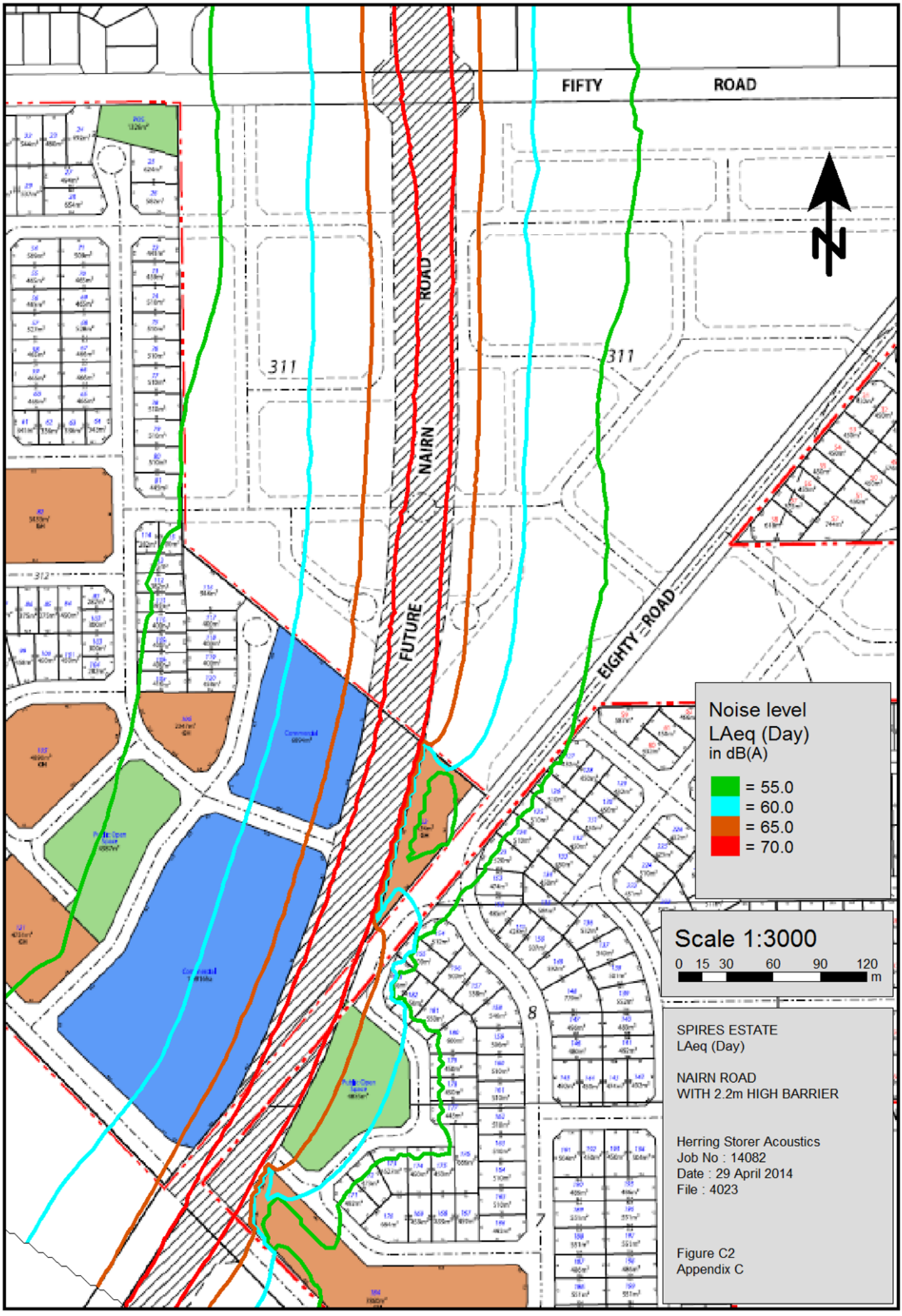
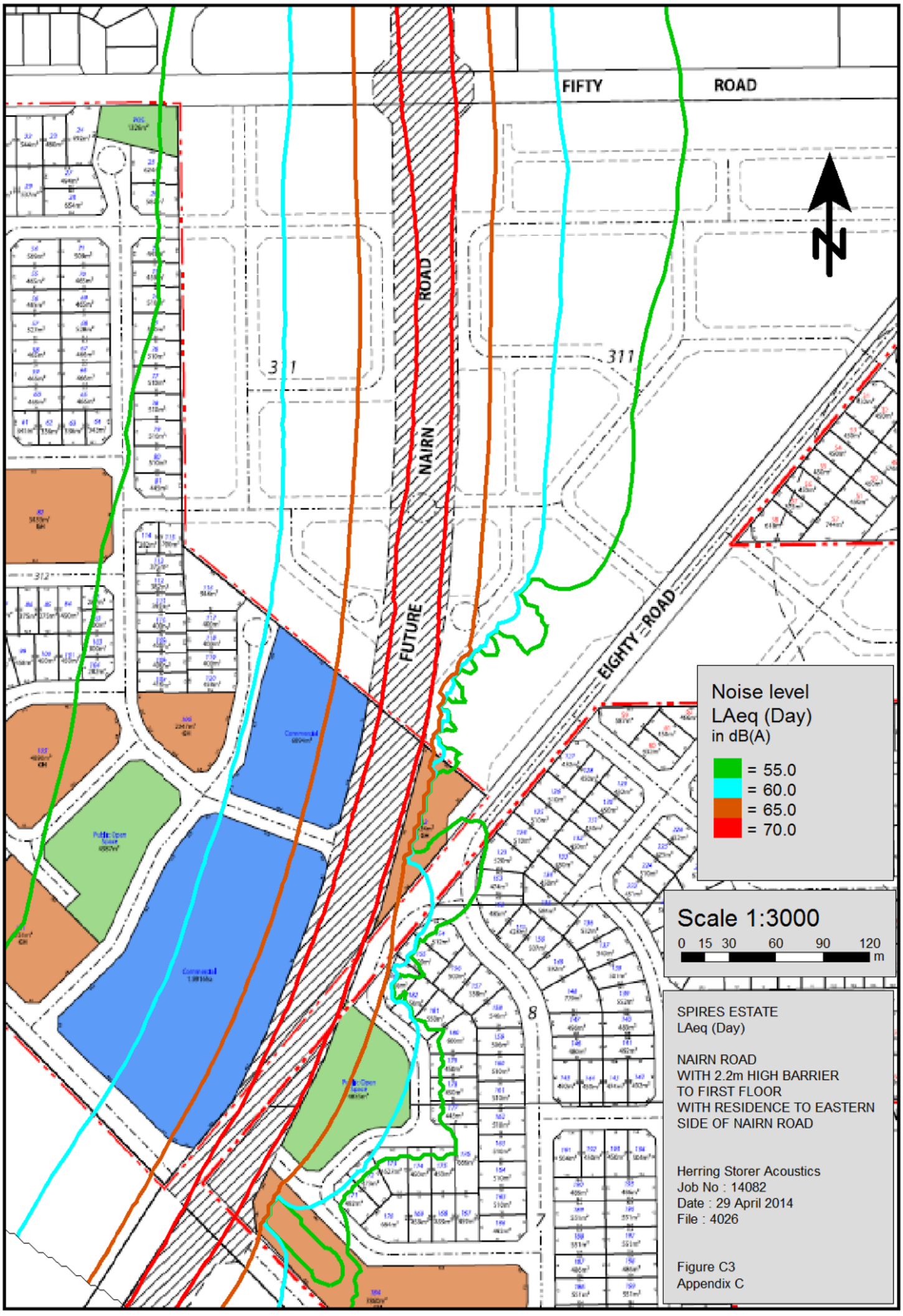
APPENDIX C

FIGURES C1 TO C3
$L_{Aeq(16hr)}$ NOISE CONTOURS FOR NAIRN ROAD

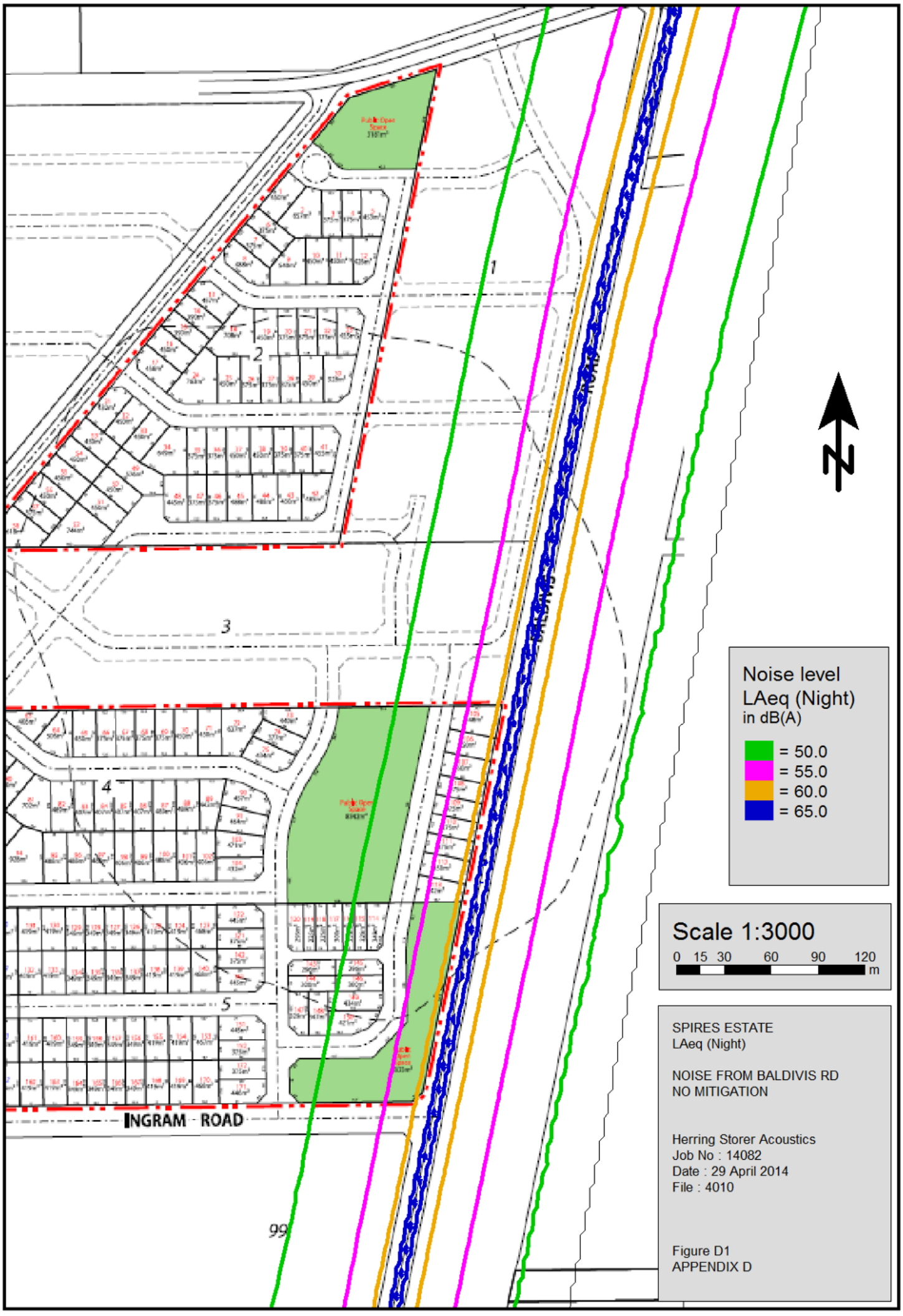

FIFTY ROAD
NAIRN ROAD
FUTURE
EIGHTY ROAD
311
312
N
Noise level
LAeq (Day)
in dB(A)
= 55.0
= 60.0
= 65.0
= 70.0
Scale 1:3000
0 15 30 60 90 120
m
SPIRES ESTATE
LAeq (Day)
NAIRN ROAD
NO MITIGATION
Herring Storer Acoustics
Job No : 14082
Date : 29 April 2014
File : 4020
Figure C1
Appendix C


FIFTY ROAD
NAIRN ROAD
FUTURE
EIGHTY ROAD
311
312
N
Noise level
LAeq (Day)
in dB(A)
= 55.0
= 60.0
= 65.0
= 70.0
Scale 1:3000
0 15 30 60 90 120
m
SPIRES ESTATE
LAeq (Day)
NAIRN ROAD
WITH 2.2m HIGH BARRIER
Herring Storer Acoustics
Job No : 14082
Date : 29 April 2014
File : 4023
Figure C2
Appendix C


FIFTY ROAD
NAIRN ROAD
FUTURE
EIGHTY ROAD
311
312
N
Noise level
LAeq (Day)
in dB(A)
= 55.0
= 60.0
= 65.0
= 70.0
Scale 1:3000
0 15 30 60 90 120
m
SPIRES ESTATE
LAeq (Day)
NAIRN ROAD
WITH 2.2m HIGH BARRIER
TO FIRST FLOOR
WITH RESIDENCE TO EASTERN
SIDE OF NAIRN ROAD
Herring Storer Acoustics
Job No : 14082
Date : 29 April 2014
File : 4026
Figure C3
Appendix C

APPENDIX D

FIGURES D1 TO D3
$L_{Aeq(8hr)}$ NOISE CONTOURS FOR BALDIVIS ROAD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in dB(A)
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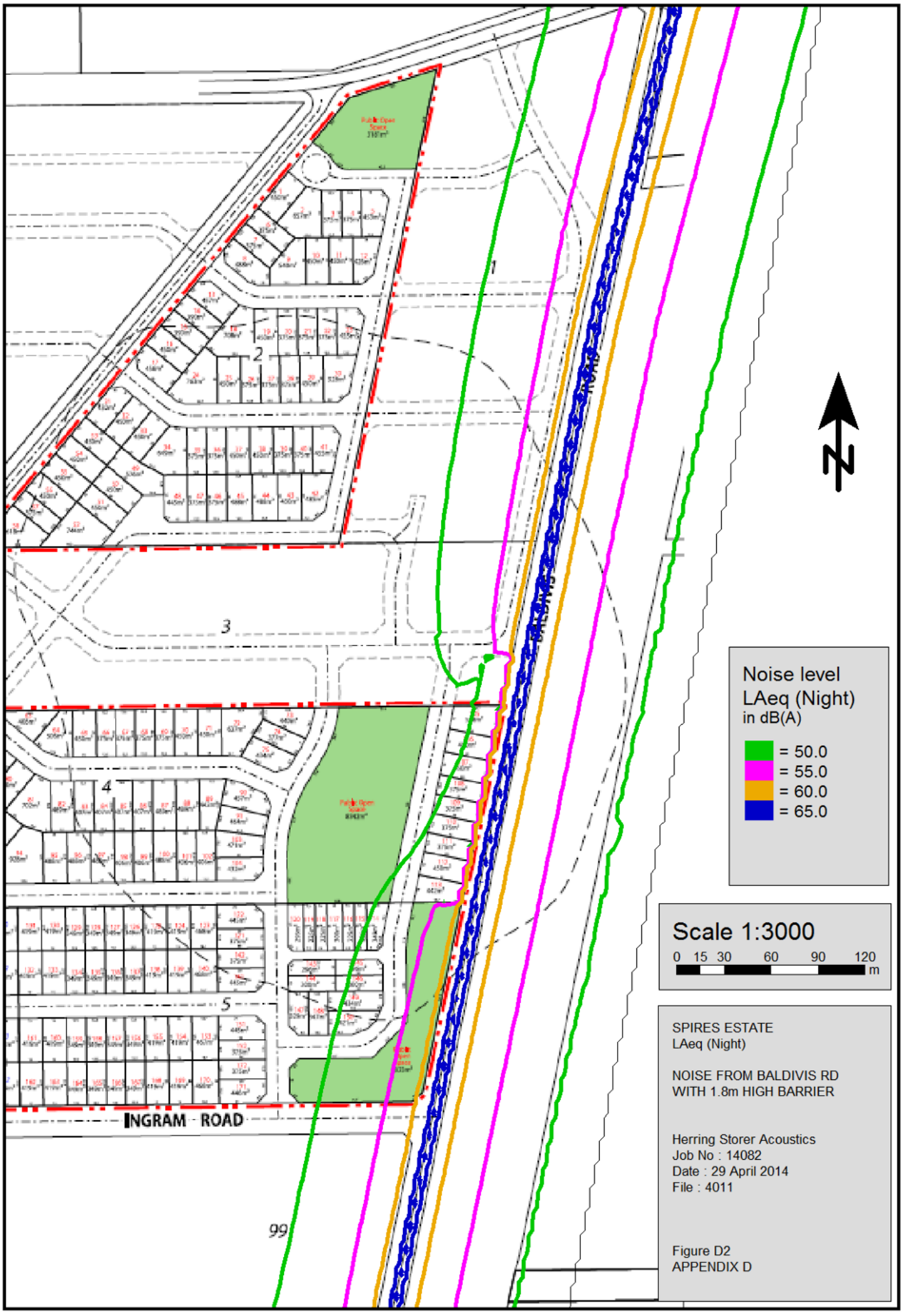
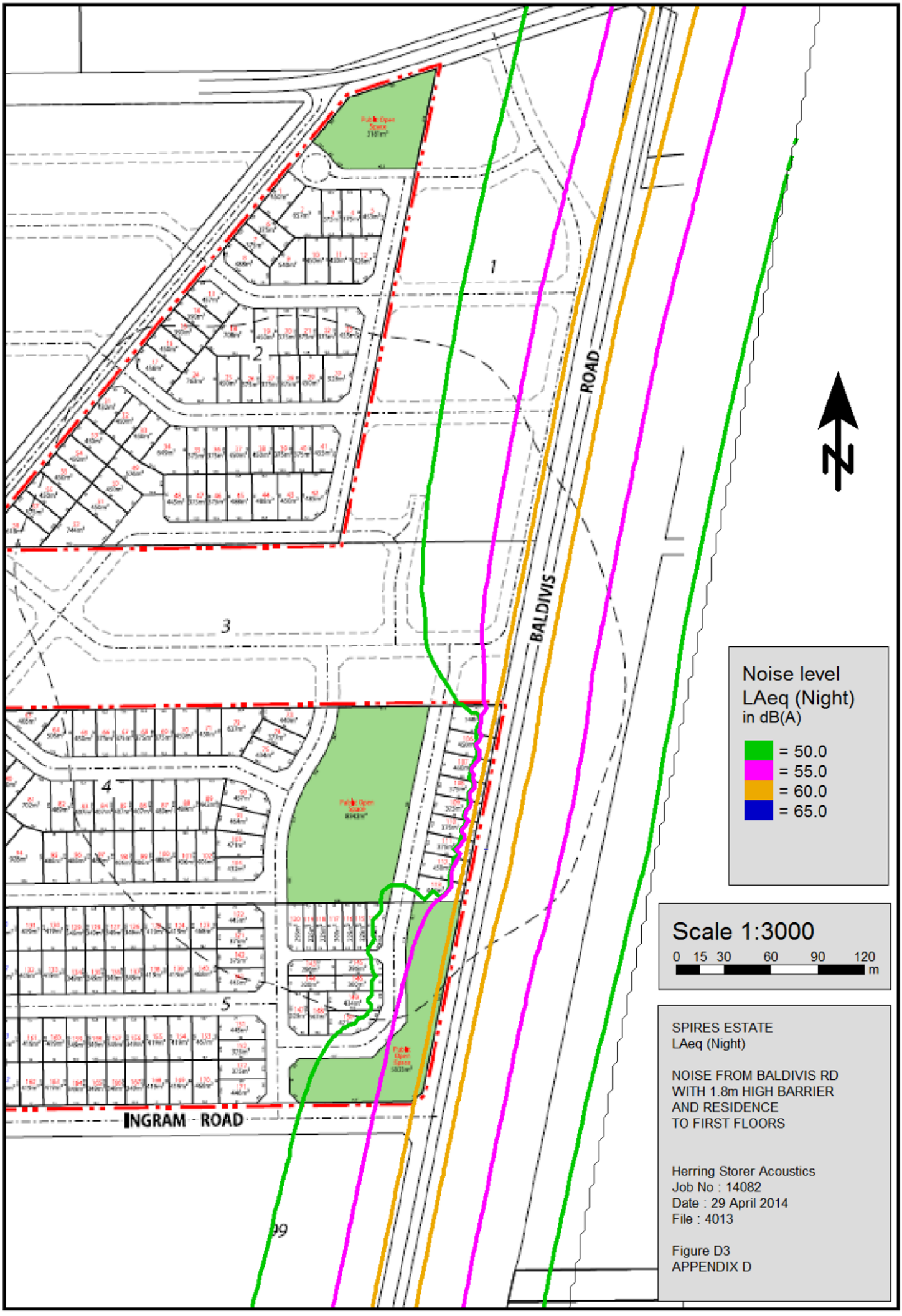
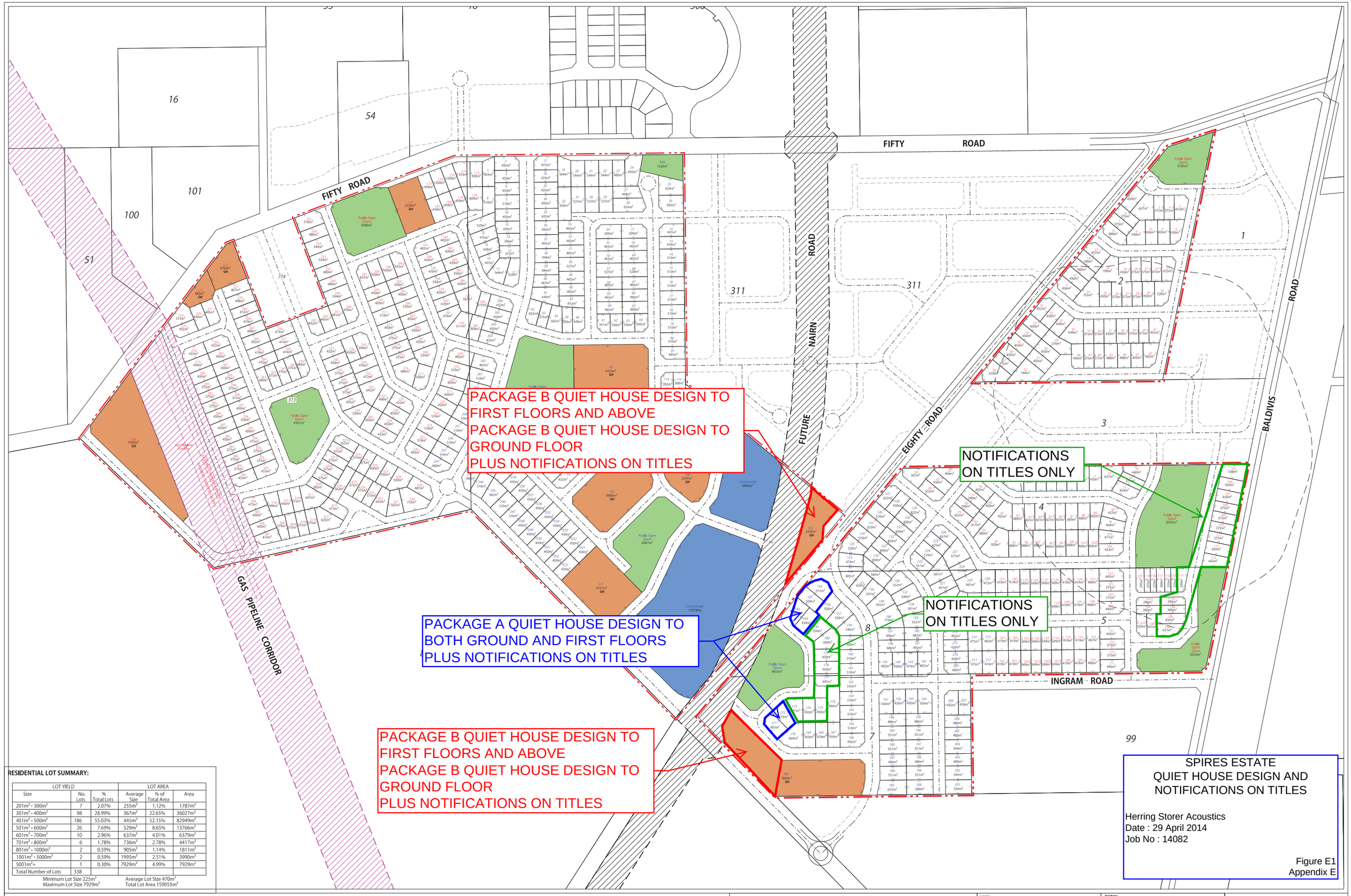
= 55.0
= 60.0
= 65.0
Scale 1:3000
0 15 30 60 90 120
m
SPIRES ESTATE
LAeq (Night)
NOISE FROM BALDIVIS RD
NO MITIGATION
Herring Storer Acoustics
Job No : 14082
Date : 29 April 2014
File : 4010
Figure D1
APPENDIX D
INGRAM ROAD
BALDIVIS ROAD
1
2
3
4
5
99


Noise level
LAeq (Night)
in dB(A)
= 50.0
= 55.0
= 60.0
= 65.0
Scale 1:3000
0 15 30 60 90 120
m
SPIRES ESTATE
LAeq (Night)
NOISE FROM BALDIVIS RD
WITH 1.8m HIGH BARRIER
Herring Storer Acoustics
Job No : 14082
Date : 29 April 2014
File : 4011
Figure D2
APPENDIX D
INGRAM ROAD
BALDIVIS RD
1
2
3
4
5
99


BALDIVIS ROAD
INGRAM ROAD
1
2
3
4
5
N
Noise level
LAeq (Night)
in dB(A)
= 50.0
= 55.0
= 60.0
= 65.0
Scale 1:3000
0 15 30 60 90 120
m
SPIRES ESTATE
LAeq (Night)
NOISE FROM BALDIVIS RD
WITH 1.8m HIGH BARRIER
AND RESIDENCE
TO FIRST FLOORS
Herring Storer Acoustics
Job No : 14082
Date : 29 April 2014
File : 4013
Figure D3
APPENDIX D

APPENDIX E

FIGURE E1 LOTS REQUIRING “QUIET HOUSE” DESIGN AND NOTIFICATIONS
“QUIET HOUSE” DESIGN – GENERAL INFORMATION



RESIDENTIAL LOT SUMMARY:

LOT YIELD			LOT AREA		
Size	No. Lots	% Total Lots	Average Size	% of Total Area	Area
201m² - 300m²	7	2.07%	255m²	1.12%	1787m²
301m² - 400m²	98	28.99%	367m²	22.65%	36027m²
401m² - 500m²	186	55.03%	445m²	52.15%	82949m²
501m² - 600m²	26	7.69%	529m²	8.65%	13766m²
601m² - 700m²	10	2.96%	637m²	4.01%	6379m²
701m² - 800m²	6	1.78%	736m²	2.78%	4417m²
801m² - 1000m²	2	0.59%	905m²	1.14%	1811m²
1001m² - 5000m²	2	0.59%	1995m²	2.51%	3990m²
5001m²+	1	0.30%	7929m²	4.99%	7929m²
Total Number of Lots	338				

Minimum Lot Size 225m² Average Lot Size 470m²
Maximum Lot Size 7929m² Total Lot Area 159055m²

SPIRES ESTATE
QUIET HOUSE DESIGN AND NOTIFICATIONS ON TITLES

Herring Storer Acoustics
Date : 29 April 2014
Job No : 14082

Figure E1
Appendix E

CONCEPT LAYOUT PLAN

Spires Estate, Fifty and Eighty Road, BALDIVIS

for: Spatial Property Group

SPATIAL Property Group™

LEGEND:

- Spires Estate Local Structure Plan Boundary
- Buffer to Egg Farm
- Gas Pipeline Corridor
- Future Road Widening
- Surrounding Cell Layout
- Public Open Space
- Commercial

NOTES:

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NORTH

Scale 1: 2000 @ A1

0 20 40 60 80 100 metres

COMPILED: DPS		DRAWN BY:	RF
DATE:	13/01/2014	REVISED:	
GRID:	MGA 50	DATUM:	AHD
DRAWING NUMBER:	CARBD-1-016	JOBCODE:	CARBDLSP
FILE ID:	M:\CARBD\BASE\FEASIBILITY & CONCEPT\CARBD-1-016 STG1.DGN		

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www.dpsplanning.com.au

QUIET HOUSE DESIGN PACKAGES

AREA TYPE	ORIENTATION	PACKAGE A	PACKAGE B
Bedrooms	Facing Road	Casement or awning windows with 6.38mm laminated glass Eaves enclosed with 6mm compressed fibre cement board Hinged doors only, fitted with acoustic seals No vents to outside walls/eaves	Casement or awning windows with 10.38mm or 6.5mm laminated glass Eaves enclosed with 6mm compressed fibre cement board No external doors No vents to outside walls/eaves
	Side-on to Road	Casement or awning windows with 6.38mm laminated glass Eaves enclosed with 6mm compressed fibre cement board No vents to outside walls/eaves	Casement or awning windows with 6.38mm laminated glass Eaves enclosed with 6mm compressed fibre cement board No vents to outside walls/eaves
	Away from Road	No Requirements	No Requirements
Living and Work Areas	Facing Road	Casement or awning windows with 6.38mm laminated glass Eaves enclosed with 6mm compressed fibre cement board 35mm (min) solid core external doors with acoustic seals Sliding doors to be fitted with acoustic seals and have overlapping meeting stiles No vents to outside walls/eaves	Casement or awning windows with 10.38mm or 6.5mm laminated glass Eaves enclosed with 6mm compressed fibre cement board No vents to outside walls/eaves Sliding doors to be fitted with acoustic seals and have overlapping meeting stiles Front door to be 40mm solid core with acoustic seals
	Side-on to Road	Casement or awning windows with 6mm glass Eaves enclosed with 6mm compressed fibre cement board	Casement or awning windows with 6.38mm laminated glass Eaves enclosed with 6mm compressed fibre cement board
	Away from Road	No Requirements	No Requirements
Other indoor areas	Any orientation	No Requirement	No Requirements

LOCAL STRUCTURE PLAN AMENDMENT

LOT 774 (NO. 125) FIFTY ROAD, BALDIVIS

V. 3 AUGUST 2014

CITY OF ROCKINGHAM

Addendum 1. Amendment No. 1: Inclusion of Lot 774 Fifty Road, Baldivis, into the Structure Plan Area - (Burgess Design Group)

PREPARED BY:

burgess design group
TOWN PLANNING + URBAN DESIGN

Lot 774 (No.125) Fifty Road, Baldivis

City of Rockingham

Spires Estate Structure Plan Amendment
Report on Minor Modification to Include Lot 774 Fifty Road

Issue 3: August 2014

Prepared for: **Niroda Holdings Pty Ltd**

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Project Planner: Mitchell Bisby
Job code: CAS BAL
File reference: 140806RLGA_Structure Plan Amendment Report (v3).docx
Revision No: 2

Quality Assurance

Issue/Version:	Date:	Author:	Reviewer:
Issue 1	1 April 2014	Mitch Bisby	J Drummond / J Burgess
Issue 2	23 June 2014	Mitch Bisby	Jaclyn Drummond
Issue 3	06 August 2014	Jaclyn Drummond	Tristan Fernandes (CoR)

EXECUTIVE SUMMARY

This Structure Plan Amendment proposes the inclusion of Lot 774 Fifty Road, Baldivis into the Spires Estate Local Structure Plan (SESP). Lot 774 Fifty Road (the subject land) has an area of 9,204m^2, is zoned 'Urban' under the MRS, zoned 'Development' under the City of Rockingham Town Planning Scheme No.2 (TPS2) and is contained within the Baldivis North District Structure Plan (DSP). Lot 774 abuts the Spires Estate Structure Plan (SESP), to which the amendment is being sought, on its eastern, southern, and western boundaries.

The SESP was adopted by the City of Rockingham on 17 June 2013, and approved by the Western Australian Planning Commission on 11 March 2014, subject to modifications.

In accordance with clause 4.2.9.1 of the Scheme, this Structure Plan Amendment shall come into operation when it is adopted by Council pursuant to clause 4.2.6.15.

A summary of all key statistics and planning outcomes of the Structure Plan Amendment area is provided in Table 2 below.

Table 2 – Land Use Summary

Item	Data	Section number references within the structure plan report
Gross Structure Plan Amendment area:	0.9204 hectares	1.2.2
Area of each land use proposed: - Residential	0.7112 hectares	3.3
Estimated Lot Yield:	18 lots	3.3
Estimated number of dwellings:	20 dwellings	3.3
Estimated residential site density	28 dwellings per site hectare	3.3
Estimated population:	52 people @2.6 persons / household	3.3

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Table 4	Lot Yield Summary
Table 5	Public Open Space Schedule

ABBREVIATIONS

DSP	Baldivis (North) District Structure Plan
SESP	Spires Estate Structure Plan
Subject land	Lot 774 Fifty Road, Baldivis
The Scheme	City of Rockingham Town Planning Scheme No.2
WAPC	Western Australian Planning Commission

1. PLANNING BACKGROUND

1.1 INTRODUCTION AND PURPOSE

Burgess Design Group has been engaged by Niroda Holdings Pty Ltd, acting on behalf of the registered landowners, to prepare an amendment to the Spires Estate Structure Plan (SESP) for the inclusion of Lot 774 Fifty Road, Baldivis (the subject site).

This Structure Plan Amendment report considers the issues, opportunities, and constraints as they relate to the subject site, and has been undertaken by a multidisciplinary team comprising:

- Burgess Design Group – Town Planning, Urban Design, and Bushfire Management;
- 360 Environmental – Environmental Assessment;
- Tabec - Servicing; and,
- Tarsc - Transport

The proposed inclusion of Lot 774 within the SESP will ensure that subdivision and subsequent development occurs in an integrated and logical manner.

It should be noted that the modifications proposed herein relate only to Lot 774. The remainder of the land that comprises the SESP is unchanged.

1.2 LAND DESCRIPTION

1.2.1 Location

The subject site is located approximately 8 kilometres south east of the Rockingham town centre, 40km south of the Perth CBD, and is within the municipal boundary of the City of Rockingham (refer **Figure 1**).

1.2.2 Area and Land Use

The subject site is 9,204m^2 in size, and accommodates a residence with an associated shed and some remnant vegetation, as is evident in the Aerial Photograph (refer **Figure 2**).

1.2.3 Legal Description and Ownership

125 (Lot 774) Fifty Road, Baldivis is legally described as:

- Lot 774 on Deposited Plan 202704, Volume 1813, and Folio 718.

The site is currently owned by Geoffrey and Rosslyn Uren, although is under contract of sale to our client, Niroda Holdings Pty Ltd.

Refer **Appendix 1** for a copy of the Certificate of Title.

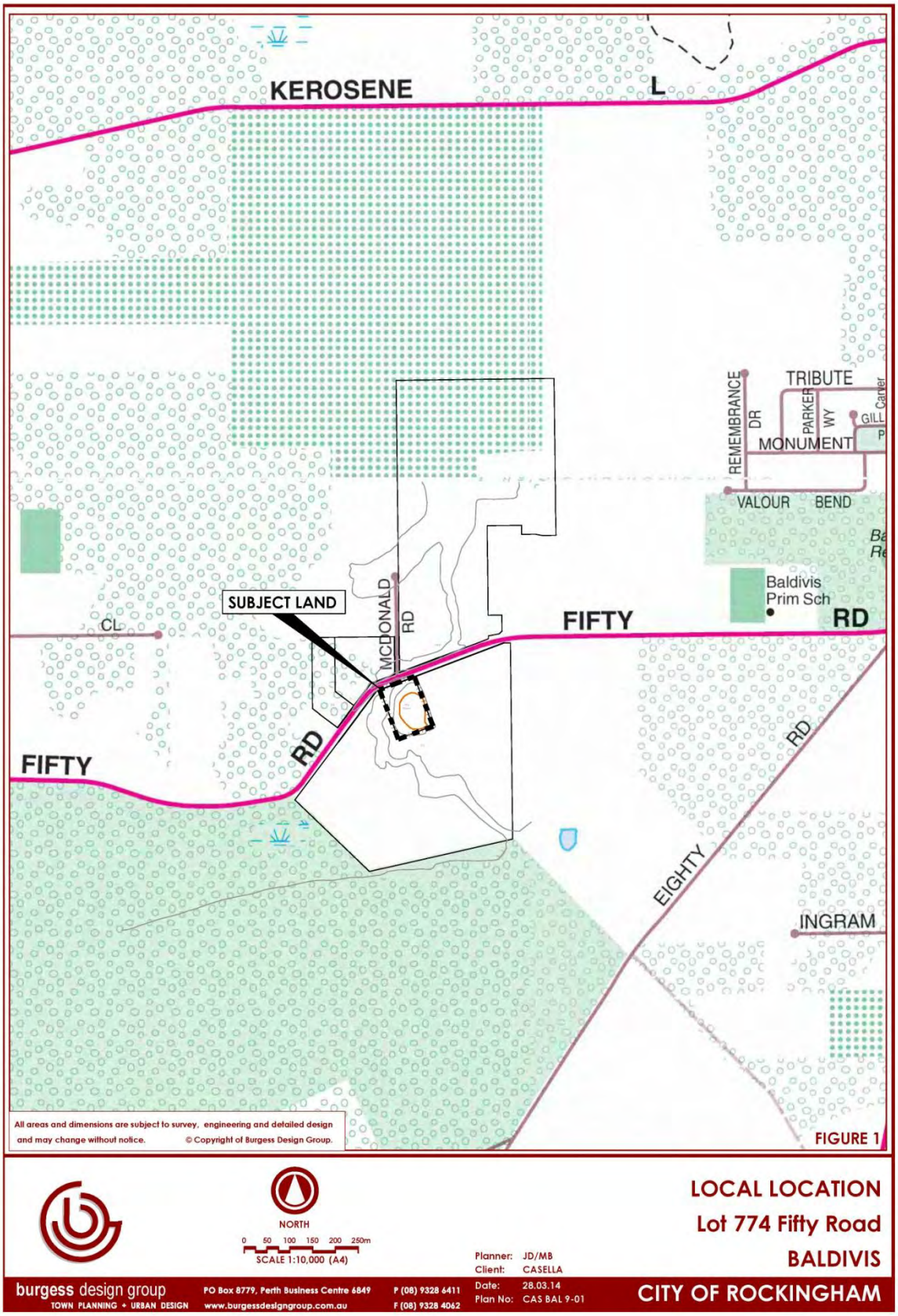


FIGURE 1 | LOCATION PLAN

FIGURE 2 | AERIAL PHOTOGRAPH

2. PLANNING FRAMEWORK

2.1 ZONING AND RESERVATIONS

The Subject site is currently zoned 'Urban' under the MRS and 'Development' under the City of Rockingham Town Planning Scheme No.2 (TPS2) (Refer **Figures 4 and 5**).

Pursuant to Clause 4.2.3 of TPS2, the 'Development' zone aims to:

(a) Identify areas requiring comprehensive planning prior to subdivision and development; and,
(b) Coordinate subdivision, land use and development of those areas requiring comprehensive planning.

The subject site is designated 'Development Area 9', and pursuant to Schedule No.9 of TPS2, requires "*an approved Structure Plan… to guide subdivision and development*."

The City requires that a Structure Plan be prepared for a Development Area prior to subdivision or development of land. The Structure Plan is required to identify key opportunities and constraints to development; outline how future development is to be integrated into the surrounding area; arrange major land uses; coordinate the provision of major services; outline the road network; and define the staging of subdivision and development.

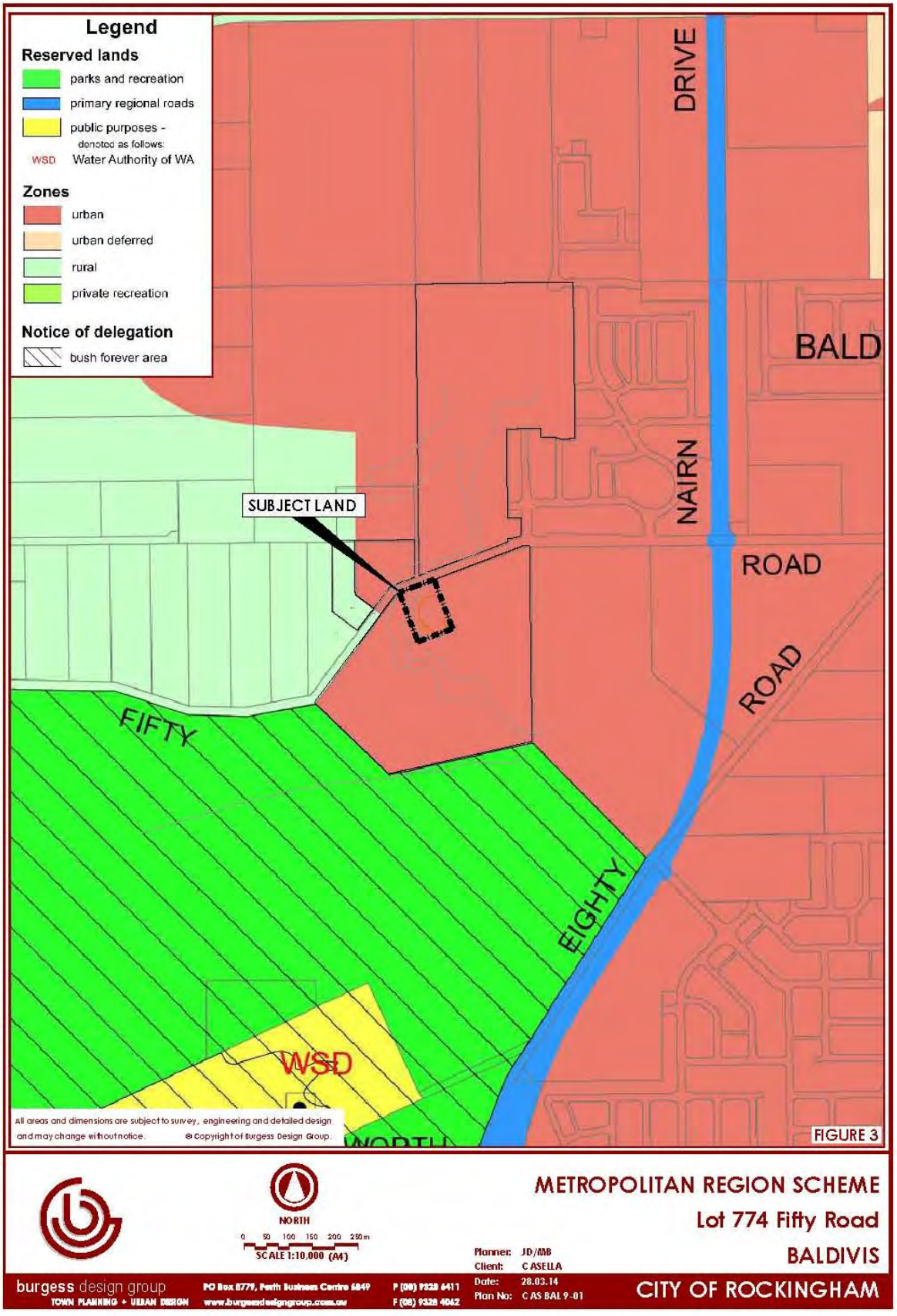


FIGURE 3 | **MRS ZONING**

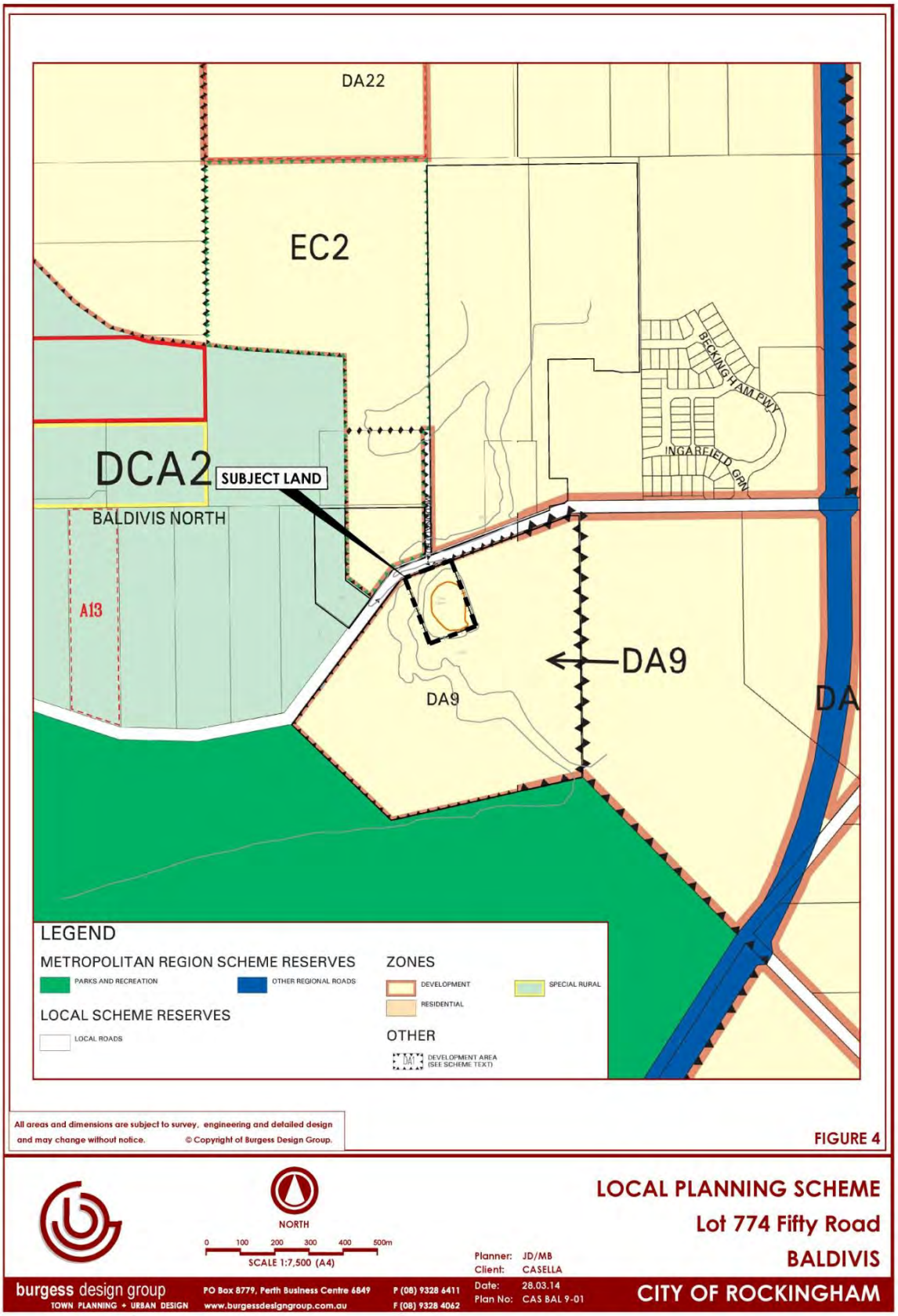


FIGURE 4 | **LOCAL PLANNING SCHEME ZONING**

2.2 PLANNING STRATEGIES AND POLICIES

The planning context comprising statutory and strategic framework and policy considerations described within the Spires Estate Structure Plan (Sections 2.1.3 and 2.2) are equally applicable to this Amendment.

2.3 STRUCTURE PLANNING

2.3.1 Baldivis (North) District Structure Plan

The City of Rockingham commissioned the preparation of the Baldivis (North) District Structure Plan (DSP) as a means of providing the necessary framework and objectives to achieve a coordinated development outcome among the fragmented land holdings in the Baldivis area.

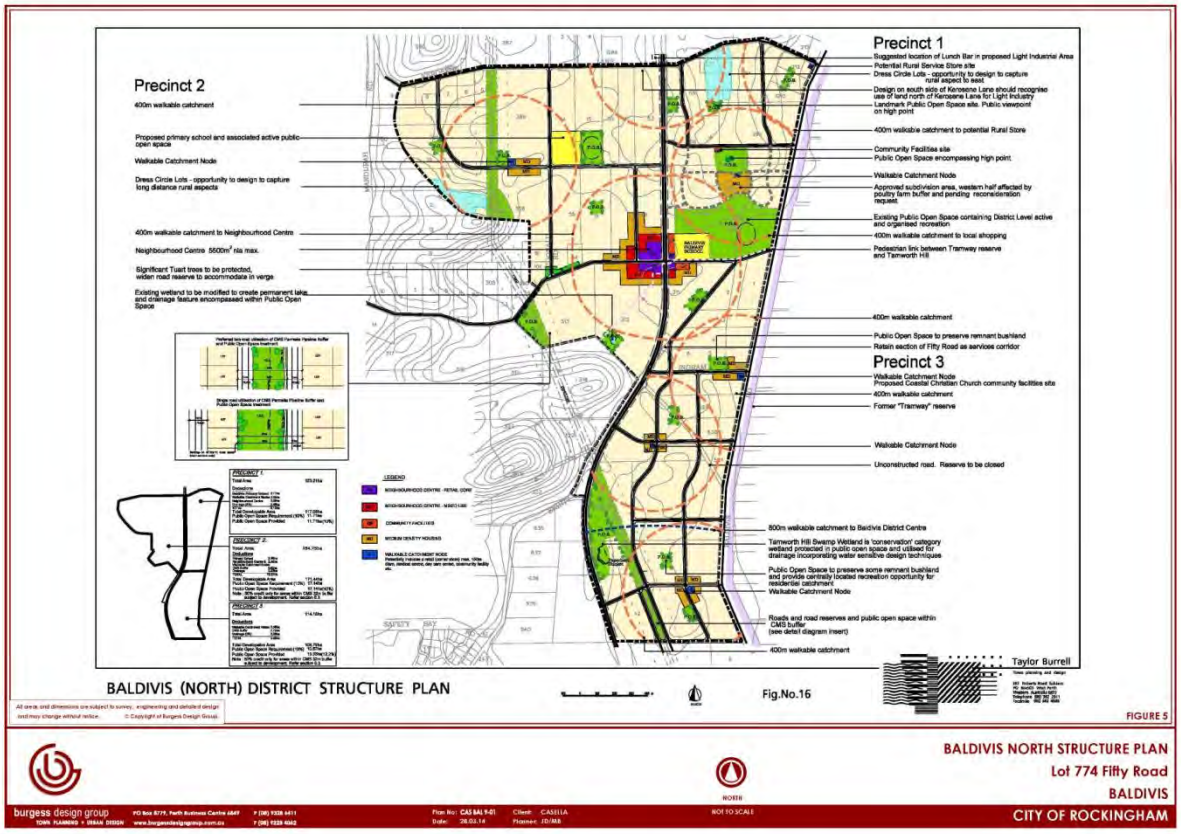
The DSP area comprises all 'Urban' and 'Urban Deferred' zoned land within Kerosene Lane, Baldivis Road, Safety Bay Road and Mandurah Road, and has been divided into three precincts to assist in the application of infrastructure cost sharing arrangements. The subject site falls within Precinct 2, which contains residential uses at a range of densities, commercial uses, a primary school, and public open space.

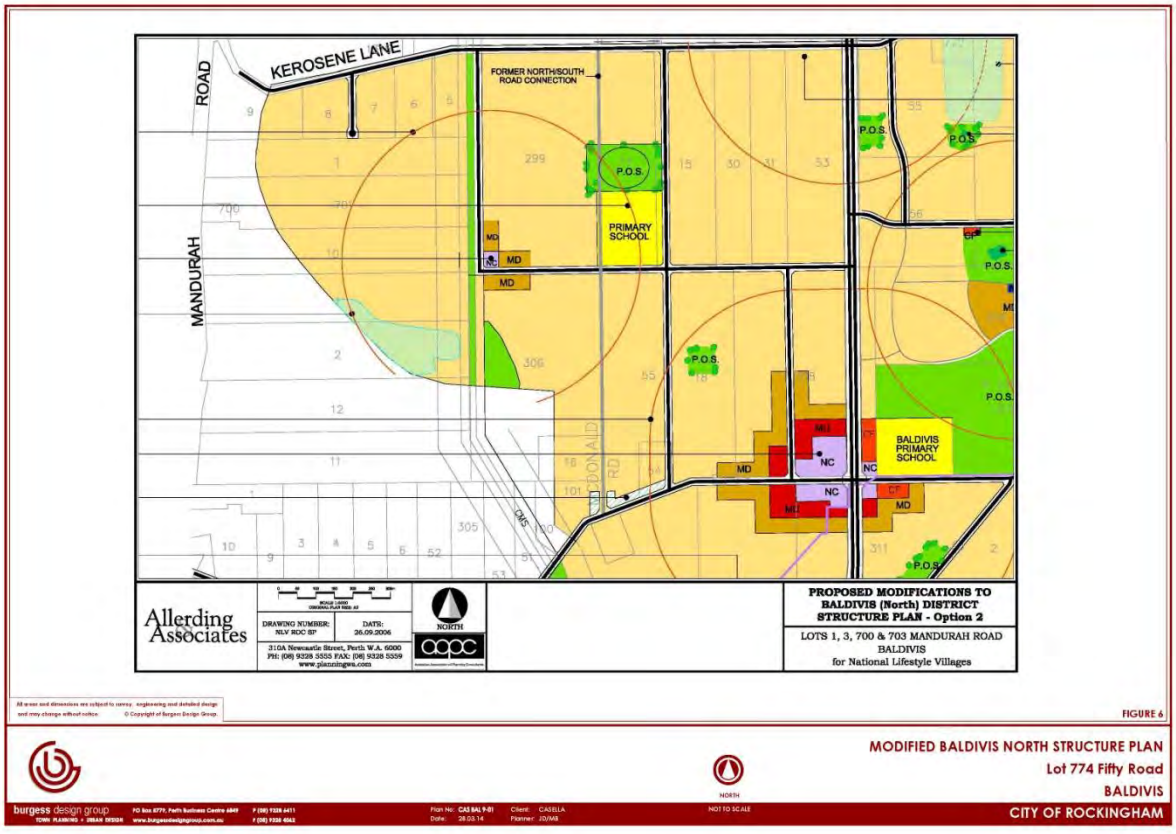
This minor amendment to the SESP is in accordance with the principles outlined within the DSP.

2.3.2 Spires Estate Structure Plan

The Spires Estate Structure Plan (SESP), to which this document seeks to amend, provides for the development of approximately 54.47 hectares of land between Fifty Road, Eighty Road, and Baldivis Road. The zonings and reservations proposed within the SESP facilitate a range of land uses including public open space, commercial activities, residential, and gas pipeline reserve (refer **Figure 6**).

As stated above, the inclusion of Lot 774 within the SESP will facilitate a coordinated approach to development by controlling and integrating land uses according to a wider local and regional context. The overall uses proposed within this amendment are consistent with those as originally outlined within the DSP, and are compatible with the surrounding uses prescribed by the SESP. In support of the amendment to the SESP, technical notes have been provided to ensure that all aspects of the development are considered and integration of the parcels is seamless.





FIGURES 5 | BALDIVIS NORTH DISTRICT STRUCTURE PLAN

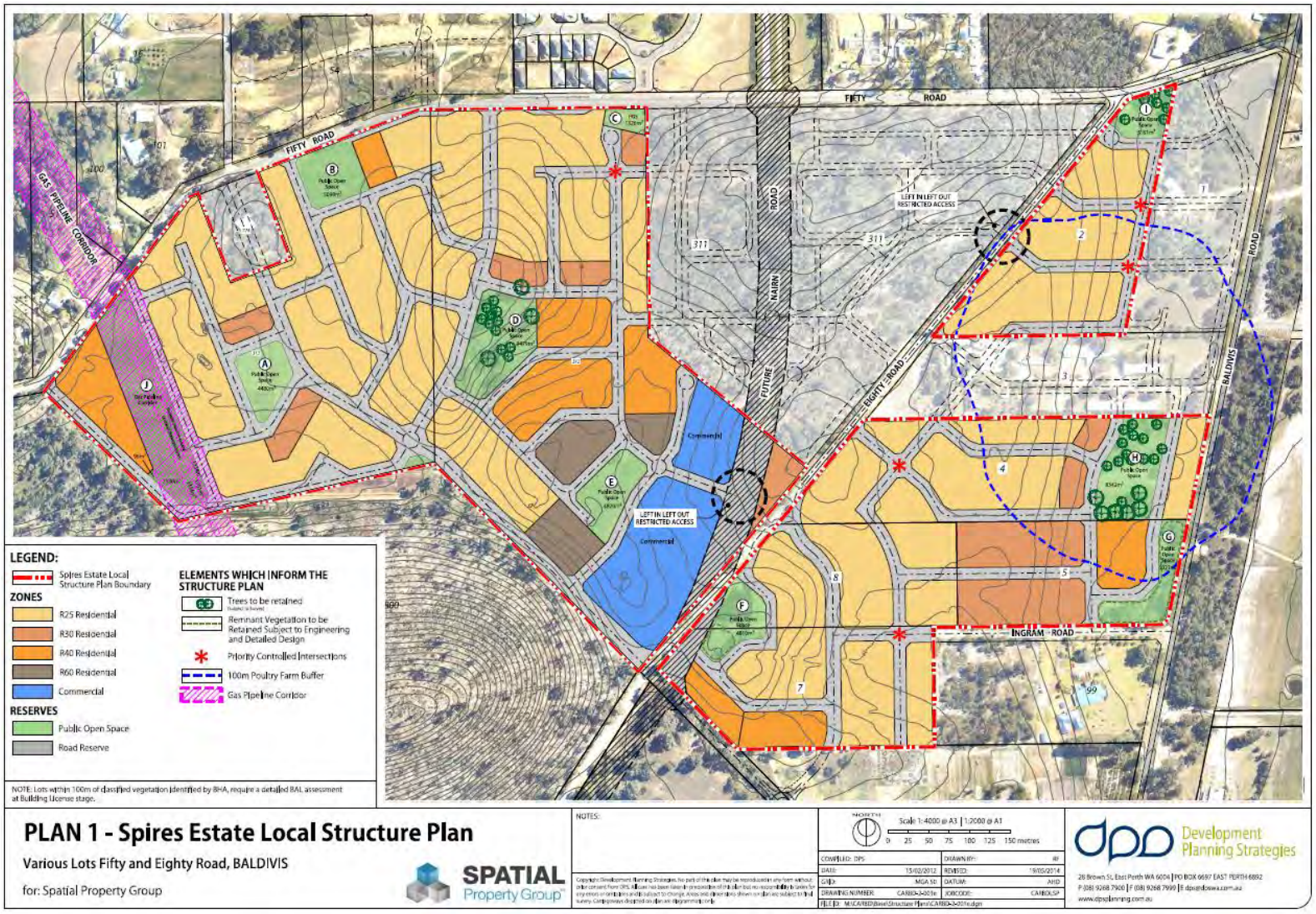


FIGURE 6 | **PROPOSED SPIRES ESTATE STRUCTURE PLAN**

3. SITE CONDITIONS AND CONSTRAINTS

Based on a review of the planning context outlined under the draft SESP, the issues and opportunities that impact on the development of the site are noted on the plan attached **(Figure 7)** and described below.

3.1 BIODIVERSITY AND NATURAL AREA ASSETS

360 Environmental has undertaken a desktop investigation, site significant tree survey and literature review of Lot 774 to understand the environmental values and attributes of the site. The information can be found in **Appendix 2** and has been summarised below.

Vegetation

Vegetation on the site is mapped as *"representative of the Cottesloe Complex (Central and South)"*. This complex exceeds the State Government's vegetation retention target of 10%, with 50% of its original pre-European extent remaining within the City of Rockingham.

It should be noted that, notwithstanding the 19 larger remnant trees present on site (refer **Figure 7**), the understory and remaining vegetation consists of exotic garden species. Resultantly, it is unlikely that any flora or communities of conservation significance are present within the site.

Fauna Habitat

A Black Cockatoo assessment and survey undertaken by 360 Environmental in November 2013 found that (refer Attachment B of **Appendix 2**):

- The site contains suitable foraging habitat in the form of remnant Tuart Trees;
- No evidence of Black Cockatoo feeding was observed;
- A total of 0.88ha of potential foraging habitat was identified; and,
- A total of 19 Tuart trees that have the potential to be used for breeding were recorded.

The assessment concludes:

> *"As a result, the proponent will consider the requirements to refer the project to the DotE for potential significant impacts to the Black Cockatoos under the Environmental Protection and Biodiversity Conservation (EPBC)* Act 1999*. It should be noted that this process is separate to the LSP assessment process and should not prevent the consideration of the LSP and accompanying technical information."*

In accordance with the *EPBC* Act 1999, the decision to refer proposals to the DotE will be made at later development stages. Due to the size of the site, its locational context and that surrounding future development areas have been primarily cleared, retention of vegetation is likely to be limited.

3.2 LANDFORM AND SOILS

The Environmental Assessment completed by 360 Environmental confirmed that the subject land is relatively flat, and varies between 8 and 10 metres Australian Height Datum (mAHD). The site features Spearwood Sands, described as pale yellowish brown and medium to coarse grained, which is suitable for infiltration.

Further, the site is identified/ mapped as having no known risk of Acid Sulfate Soils occurring within 3m of natural soil surface.

3.3 GROUNDWATER AND SURFACE WATER

The Environmental Assessment completed by 360 Environmental states that the depth to groundwater is approximately 7 to 9 metres below ground level. This depth is considered sufficient to allow development to occur without the need for additional fill.

The site does not feature any significant natural surface water bodies, is not located within a floodplain, and does not occur within a Public Drinking Water Source Area.

The surrounding SESP area has an existing approved Local Water Management Strategy which considers Lot 774 in its calculations. Stormwater Management will be in line with the approved Spires Estate LWMS strategy (refer **Appendix 2).**

3.4 BUSHFIRE HAZARD

A bushfire hazard assessment has been carried out for the subject site in accordance with Methodology 1 within Appendix 1 of the WAPC Planning for Bush Fire Protection Guidelines (edition 2, 2010). The hazard assessment has been carried out to:

a) determine the site suitability for subdivision /development at the strategic level only;

b) identify whether the subject land shall be designated as subject, or likely to be subject, to bush fires; *and*

c) assess whether any future subdivision/development will require an increase of building construction standards in accordance with AS-3959.

Classification of vegetation within nearby and surrounding landholdings (minimum 100m distance) of the subject land has been carried out. It has been determined that cumulative vegetation within Lots 90, 100 and 118 Fifty Road, to the north west of the subject land, contains vegetation types that pose a moderate to extreme bush fire risk. Existing vegetation within Lot 313, directly abutting the site to the west, has also been identified as posing a moderate to extreme bush fire risk.

As such, the land subject to this Amendment is identified as "*being subject, or likely to be subject, to bush fires*" and is considered a bush-fire prone area.

Under the WAPC Planning for Bush Fire Guidelines, every building is to be sited a minimum distance of 100m from any vegetation classified as posing a moderate or extreme risk. By deeming the subject land as being a 'bush-fire prone area', it enables the implementation of AS-3959-2009. AS-3959-2009 is primarily concerned with improving the ability of buildings to better withstand attack from bush fire. Under AS-3959-2009, the minimum 100m hazard

separation area may be reduced provided the building construction standard is increased to align with the appropriate bush fire attack level (BAL) rating.

Lot 313 Fifty Road forms part of the SESP and is zoned for residential land uses under the Structure Plan. Any existing vegetation risk located within Lot 313 is likely to be removed in the future. However, development of Lot 774 Fifty Road will need to take into consideration the timeframes and staging of development of Lot 313. Should the existing vegetation risk located within Lot 313 not be removed prior to development of Lot 774 commencing, this could prohibit development of lots along the western boundary of Lot 774, as the minimum separation distances of the site to classified vegetation will not be achieved. AS-3959-2009 construction standards (BAL) would also need to be increased for development within the eastern portion of site.

Notwithstanding, existing cumulative vegetation within Lots 90, 100 and 118 Fifty Road are not likely to be removed as these landholdings remain within rural zonings. Whilst only a small portion of the classified vegetation falls within 100m of the subject land, the cumulative area of this vegetation is significant and poses a moderate to extreme risk. Consequently, some future residential lots located along the western boundary of the subject land will need an increased construction standard as the minimum 100m separation distance cannot be implemented.

It is noted the bush fire hazard assessment contained at Appendix 3 is a strategic level assessment only. Further assessment of site specific separation distances to classified vegetation and relative bush fire attack level ratings will need to be considered at the later subdivision and development stages.

3.5 HERITAGE

A search of the Department of Aboriginal Affairs Aboriginal Heritage Enquiry System did not identify any aboriginal sites of significance within or adjacent to Lot 774.

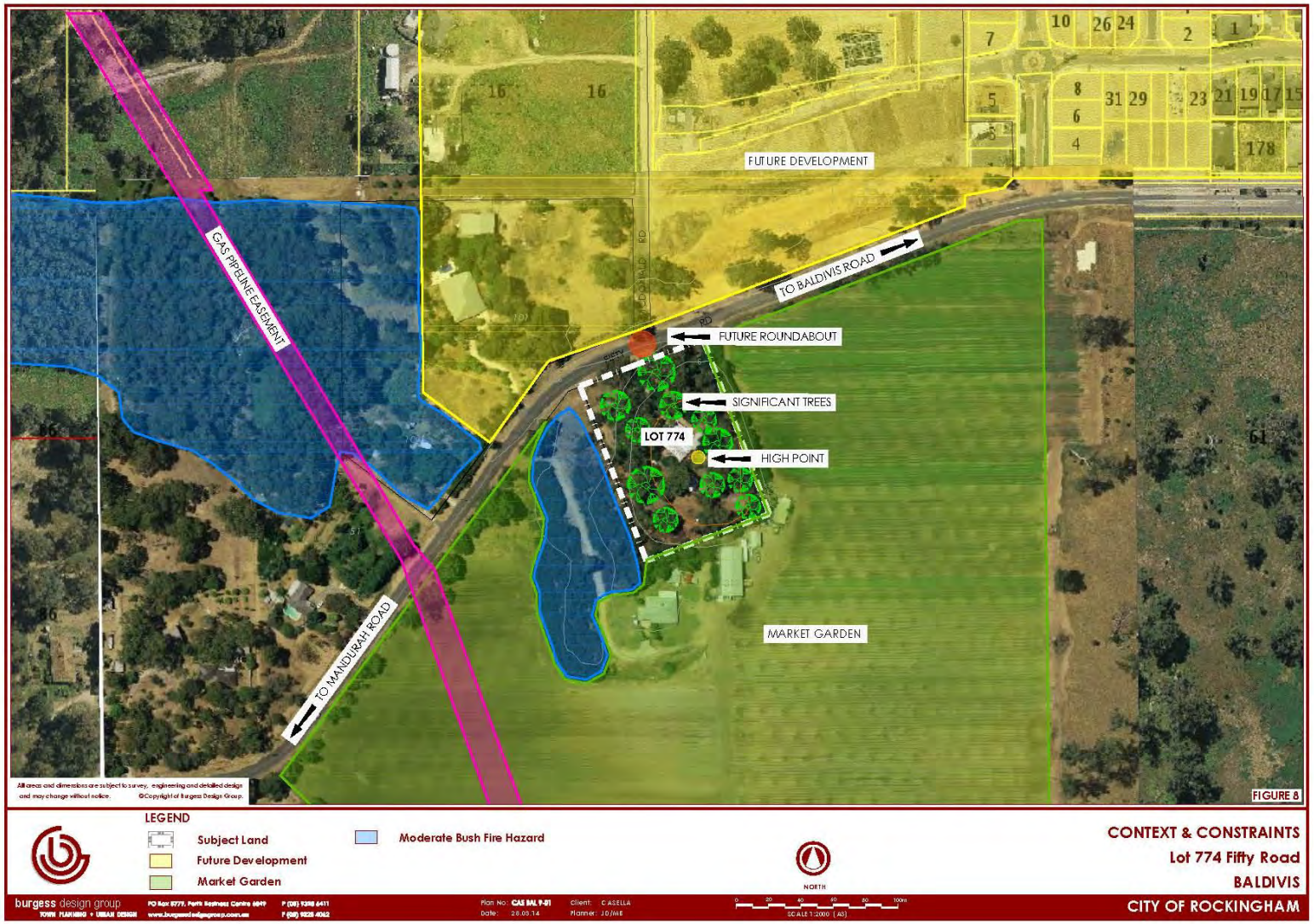


FIGURE 7 | **CONTEXT & CONSTRAINTS MAPPING**

4. PROPOSED MINOR CHANGE TO SESP

The Structure Plan Amendment Map (refer to **Plan 1**) outlines land uses, zones and reserves applicable within the structure plan amendment area. The zones and reserves designated under this Amendment will be incorporated into the Spires Estate Structure Plan and will apply to the subject land as if the zones and reserves were incorporated into the Scheme.

4.1 LAND USE

The land uses proposed as part of this Structure Plan amendment comprise primarily low density residential uses, with two possible medium density grouped housing sites located at the corner of Fifty Road and the future extension of McDonald Road (refer **Figure 8**). The proposed land uses are in accordance with the approved DSP and are compatible with those proposed within the SESP.

4.2 OPEN SPACE

The provision of a minimum of 10% Public Open Space (POS) is to be provided in accordance with the Western Australian Planning Commission's Liveable Neighbourhoods document.

The subject land area is such that a 10 per cent contribution would be too small to be of practical use and it is considered there is already an adequate provision and distribution of public parkland identified under the SESP.

In accordance with the SESP and its indicative design over Lot 774 Fifty Road, no Public Open Space (POS) is proposed within the subject site. The SESP identifies two areas of POS in close proximity to the subject site, one being located approximately 50 metres to the east, and another 80 metres to the south. Both areas are highly accessible from the subject site. The SESP identifies approximately 11% of the Structure Plans gross subdivisible area for Public Open Space.

In this regard, it is considered a cash-in-lieu contribution for public open space is acceptable in accordance with the provisions of Section 153 of the Planning and Development Act 2005.

4.3 RESIDENTIAL

This minor Structure Plan Amendment proposes a residential density of R20 across the majority of the site, with an R40 density applicable over those portions at the intersection of Fifty Road and the proposed internal road.

The proposed base density of R20 is in accordance with that as specified in the adjoining areas within the SESP. The proposed density of R40 is considered appropriate given the strategic location of the site, adjoining the shared path network connecting to nearby future commercial uses, being located within the '400m Ultimate Bus Route Catchment' as depicted within the SESP, and being in close proximity to Public Open Space. Furthermore, this increase in density, facilitating duplex development, effectively allows for the creation of two dwelling frontages on a corner location, thereby helping to improve the streetscape amenity of the area, as well as improving passive surveillance of the public realm.

This Amendment aims to accommodate 18-20 single residential lots over 7,112m^2, and is predicted to house approximately 52 residents in 20 dwellings (at 2.6 persons per household

(ABS 2011)), representing a density of 28 dwellings per site hectare and 22 dwellings per gross urban zoned hectare.

Lots overall have been orientated such that they would provide effective surveillance of, and achieve an effective relationship with, the surrounding street network.

4.4 DETAILED AREA PLANS

As per the requirements of the SESP, detailed area plans (DAP's) are to be prepared for any lot with a direct boundary frontage (primary or secondary) to Fifty Road or nay lot within 100m of a Bushfire Hazard.

The requirement for DAP's make sufficient provision to ensure that any grouped dwellings constructed on lots abutting Fifty Road adequately address both Fifty Road and the proposed internal road. DAP's and should consider, among other factors, fencing (including visual permeability), dwelling orientation, vehicular access, setbacks and bushfire attack level (BAL).

4.5 MOVEMENT NETWORKS

The movement network within the site comprises a single 18m wide through road, being a Neighbourhood Connector 'B' road, as specified in the SESP, which intersects with Fifty road and McDonald Street at the northern boundary of the site through a proposed roundabout.

The technical note (refer **Appendix 4**) prepared to assess the proposed roundabout demonstrates that the intersection should operate at a very good level of service for all movements in peak conditions.

In accordance with the SESP, Fifty Road is designated a Neighbourhood Connector A road and is to be widened by 3m (to a total reserve width of 23m) where it abuts the subject site. This widening is to be accommodated within the subject site, and is to be upgraded to a 'Boulevard' standard at the time of subdivision.

In accordance with the SESP, a 'shared path' is required to both sides of the proposed internal Neighbourhood Connector road reserve.

Additionally, the site is located within the '400m Ultimate Bus Catchment' as shown within the SESP.

It should be noted that the City will not support direct driveway access to Fifty Road as it is designated for a high order District Distributor function and will accommodate significant traffic flow in the future. DAP's required for those lots fronting Fifty Road will address restricted vehicle access for lots fronting Fifty Road.

4.6 WATER MANAGEMENT

A Water Management Strategy has been prepared by 360 Environmental to act as an addendum to the approved SESP LWMS (refer Attachment A of **Appendix 2**). This Water Management Strategy is summarised below:

Water Usage Strategy

Water efficiency measures, in the form of the '5 Star Plus Code' (requiring a range of dwelling design elements and 3 or 4 star rated fittings and fixtures), will be implemented to reduce scheme water demand. Additionally, all households will be encouraged and supported to implement the Water Corporations water wise practices.

Stormwater Management

The subject site forms part of Catchment 10b, as identified in the SESP LWMS. Modelling undertaken by 360 Environmental indicates that the subject site formed part of the LWMS drainage calculations.

Lot drainage is to be managed by infiltration through soakwells, which will be the lot owner's responsibility to provide, install and maintain.

Minor storm events (1 in 5 year ARI event) will be conveyed through a piped conveyance system, whilst major storm events (up to 1 in 100 year ARI event) will be conveyed via the road network to basins within the SESP POS.

Groundwater Management

Given the clearance to groundwater (7-9m below ground level):

- It is not anticipated that fill will be required;
- Subsoil drainage will not be required; and,
- The groundwater clearance supports infiltration on lots via soakwells.

4.7 EDUCATION FACILITIES

It is noted that the DSP shows two primary schools within 700 metres of the subject site (the existing Baldivis Primary School to the east, and a proposed primary school to the north).

4.8 ACTIVITY CENTRES AND EMPLOYMENT

There are no commercial or retail land uses within the subject land.

It is noted that the future residents within the subject land and the broader Spires Estate will be appropriately serviced by commercial and retail facilities. These land uses have been provided for in the endorsed DSP, and have been included within the SESP.

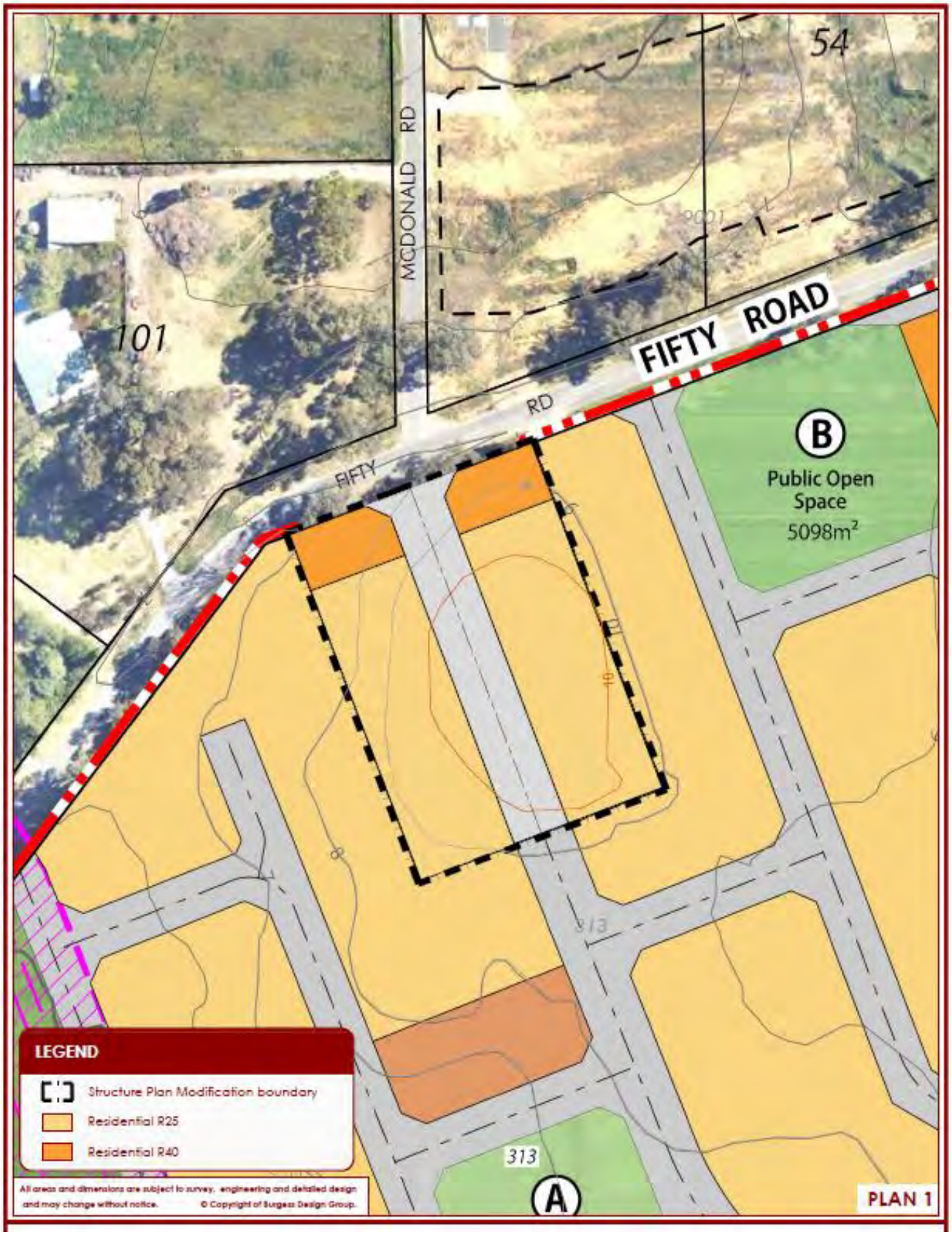


FIGURE 8 | **PROPOSED MINOR CHANGE TO SESP**

5. INFRASTRUCTURE COORDINATION, SERVICING AND STAGING

TABEC Civil Engineering Consultants prepared an Engineering Infrastructure Report (refer **Appendix 5)** in January 2014 to support the preparation of this amendment. The report confirms that there are no identified servicing constraints that prevent the land from being developed for urban purposes. A summary of the report is provided below.

5.1 POWER

Existing 22kV Western Power overhead aerials are located along the north side of Fifty Road. The network capacity mapping tool on the Western Power website does not show this as a critical area. It is therefore unlikely that any major upgrades or network reinforcement would be required for Fifty Road.

5.2 TELECOMMUNICATIONS

NBN Co is responsible for the installation of fibre in all broad acre developments of 100 or more premises within the long term optic fibre footprint. A developer agreement will be necessary prior to any construction works commencing. However, as Lot 774 is unlikely to qualify independently, it may be possible to create a developer agreement based on the greater surrounding developments proposed and view the project in terms of area demand.

5.3 WATER

Initial water supply may be possible from the existing 250mm main on Fifty Road. However, the Water Corporation's scheme planning indicates that an additional water main along Fifty Road will be required, which is proposed to be 375mm in diameter and would be subject to prefunding arrangements.

The Water Corporation's ultimate planning provides for an additional major water distribution main to supplement the proposed assets within Fifty Road and provide the wider area with distribution mains from which reticulated services may be connected.

5.4 SEWER

Lot 774 falls within the catchment of the existing McDonald Road waste water pump station which is located approximately 140 metres to the immediate north of the site.

Ultimately, the McDonald Road waste water pump station will be upgraded to a Type 90 with a flow rate capable of approximately 85 litres per second. The McDonald Road pump station also lies in the catchment of the East Rockingham Waste Water Treatment Plant (ERWWTP) so the ultimate pressure main will be directed north along McDonald Road, and then gravity fed toward a future Type 180 waste water pump station near Kerosene Lane. There will be a 450mm diameter pressure main from this pump station discharging to the ERWWTP.

Due to the current limited capacity of the McDonald Road waste water pump station and temporary outfall nature of the existing pressure main toward Baldivis Road, further detailed planning with Water Corporation is required, with confirmed development timing, to assess the viability of interim arrangements prior to ERWWTP being available. This detailed planning will be undertaken at the appropriate time.

6. LAND USE AND SUBDIVISION REQUIREMENTS

Subdivision and development of the Structure Plan area shall generally be in accordance with the Spires Estate Structure Plan Map (as amended).

General standards for subdivision and development, as well as variations to the Residential Design Codes, shall be in accordance with that specified in the Spires Estate Structure Plan report.

6.1 STAGING

As the subject site is relatively small, and readily accessed and serviced from Fifty Road, it is envisaged that subdivision will occur in one stage, shortly after the adoption of this amendment.

It may be necessary to stage the development of Lot 774 as a result of the existing bush fire risk located along the western boundary of Lot 774 and within Lot 313. In this regard, the eastern portion of the subject site may be required to be developed first should a coordinated and timely approach to development not be achieved with the adjoining landowner.

6.2 DEVELOPMENT CONTRIBUTION ARRANGEMENTS

The subject land falls within the City of Rockingham's Development Contribution Area No.2. As such, the site is subject to cost contributions as outlined under Schedule 12 'Development Contribution Plan No. 2' within the City's Town Planning Scheme No.2.

6.3 PLANNING FOR BUSH FIRE

A Bush Fire Hazard Assessment has been carried out for the subject land (refer Appendix 3) in order to classify any potential bush fire hazard at the strategic level and determine the site's suitability for future subdivision and development. The hazard assessment has identified the subject land as being located within 100m of an area recognised as containing a moderate or extreme bush fire hazard.

As such, the subject land should be designated as being subject, or likely to be subject, to bush fires.

The current Australian Standard 3959 (AS3959) 'Construction of Buildings in Bush-fire Prone Areas' should therefore be applied and a Bush-fire Attack Level determined for any buildings within the subject land at the subdivision/development stage.

6.4 Other Requirements

Appendix No.	Document Title	Approval Required OR Supporting Documentation Only	Approval Status	Approval Agency
1	Certificate of Title	Supporting		
2	Environmental Assessment	Supporting		
3	Bush Fire Hazard Assessment	Approval required		City of Rockingham
4	Traffic Assessment	Supporting		
5	Servicing Report	Supporting		

7. CONCLUSION

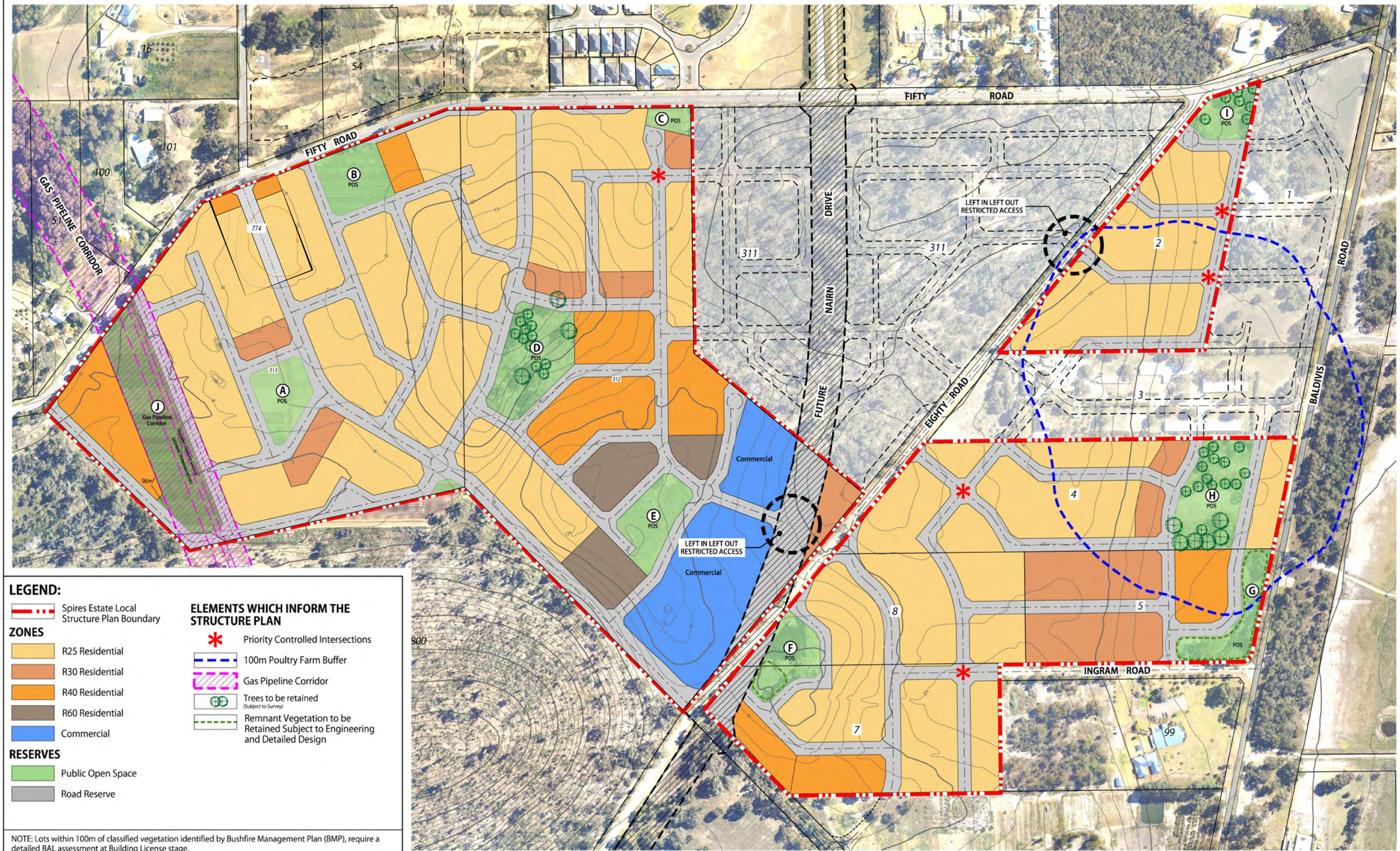
This Structure Plan Amendment report, accompanying plans, and appendices, satisfy the Council's Scheme requirements with respect to the objectives of the 'Development' zone, and the preparation of Structure Plans.

The proposed minor modification to the SESP as described in this report satisfies the planning frameworks adopted by the City of Rockingham and the Western Australian Planning Commission and the advice received during consultation with other agencies. The Plan should ultimately assist in achieving a contemporary and integrated subdivision that provides the foundation for a strong and cohesive community.

In light of the above, the Local Structure Plan Amendment, as submitted, represents a logical, well-planned and timely addition to the ongoing development of the Baldivis locality.

PLAN 1

AMENDMENT TO SPIRES ESTATE LSP



LEGEND:

Spires Estate Local Structure Plan Boundary

ZONES

- R25 Residential
- R30 Residential
- R40 Residential
- R60 Residential
- Commercial

RESERVES

- Public Open Space
- Road Reserve

ELEMENTS WHICH INFORM THE STRUCTURE PLAN

- Priority Controlled Intersections
- 100m Poultry Farm Buffer
- Gas Pipeline Corridor
- Trees to be retained (Subject to Survey)
- Remnant Vegetation to be Retained Subject to Engineering and Detailed Design

NOTE: Lots within 100m of classified vegetation identified by Bushfire Management Plan (BMP), require a detailed BAL assessment at Building License stage.

PLAN 1 - Spires Estate Local Structure Plan

Various Lots Fifty and Eighty Road, BALDIVIS

for: Spatial Property Group

SPATIAL Property Group™

NOTES: Modified by Burgess Design Group to include Lot 774 Fifty Road - 11 August, 2014.

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NORTH

Scale 1: 4000 @ A3 | 1:2000 @ A1

0 25 50 75 100 125 150 metres

COMPILED: DPS		DRAWN BY:	RF
DATE:	15/02/2012	REVISED:	29/07/2014
GRID:	MGA 50	DATUM:	AHD
DRAWING NUMBER:	CARBD-2-001e	JOBCODE:	CARBDLSP
FILE ID:	M:\CARBD\Base\Structure Plans\CARBD-2-001e.dgn		

Development Planning Strategies
28 Brown St, East Perth WA 6004 | PO BOX 6697 EAST PERTH 6892
P (08) 9268 7900 | F (08) 9268 7999 | E dps@dpswa.com.au
www.dpsplanning.com.au

APPENDIX 1
CERTIFICATE OF TITLE

WESTERN AUSTRALIA

REGISTER NUMBER	
774/DP202704	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
N/A	**N/A**

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

VOLUME **1813** FOLIO **718**

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 774 ON DEPOSITED PLAN 202704

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

GEOFFREY WARREN UREN
ROSSLYN DIANE UREN
BOTH OF 171 FIFTY ROAD, BALDIVIS
AS JOINT TENANTS

(T H735575) REGISTERED 2 MAY 2001

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. H735576 MORTGAGE TO BANK OF WESTERN AUSTRALIA LTD REGISTERED 2.5.2001.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: 1813-718 (774/DP202704).
PREVIOUS TITLE: 1245-113.
PROPERTY STREET ADDRESS: 125 FIFTY RD, BALDIVIS.
LOCAL GOVERNMENT AREA: CITY OF ROCKINGHAM.

NOTE 1: A000001A LAND PARCEL IDENTIFIER OF PEEL ESTATE LOT 774 (OR THE PART THEREOF) ON SUPERSEDED PAPER CERTIFICATE OF TITLE CHANGED TO LOT 774 ON DEPOSITED PLAN 202704 ON 14-AUG-02 TO ENABLE ISSUE OF A DIGITAL CERTIFICATE OF TITLE.
NOTE 2: THE ABOVE NOTE MAY NOT BE SHOWN ON THE SUPERSEDED PAPER CERTIFICATE OF TITLE OR ON THE CURRENT EDITION OF DUPLICATE CERTIFICATE OF TITLE.

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Superseded - Copy for Sketch Only

Page 1 of 2 pages) VOL 1813 FOL 718

ORIGINAL - Not to be produced with Application

LT 37

CT 1813 0718 F

1813 718

Transfer D900435
Volume 1245 Folio 113

WESTERN AUSTRALIA

CERTIFICATE OF TITLE

UNDER THE "TRANSFER OF LAND ACT, 1893" AS AMENDED

I certify that the person described in the First Schedule hereto is the registered proprietor of the undermentioned estate in the undermentioned land subject to the easements and encumbrances shown in the Second Schedule hereto.

REGISTRAR OF TITLES

Dated 12th October, 1988

ESTATE AND LAND REFERRED TO

Estate in fee simple in Peel Estate Lot 774, delineated on the map in the Third Schedule hereto, limited however to the natural surface and therefrom to a depth of 60.96 metres.

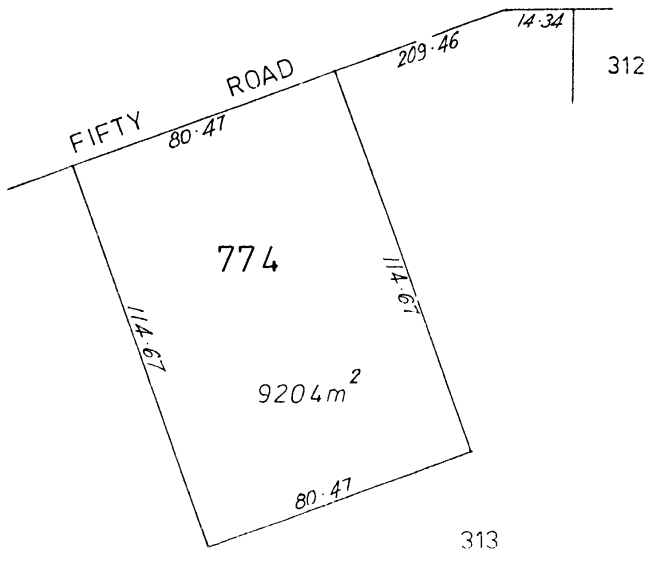
FIRST SCHEDULE (continued overleaf)

~~William John Cowlin~~ and Valerie Eileen Cowlin, ~~both of 7 Harbour Court, Safety Bay, as joint tenants.~~

SECOND SCHEDULE (continued overleaf)

1. ~~MORTGAGE D900436 to The Rural & Industries Bank of Western Australia. Registered 12.10.88 at 9.00 hrs.~~
Discharged H735574 2.5.01

THIRD SCHEDULE



SCALE 1:2000
INDEX PLAN PEEL 10 000 2·5

PERSONS ARE CAUTIONED AGAINST ALTERING OR ADDING TO THIS CERTIFICATE OR ANY NOTIFICATION HEREON

NOTE RULING THROUGH AND SEALING WITH THE OFFICE SEAL INDICATES PLACE ENTRY NO LONGER HAS EFFECT
ENTRIES NOT RULED THROUGH MAY STILL AFFECT THE LAND - SEARCH FOR FURTHER DEVELOPMENTS

61174/5/88-2500-S/2860

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LANDGATE COPY OF ORIGINAL NOT TO SCALE Tue Jan 21 09:05:16 2014 JOB 43732949

Superseded - Copy for Sketch Only

LT. 37

FIRST SCHEDULE (continued)

NOTE: RULING THROUGH AND SEALING WITH THE OFFICE SEAL INDICATES THAT AN ENTRY NO LONGER HAS EFFECT. ENTRIES NOT RULED THROUGH MAY BE AFFECTED BY SUBSEQUENT ENDORSEMENTS.

REGISTERED PROPRIETOR	INSTRUMENT NATURE	INSTRUMENT NUMBER	REGISTERED	TIME	SEAL	INITIALS
Geoffrey Warren Uren and Rosslyn Diane Uren both of 171 Fifty Road, Baldivis, as joint tenants.	Transfer	H735575	2.5.01	8.08		

SECOND SCHEDULE (continued)

NOTE: RULING THROUGH AND SEALING WITH THE OFFICE SEAL INDICATES THAT AN ENTRY NO LONGER HAS EFFECT. ENTRIES NOT RULED THROUGH MAY BE AFFECTED BY SUBSEQUENT ENDORSEMENTS.

INSTRUMENT NATURE	INSTRUMENT NUMBER	PARTICULARS	REGISTERED	TIME	SEAL	INITIALS	CANCELLATION	NUMBER	REGISTERED OR LODGED	SEAL	INITIALS
Mortgage	H735576	to Bank of Western Australia Ltd.	2.5.01	8.08							

CERTIFICATE OF TITLE VOL. 1813 FOL. 718

APPENDIX 2
ENVIRONMENTAL ASSESSMENT

Our Ref: 265AB

18 December 2013

Kelley O'Neill
Senior Town Planner
Burgess Design Group
101 Edward Street
PERTH WA 6000

Dear Kelley,

Lot 774 Fifty Road Baldivis, Environmental Assessment

1. Background

360 Environmental have been commissioned by the landowners of Lot 774 Fifty Road, Baldivis to prepare an environmental report detailing site constraints and environmental features to support a Local Structure Plan (LSP).

Lot 774 is adjacent to the Spires Estate (Lots 312 and 313 Fifty Road, and Lots 2, 4, 5, 7 and 8 Eighty Road Baldivis) (Figure 1) for which a Local Structure Plan was prepared in January 2013 (Spatial Property Group 2013). The Spires Estate structure plan (West Baldivis) included an overview of site conditions and the environment, which have been considered in relation to Lot 774.

360 Environmental has also undertaken a desktop assessment, site significant tree survey and literature review of Lot 774 in isolation, to provide a site specific overview of environmental features for consideration, in accordance with the City of Rockingham and state agency expectations for a LSP application. The information gained from the site investigations will provide the additional information necessary for the inclusion of Lot 774 into the West Baldivis LSP and are summarised below.

2. Environmental Assessment

2.1. Soils and Topography

Lot 774 is classified as having Spearwood Sands (S7) which is described as pale yellowish brown and medium to coarse grained. These sands feature a permeability of >10m/day and a Phosphorus Retention Index of 5-12mL/g (Figure 2).

The topography of Lot 774 is relatively flat, and varies between 8 and 10 metres Australian Height Datum (mAHD) (Figure 2).

2.2. Acid Sulfate Soils

According to Acid Sulfate Soil (ASS) risk mapping the site is identified as having ''low to nil risk of ASS within 3m from the ground surface'' ASS risk (Figure 3). The nearest site with an ASS risk of High to Moderate risk is approximately 200m North West and is associated with a conservation category wetland (UFI6400) in this location. The need for a detailed ASS risk assessment, in accordance with the Department of Environment and Regulation's (DER's) requirements, is therefore unlikely to be triggered and a subdivision condition relating to ASS should be avoided for the site.

2.3. Groundwater

In consideration of the topography of Lot 774 and the groundwater levels as shown in the Perth Groundwater Atlas (DoW, 2013), the depth to groundwater is approximately 7 to 9 metres below ground level. The location does not occur within a Public Drinking Water Source Area.

2.4. Surface Water

There are no significant natural surface water bodies or wetlands within or adjacent to Lot 774. A Conservation Category Wetland (CCW) (UFI6400) is located approximately 200m to the North West of Lot 774 (Figure 4).

Further to this, the site is not situated within a floodplain, consistent with properties included in the LSP.

The surrounding structure plan area associated with the Spires Estate has an existing approved Local Water Management Strategy (LWMS). This LWMS outlines the stormwater management strategy, to protect the water regime and ensure stormwater is managed and controlled within the site to the expectations of the City of Rockingham and the Department of Water (DoW).

2.4.1. Surface Water Management

Stormwater Management will be in line with the strategy from the Spires Estate LWMS. Drainage from the lots will be managed by infiltration through soakwells. Minor storm events (up to the 5yr ARI event) will be conveyed through a pipe system connected to the Spires Estate system. Major storms (greater than the 5yr ARI event) will be conveyed via the road network to the basin in the Spires Estate POS.

A separate letter addressing water management which has been prepared in consultation with the City of Rockingham and the Department of Water is attached to this correspondence (Attachment A).

2.5. Vegetation

The regional vegetation complex on the site is mapped as 'representative of the 'Cottesloe (Central and South)' (Heddle et al., 1980) which is described as:

> *Cottesloe Complex (Central and South), described as a mosaic of woodland of Eucalyptus"gomphocephala and open forest of Eucalyptus gomphocephala – Eucalyptus marginata – Coryumbia calophylla: closed heath on the limestone outcrops (Heddle et al., 198).*

The Cottesloe vegetation complex meets the State government target of at least 10% of the original extent proposed for protection and is locally well represented with 50% of its original pre-European extent remaining within the City of Rockingham.

A site assessment of the vegetation and significant trees was undertaken in November, 2013 to determine the extent and condition of the remnant vegetation within the site. The assessment determined that apart from 19 larger remnant trees (discussed further in Section 2.6 below), the understorey and remaining vegetation consisted of exotic garden species, and was not indicative of remnant native vegetation. As a result, it is considered unlikely that any flora or communities of conservation significance are present within the site.

2.6. Fauna Habitat

A search of the WA Department of Parks and Wildlife (DPaW) and federal Department of the Environment (DotE) websites and databases revealed that the Vulnerable Forest Red-tailed Black Cockatoo and Endangered Carnaby's Black Cockatoo are likely to occur within the Project area.

A Black Cockatoo assessment and survey was undertaken by 360 Environmental in November 2013 to:

- Determine the extent of potential Black Cockatoo habitat in the study area;
- Record the location and number of potential breeding or actual breeding trees used by the Black Cockatoo species; and
- Record the location and number of any Black Cockatoos observed in the study area.

The results of this assessment are summarised below and presented in Attachment B:

- Suitable foraging habitat was recorded in the survey area in the form of remnant Tuart trees .The understorey in survey area consisted of exotic garden species and therefore not considered suitable foraging habitat for Black Cockatoos;
- No evidence of Black Cockatoo feeding was observed during the assessment;
- A total of 0.88 ha of foliage area on potential foraging habitat was identified in the survey area and is illustrated in Figure 5; and,
- A total of 19 Tuart trees that have the potential to be used for breeding were recorded within the survey area i.e. trees with a DBH ≥ 500 mm as defined by the federal DotE in the *Referral Guidelines for the three Threatened Black Cockatoo Species* (DotE, 2012). The location of these trees is outlined in Figure 5.

As a result, the proponent will consider the requirement to refer the project to the DotE for potential significant impacts to the Black Cockatoos under the *Environmental Protection and Biodiversity Conservation* (EPBC) Act (1999). It should be noted that this process is separate to the LSP assessment process and should not prevent the consideration of the LSP and accompanying technical information.

2.7. Environmentally Sensitive Areas

The site is located approximately 200m to Bush Forever Site 356. Development of Lot 774 is unlikely to impact on this Bush Forever Site due to the distance from the reserve (Figure 6).

There are no sensitive environmental areas within or adjacent to the Lot boundary.

2.8. Contaminated Sites

A search of the Department of Parks and Wildlife's (DPaW) contaminated sites database showed there are no contaminated sites within or adjacent to Lot 774 (Figure 7). The closest registered contaminated site is located approximately 400m north east of the site.

2.9. Heritage

A search of the Department of Indigenous Affairs, Aboriginal Heritage Inquiry System (AHIS) did not identify any aboriginal sites of significance within or adjacent to Lot 774 Fifty Road, Baldivis.

3. Conclusion

360 Environmental considers from the information reviewed there are no significant environmental constraints on Lot 774 Fifty road, which would prevent consideration of the LSP.

Should you have any questions or require further action please do not hesitate to contact the undersigned on (08) 9388 8360. We look forward to hearing from you.

For and on behalf of

360 Environmental Pty Ltd

Luke Rogers – Senior Environmental Scientist

Enc:
Figure 1 – Location Plan
Figure 2 – Soils and Topography
Figure 3 – Acid Sulfate Soils
Figure 4 – Hydrology
Figure 5 - Potential Habitat Trees
Figure 6 – Environmentally Sensitive Areas
Figure 7 – Contaminated Sites

Attachment A – Surface Water Management Letter
Attachment B – Significant Tree Survey

References

DotE. (2013). *Referral Guidelines for the three Threatened Black Cockatoo Species*. Department of the Environment, Canberra.

Department of Water. (2004). Perth Groundwater Atlas online. Department of Water,Perth. www.water.wa.gov.au

Heddle, E.M. Loneragan, O.W, Havel, J.J (1980) Vegetation Complexes of the Darling System Western Australia, In. Atlas of Natural Resources, Darling System, Western Australia. Department of Conservation and Environment,

FIGURES

Legend

Site Location

Roads

0 25 50 100 150 200

Metres

1:8,000 @ A4

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

a 10 Bermondsey St, West Leederville, 6007 WA
t (08) 9388 8360
f (08) 9381 2360
w www.360environmental.com.au

DRAWING ID	DATE
265_site_location.mxd	11-Dec-2013

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
CS	NL	LR	0

Burgess Design Group Pty Ltd
Lot 774, Fifty Road

Environmental Report

Figure 1 - Site Location

- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE 2012
- LOCALITY MAP SOURCED FROM LANDGATE 2006
- STREET DIRECTORY MAP SOURCED FROM STREETSMART 2008
- ROADS SOURCED MAIN ROADS WA 2012

K:\Projects\3.0 LD\265 Baldivis\Figures

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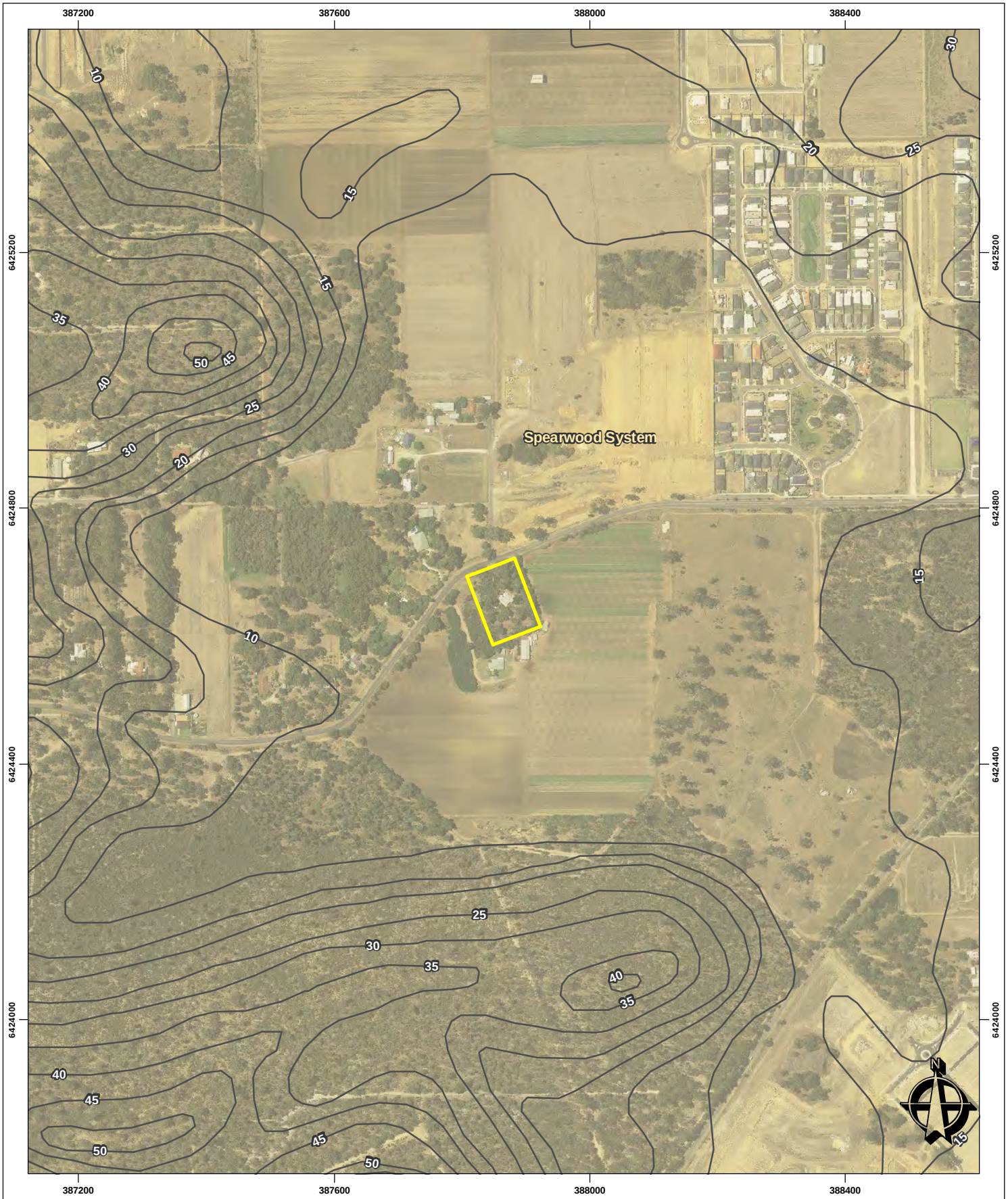

Legend

- 25k contours
- Site Location

Soils

- Spearwood System

0 50 100 200 300

Metres

1:8,000 @ A4

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

360 environmental
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265_figure 2 - soils and topo.mxd	18-Dec-2013

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GDA 1994 MGA Zone 50

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CS	NL	LR	0

Burgess Design Group Pty Ltd
Lot 774, Fifty Road

Environmental Report

Figure 2 - Soils and Topography

- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE 2013
- LOCALITY MAP SOURCED FROM LANDGATE 2006
- STREET DIRECTORY MAP SOURCED FROM STREETSMART 2008
- ENVIRONMENTALLY SENSITIVE AREAS SOURCED DEC 2012
- ABORIGINAL SITES REGISTER SOURCED DAA 2013
- BUSHFOREVER SOURCED DPI 2012

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Legend

Site Location

Acid Sulfate Soils Disturbance Risk

High to moderate risk

Moderate to low risk

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- LOCALITY MAP SOURCED FROM LANDGATE 2006
- STREET DIRECTORY MAP SOURCED FROM STREETSMART 2008
- ACID SULFATE SOILS SOURCED DEC 2010

0 25 50 100 150 200

Metres

1:8,000 @ A4

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

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Figure 3 - Acid Sulfate Soils

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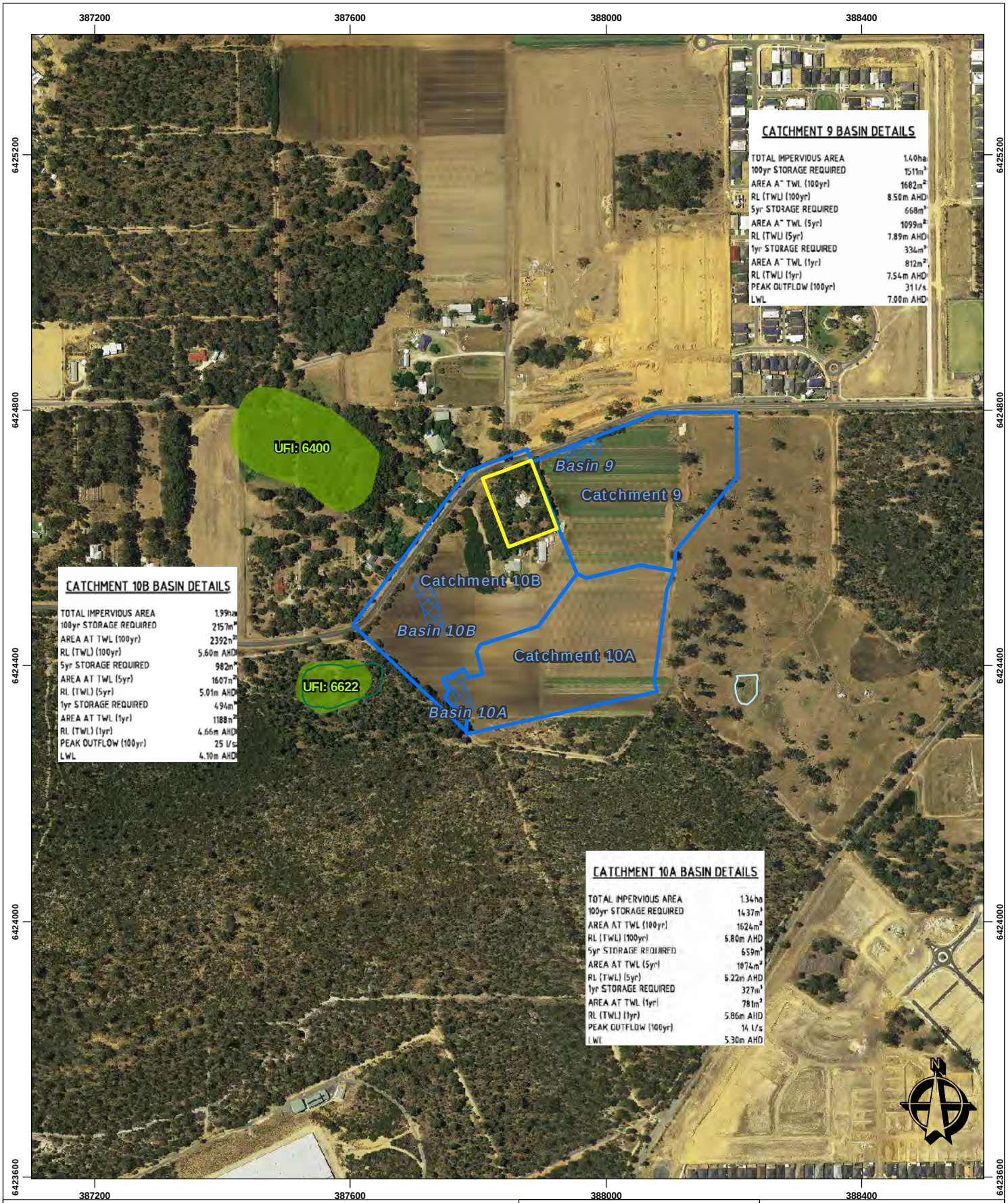

Legend

- Site Location
- Catchments
- Basins
- Watercourse
- Swamp - non-perennial

Geomorphic Wetlands

- Conservation
- Resource Enhancement
- Multiple Use
- Not Assessed

0 25 50 100 150 200
Metres
1:8,000 @ A4

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE 2013
- LOCALITY MAP SOURCED FROM LANDGATE 2006
- STREET DIRECTORY MAP SOURCED FROM STREETSMART 2008
- HYDROGRAPHY SOURCED DOW 2010
- CATCHMENTS & BASINS SOURCED COTERRA 2012
- GEOMORPHIC WETLANDS SOURCED DPAW 2013

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265_figure 4 - hydrology.mxd	18-Dec-2013

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Figure 4 - Hydrology

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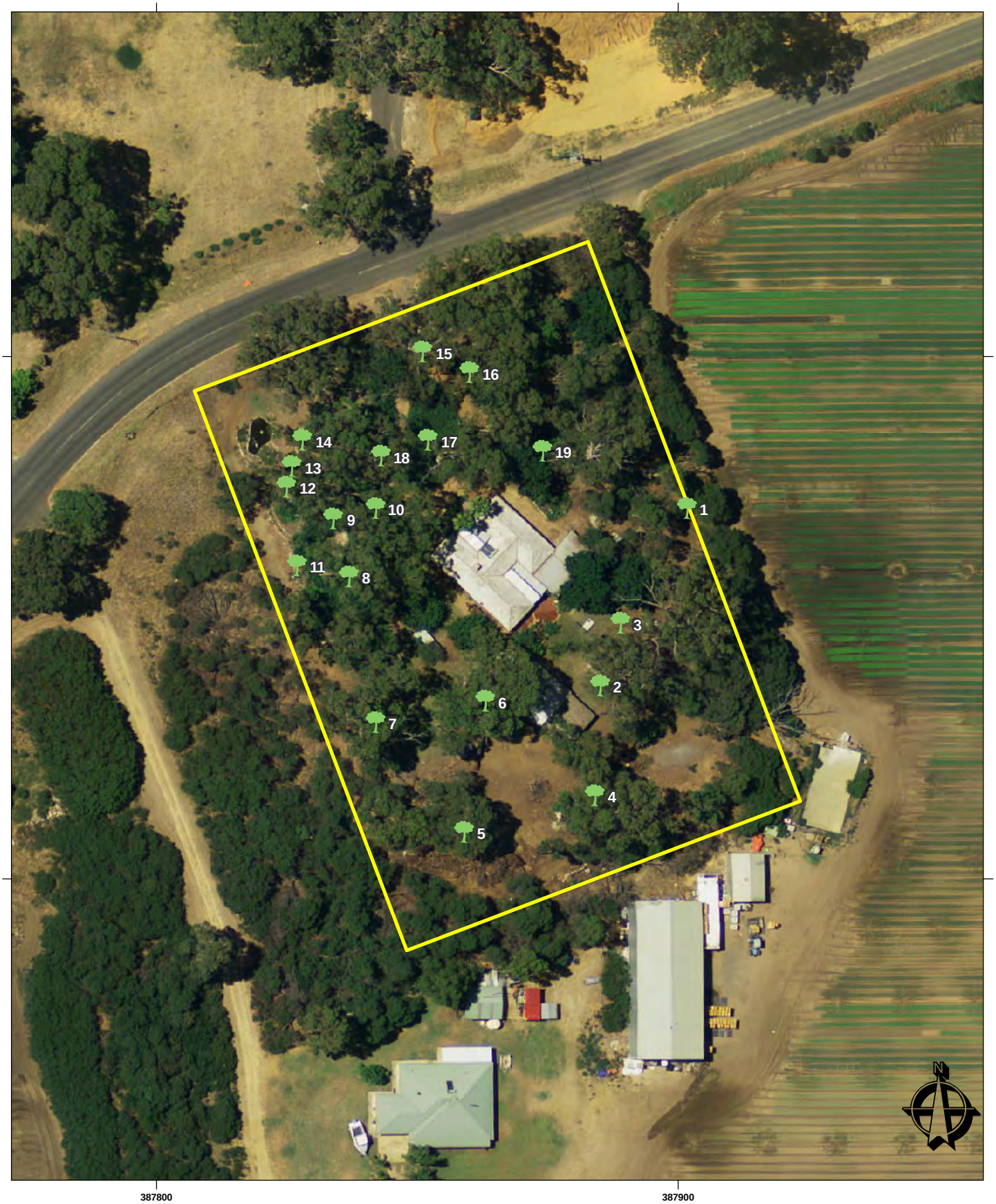

Legend

Site Location

Eucalyptus gomphocephala

0 5 10 20 30 40

Metres

1:1,000 @ A4

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265_figure 5 - breeding_habitat.mxd	18-Dec-2013

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Lot 774, Fifty Road

Black Cockatoo Assessment

Figure 5 - Potential Breeding Habitat

- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE 2012
- LOCALITY MAP SOURCED FROM LANDGATE 2006
- STREET DIRECTORY MAP SOURCED FROM STREETSMART 2008
- ROADS SOURCED MAIN ROADS WA 2012

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Legend

- Site Location
- Aboriginal Sites Register
- Environmentally Sensitive Areas
- BushForever

0 25 50 100 150 200

Metres

1:8,000 @ A4

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

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Lot 774, Fifty Road

Environmental Report

Figure 6 - ESA Constraints

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- LOCALITY MAP SOURCED FROM LANDGATE 2006
- STREET DIRECTORY MAP SOURCED FROM STREETSMART 2008
- ENVIRONMENTALLY SENSITIVE AREAS SOURCED DEC 2012
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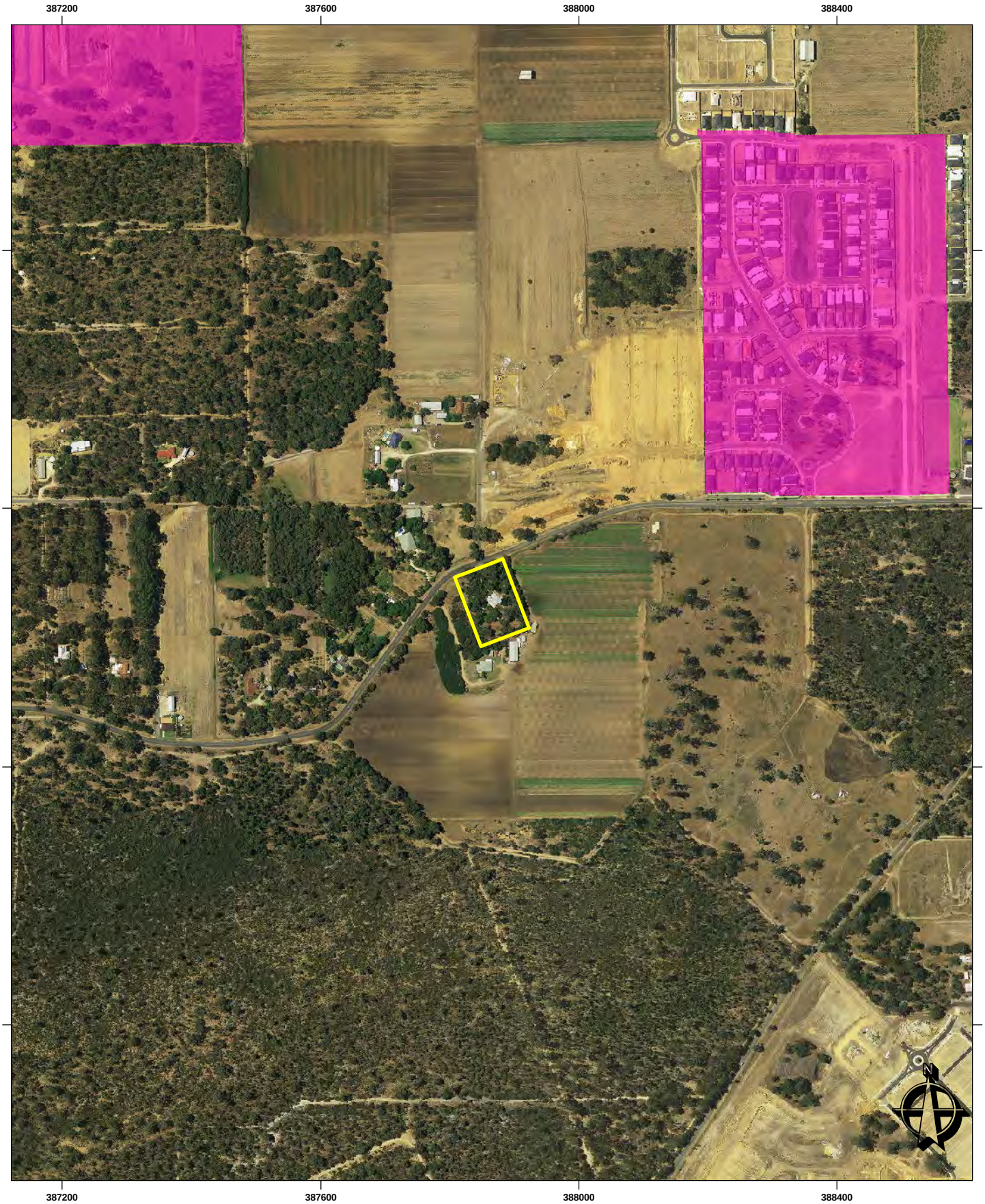

Legend

- Site Location
- Contaminated Sites Database

0 25 50 100 150 200

Metres

1:8,000 @ A4

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

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265_figure 7 - contamination.mxd	18-Dec-2013

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Lot 774, Fifty Road

Environmental Report

Figure 7 - Contamination

- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE 2013
- LOCALITY MAP SOURCED FROM LANDGATE 2006
- STREET DIRECTORY MAP SOURCED FROM STREETSMART 2008
- CONTAMINATED SITES DATABASE SOURCED DPAW 2013

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ATTACHMENT A

SURFACE WATER MANAGEMENT

Our Ref: 265AA

18 December 2013

Kelley O'Neill
Senior Town Planner
Burgess Design Group
101 Edward Street
PERTH WA 6000

Dear Kelley,

Lot 774 Fifty Road Water Management

1. Background

In support of the Local Structure Plan (LSP) for Lot 774 Fifty Road Baldivis, water management strategies outlining water efficiency, stormwater management and groundwater management are provided in this document. The proposed development of Lot 774 features a number of residential lots.

Lot 774 is adjacent to the Spires Estate (Lots 312 and 313 Fifty Road, and Lots 2, 4, 5, 7 and 8 Eighty Road Baldivis) (Figure 1) for which a Local Structure Plan was prepared in January 2013. The Spires Estate Structure Plan included a Local Water Management Strategy (LWMS) prepared by Coterra (2012) that largely addresses the urban water management requirements for Lot 774.

According to the Better Urban Water Management (WAPC, 2008) framework a detailed LWMS should be prepared for Lot 774. However, correspondence with Department of Water (13/11/13) confirmed that a full LWMS is not required for this site owing to the previous work, small size of the site and high clearance to groundwater.

2. Site Conditions

The Spires LWMS (Coterra, 2012) provides a detailed summary of the surrounding area and the key environmental features related to water are provided below.

2.1. Groundwater

No site specific groundwater monitoring was undertaken for the site given the published regional groundwater information indicated depths to groundwater up to 13mbgl (metres

below ground level). As the topography of Lot 774 varies between 8 and 10mAHD, the depth to groundwater is approximately 7 to 9mbgl.

As no site specific testing was undertaken, regional soils information was described by Coterra (2012). Lot 774 is classified as having Cottesloe Sands (S7) which is described as pale yellowish brown and medium to coarse grained. These sands feature a permeability of >10m/day and a Phosphorus Retention Index of 5-12mL/g. There is no known risk of Acid Sulphate Soils.

The groundwater and soil conditions are favourable for onsite infiltration.

2.2. Surface Water

There are no significant natural surface water bodies, wetlands or floodplains within or near Lot 774. A Conservation Category Wetland is located approximately 200m to the west.

3. Water Usage Strategy

Scheme water is proposed to service the residential lots.

Water efficiency measures will be implemented to reduce scheme water demand from residential water use. Household water efficiency will be achieved by implementing the 5 Star Plus Code: Water Use in the House Code (Department of Housing, 2007), which includes:

- 3 or 4 Star rated water efficient fittings and fixtures fitted;
- All hot water outlets in new homes be located close to the hot water system or a re-circulating hot water supply to minimise wastage of energy and water;
- Homes be plumbed so that they can be connected to an approved alternative water supply at a later date;
- Homes be plumbed to enable connection at a later time to a grey water diversion system;
- Homes with a high water demand for landscaping have an approved alternative water supply for appropriate non-potable use; and
- Homes with a high water demand for internal use have an approved alternative water supply for appropriate non-potable use.

The water corporation also provides guidance on using efficient appliances such as toilets, washing machines and dishwashers as well as water saving showerheads, tap and toilets. All households will be encouraged and supported to implement these waterwise practices.

Wastewater will be disposed of through a connection to the mains sewage system.

It is unlikely that additional POS will be located within Lot 774 and therefore no water will be required for irrigation. If the LSP is modified to include POS, irrigation will be sourced from the Superficial Aquifer at a rate of 7,500kL/ha/annum. There is no licence currently allocated to Lot 774 however it is understood allocations are available for the Stakehill Groundwater Area (Tamworth Swamp Sub Area).

4. Stormwater Management

Stormwater Management will be in line with the strategy from the Spires Estate LWMS (Coterra, 2012) as Lot 774 has already been considered in the previous stormwater modelling. Figure 2 provides catchment 10B from Coterra (2012). The areas for Catchment 10B, including lot and road breakdown, were generated independently using GIS and are consistent with those reported in the LWMS. This demonstrates that the previous modelling includes Lot 774.

Lot drainage will be managed by infiltration through soakwells which will be the lot owner's responsibility to provide and install. Lot drainage connections to the road drainage network are not proposed.

Minor storm events (up to the 5yr ARI event) will be conveyed through a piped conveyance system connected to the Spires Estate system. Lot 774 is at the top of catchment 10B and there is sufficient gradient for the system to operate.

Major storm events (greater than the 5yr ARI event, up to the 100yr ARI event) will be conveyed to via the road network to basins with the Spires Estate POS. Details of the basin for Catchment 10B are documented in Coterra (2012) and will be the responsibility of Spires Estate to construct. The basin will be planted with vegetation to assist with erosion prevention, maintain soil infiltration and remove particulate and soluble pollutants. No soil amendment is proposed for the basin (Coterra, 2012).

As the basin's top water level for the 100yr ARI event is reported as 5.60mAHD, there is sufficient clearance to Lot 774 which has an existing level of 8mAHD.

5. Groundwater Management

It is not anticipated that fill will be required for this site as there is sufficient depth to groundwater (7 to 9mbgl). Similarly, the use of subsoil drainage will not be required.

The groundwater clearance supports infiltration on lots via soakwells. Coterra (2012) describes Basin 10B as having approximately 2.1m of separation to groundwater, which is sufficient for infiltration. This will be confirmed during detailed design of the Spires Estate's POS and drainage infrastructure.

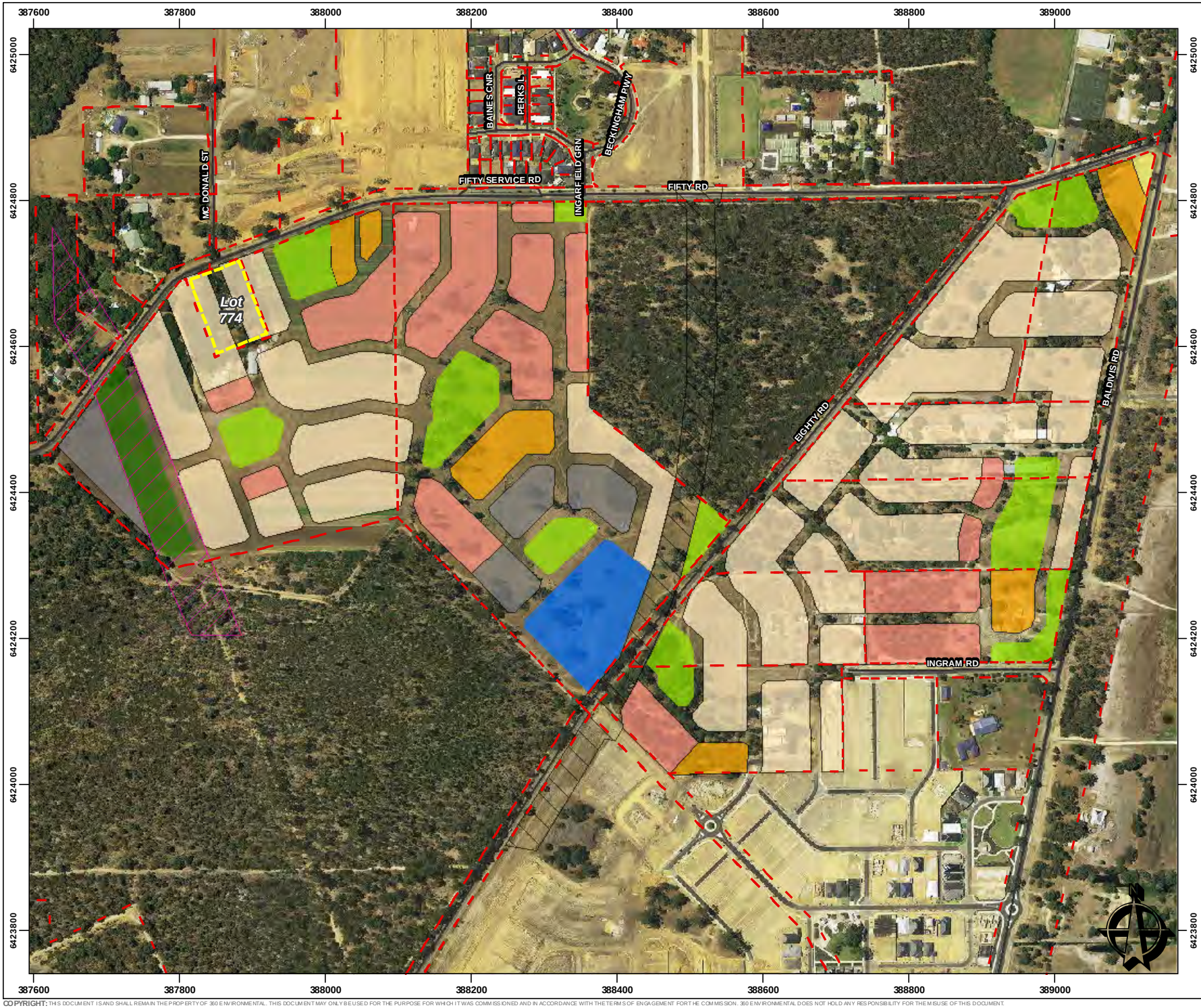
Should you have any questions or require further action please do not hesitate to contact the undersigned on (08) 9388 8360. We look forward to hearing from you.

For and on behalf of

360 Environmental Pty Ltd

Luke Rogers – Senior Environmental Scientist

Enc:
Figure 1 – Location Plan
Figure 2 – Stormwater Catchment Plan



Legend

- Site Location
- Cadastre
- Roads
- Commercial
- Public Open Space
- Public Purposes
- R25 Residential
- R30 Residential
- R40 Residential
- R60 Residential
- Gas Pipeline Reserve
- Gas Pipeline Corridor
- Future Nairn Road

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- CADASTRE SOURCED DOP 2013
- ROADS SOURCED MRWA 2013
- LOCALITY MAP SOURCED FROM LANDGATE 2006
- PLANNING AND CATCHMENTS SOURCED COTERRA PTY LTY 2012
- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE 2012
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HORIZONTAL DATUM AND PROJECTION
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Lot 774, Fifty Road
Water Management

Figure 1 - Location Plan

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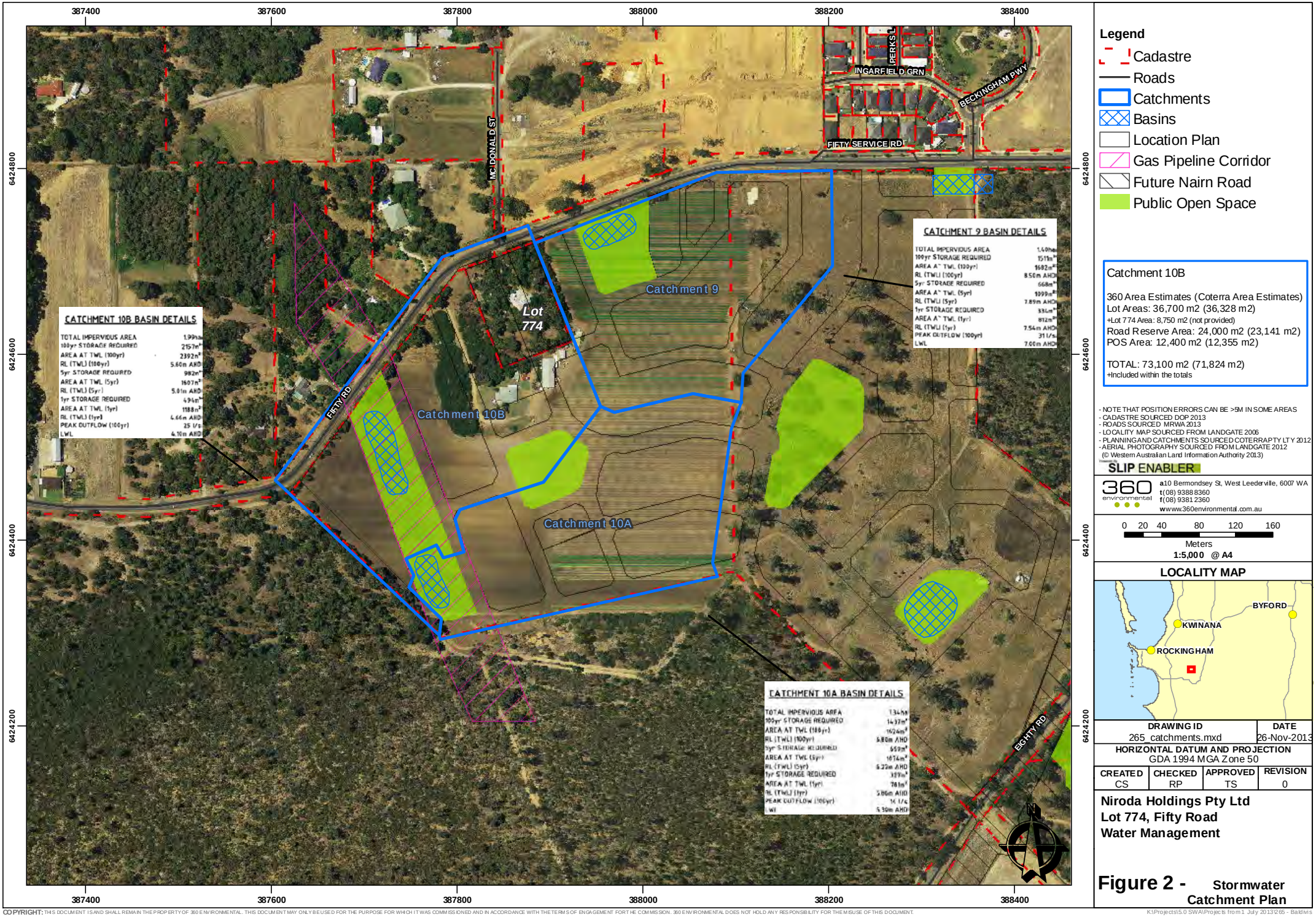

Legend

- Cadastre
- Roads
- Catchments
- Basins
- Location Plan
- Gas Pipeline Corridor
- Future Nairn Road
- Public Open Space

Catchment 10B

360 Area Estimates (Coterra Area Estimates)
Lot Areas: 36,700 m2 (36,328 m2)
+Lot 774 Area: 8,750 m2 (not provided)
Road Reserve Area: 24,000 m2 (23,141 m2)
POS Area: 12,400 m2 (12,355 m2)

TOTAL: 73,100 m2 (71,824 m2)
+Included within the totals

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- CADASTRE SOURCED DOP 2013
- ROADS SOURCED MRWA 2013
- LOCALITY MAP SOURCED FROM LANDGATE 2006
- PLANNING AND CATCHMENTS SOURCED COTERRA PTY LTY 2012
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Water Management

Figure 2 - Stormwater Catchment Plan

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ATTACHMENT B

SIGNIFICANT TREE SURVEY (360 ENVIRONMENTAL, 2013)

360 environmental

Black Cockatoo Assessment - Lot 774 Fifty Rd Baldivis

Prepared for:

Burgess Design Group

December 2013

people • planet • professional

Document Reference	Revision	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
265AA	A INTERNAL DRAFT	HA	RF		15/12/13
265AA	B CLIENT REPORT			1 Electronic (email)	

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Executive Summary

360 Environmental Pty Ltd (360 Environmental) was commissioned by Burgess Design Group in November 2013 to undertake a Black Cockatoo assessment for Lot 774 Fifty Rd Baldivis (the survey area). The survey involved a Black Cockatoo breeding and foraging habitat assessment.

A search of the Australian Governments Department of Environment (DotE) protected matters search tool was used to generate a report to help determine whether matters of national environmental significance, such as Black Cockatoos are likely to occur in the study area. The report indicated that the Endangered Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Vulnerable Baudin's Black Cockatoo (Calyptorhynchus baudinii) and Vulnerable Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksia naso*) are likely to occur in the survey area or in the nearby vicinity.

A total of 19 Tuart trees (*Eucalyptus gomphocephala*) in the survey area are of a size that the DotE considers being potential breeding trees (also breeding habitat) for Black Cockatoo species, as they have the potential to form hollows suitable for Black Cockatoos nesting.

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1.2 Black Cockatoo Referral Guidelines 6
1.3 Objectives 7
2 Methods 8
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1 Introduction

360 Environmental Pty Ltd (360 Environmental) was commissioned by Burgess Design Group (BDG) in November 2013 to undertake a Black Cockatoo assessment for Lot 774 Fifty Rd Baldivis (the survey area). The survey area is approximately 0.92 ha in size and is located along Fifty road in Baldivis (Figure 1). The site includes a semi-rural residential property consisting of house, sheds and ornamental gardens with scattered remnant *Eucalyptus* trees. The Black Cockatoo assessment involved a foraging and breeding habitat assessment of the site, with the purpose of identifying potential areas of Black Cockatoo habitat (foraging and breeding).

1.1 Black Cockatoo Background

Three species of Black Cockatoo occur in the south-west of Western Australia. All three species are protected under the following State and Commonwealth legislation (Table 1):

- The Western Australian *Wildlife Conservation Act 1950* (WC Act); and
- The Australian Government *Environment Protection and Biodiversity Conservation Act1999* (EPBC Act).

Table 1: The conservation status of Black Cockatoo species that potentially occur in the survey area.

Common Name	Scientific Name	Conservation Code	
		EPBC Act	WC Act
Carnaby's Cockatoo	*Calyptorhynchus latirostris*	EN	S1
Baudin's Cockatoo	*Calyptorhynchus baudinii*	VU	S1
Forest Red-tailed Black Cockatoo	*Calyptorhynchus banksii naso*	VU	S1

Key: VU = vulnerable, EN = endangered and S1 = Schedule 1 (Fauna that is rare or is likely to become extinct).

A brief description of each Black Cockatoo species, including its distribution, ecology and threats is discussed below.

Carnaby's Black Cockatoo

Carnaby's Black Cockatoo is a large Cockatoo that is 53 to 58 cm in length, with a wingspan of approximately 110 cm, and a mass of 520 to 790 g. Carnaby's Black Cockatoo has a white patch on its cheek, white bands on its tail, and a strong curved bill. Carnaby's Black Cockatoo is also known as the Short-billed Cockatoo. In males, the bill

is black and the eye-ring dark-pink. Females have a light grey bill, grey eye-ring, and the cheek patch is less distinctive (Higgins 1999; Johnstone and Storr 1998).

Carnaby's Black Cockatoo is endemic to the south-west of WA, extending from the Murchison River to Esperance, and inland to Coorow, Kellerberrin and Lake Cronin (DEC 2009). There is evidence that the species is currently expanding its breeding range westward and south into the Jarrah-Marri forests of the Darling Range and into the Tuart forests of the Swan Coastal Plain (Johnstone and Kirkby 2006).

Carnaby's Black Cockatoo primarily breed in the wheatbelt, from the Stirling Ranges north-west to around Three Springs, but they have also been recorded on the coastal plain to the south-west, around Bunbury (Higgins 1999; Saunders 1974).

Carnaby's Black Cockatoo display strong pair bonds. They occur in uncleared or remnant areas of Eucalypt woodland, principally Salmon gum (*Eucalyptus salmonophloia*) or Wandoo (*E. wandoo*), and shrubland or kwongan heath dominated by Hakea and Banksia species. Carnaby's Black Cockatoo nest in the hollows of live or dead smooth-barked Eucalypts (Salmon Gum and Wandoo) but also in Red Morrell (*E. longicornis*), York Gum (*E. loxophleba*), Marri and Tuart (Johnstone and Storr 1998).

On the Swan Coastal Plain, the birds feed on a large variety of plants including the Proteaceae (Banksia and Grevillea), Marri nuts and introduced species – notably Pines (Valentine and Stock 2008).

Carnaby's Black Cockatoo has undergone a dramatic decline in recent years, declining by 50 percent in the past 45 years, one of the main contributing factors being land clearing (DEC 2009). The long-term survival and recovery of this species is linked to the survival of its habitat – both in breeding areas in the wheatbelt and non-breeding areas (though these areas are changing overtime) such as the Swan Coastal Plain (DEC 2009). In addition, clearing of heathland near breeding sites has reduced the availability of food for breeding pairs and their young (DEC 2009).

Baudin's Black Cockatoo

Baudin's Black Cockatoo is a large black cockatoo which measures 50–57 cm in length, with a wingspan of approximately 110 cm, and a mass of 560–770 g. It is mostly dull black in colour, with pale whitish margins on the feathers, large, rounded patches on the ear coverts, and rectangular white panels in the tail. It has a large bill that is coloured black in the male and whitish-grey with a black tip in the female. It also features a dark brown iris that is surrounded by a reddish-pink eye-ring in the male and a grey eye-ring in the female (Higgins 1999; Johnstone and Storr 1998)

This species is only found in the extreme South-west of Western Australia. It occurs in areas of high rainfall and usually in heavily forested locations dominated by Marri, Karri or Jarrah. However, it also occurs in woodlands of Wandoo (*E. wandoo*), Blackbutt (*E. patens*), Flooded Gum (*E. rudis*), Yate (*E. cornuta*) and in orchards, and is occasionally recorded in farmland and grasslands (Johnstone and Kirkby 2008).

The diet of Baudin's Black Cockatoo consists mostly of Eucalyptus seeds (e.g. Marri and Jarrah) and occasionally insect larvae and the seeds of other plants such as *Banksia, Dryandra, Erodium, Hakea, Malus sylvestris* (apple) and *Pyrus communis* (pear), and occasionally with nectar from Marri or other plants (Higgins 1999).

Baudin's Black-Cockatoo is gregarious. It is usually seen in groups of three (comprising the adult pair and a single dependent young) or in small parties, but will occasionally gather in large flocks of up to 300 birds during the non-breeding season, usually at sites where food is abundant (Higgins 1999). During the breeding season, adults nest in solitary pairs.

Loss of habitat was previously the major threat to Baudin's Black Cockatoo, however, currently the major threats appear to be illegal shooting and competition with introduced bees for nest hollows.

Forest Red-tailed Black Cockatoo

The Forest Red-tailed Black Cockatoo is 55–60 cm in length and weighs between 570 - 870 g (Higgins 1999). Males can be distinguished by broad red tail panels that are only visible when taking off or alighting (Higgins 1999). Females on the other hand can be distinguished by yellow or whitish spots on the feathers of the head and upper wing coverts. Their tail feathers are bright red and orange, grading to yellow on the inner margins, and have variable black horizontal barring.

This species is endemic to the South-west humid and semi-humid zones of Western Australia. Historically, It typically inhabited dense Jarrah, Karri and Marri forests which received more than 600 mm average annual rainfall (SEWPaC 2012). Although most records are in Jarrah-Marri forests, the Forest Red-tailed Black Cockatoo has been observed in a range of other forest and woodland types, including Blackbutt (*E. patens*), Wandoo (*E. wandoo*), Tuart (*E. gomphocephala*), Albany Blackbutt, Yate (*E. cornuta*), and Flooded Gum (*E. rudis*) (Abbott 1998a and b).

Forest Red-tailed Black Cockatoos feed predominantly on the seeds of Jarrah and Marri fruits. The other species used for feeding include Blackbutt, Albany Blackbutt, Forest Sheoak, Snottygobble and the non-indigenous native Spotted Gum and Cape Lilac (Johnstone and Kirkby 1999).

The Forest Red-tailed Black Cockatoo has declined in range by 25–30% as a result of clearing of the margins of the forests for agriculture in the early 1900s (Mawson and Johnstone 1997) and is projected to further decline by 30% or more between 2005 and 2015 (Chapman 2005).

Key threats to the Forest Red-tailed Black Cockatoo are habitat loss, nest hollow shortage and competition for available nest hollows from other species, and injury or

death from the European Honeybee (*Apis mellifera*), illegal shooting (Chapman 2005) and fire (CALM 2006).

1.2 Black Cockatoo Referral Guidelines

In addition to the State and Commonwealth legislation, there are also specific EPBC Act referral guidelines for the three threatened species of Black Cockatoo that occur in the south-west of WA (DSEWPaC 2012a – now Department of the Environment [DotE]). These guidelines are intended to assist proponents in determining whether a proposed action needs to be referred (Table 2). The guidelines also provide among other things, recommendations, as to how the habitat assessment should be undertaken, and this forms the basis of this Black Cockatoo assessment.

Table 2: Black Cockatoo Referral Guidelines (see DSEWPaC 2012a).

HIGH RISK OF SIGNIFICANT IMPACTS: REFERRAL RECOMMENDED
• Clearing of any known nesting tree; • Clearing or degradation of any part of a vegetation community known to contain breeding habitat; • Clearing of more than 1 ha of quality foraging habitat; • Clearing or degradation (including pruning the top canopy) of a known night roosting site; and • Creating a gap of greater than 4 km between patches of Black Cockatoo habitat (breeding, foraging or roosting).
MEDIUM RISK OF SIGNIFICANT IMPACTS: REFERRAL RECOMMENDED
• Degradation (such as through altered hydrology or fire regimes) of more than 1 ha of foraging habitat. Significance will depend on the level and extent of degradation and the quality of the habitat; • Clearing or disturbance in areas surrounding Black Cockatoo breeding, foraging or night roosting habitat that has the potential to degrade habitat through introduction of invasive species, edge effects, hydrological changes, increased human visitation or fire; • Actions that do not directly affect the listed species but that have the potential for indirect impacts such as increasing competitors for nest hollows; and • Actions with the potential to introduce known plant diseases such as *Phytophthora* spp. To an area where the pathogen was not previously know.
LOW RISK OF SIGNIFICANT IMPACTS: REFERRAL RECOMMENDED

HIGH RISK OF SIGNIFICANT IMPACTS: REFERRAL RECOMMENDED
● Actions that do not affect Black Cockatoo habitat or individuals; and ● Actions whose impacts occur outside the modeled distribution of the three Black Cockatoos.

1.3 Objectives

The objectives of the Black Cockatoo assessment were to:

- Determine the extent of potential Black Cockatoo foraging habitat in the survey area;
- Record the location and number of potential breeding or actual breeding trees used by the Black Cockatoo species; and
- Record the location and number of any Black Cockatoos observed in the survey area.

2 Methods

2.1 Background Research

The background research is designed to gather existing data on known feeding and breeding locations of Black Cockatoos. The background research and desktop survey included the review of the following:

- WA Department of Parks and Wildlife (DPaW) and DotE databases and websites;
- EPBC Act referral guidelines for three threatened Black Cockatoo species; and
- Reports of previous studies undertaken in the survey area or nearby if publically available.

2.2 Black Cockatoo Assessment

2.2.1 Survey Personnel and timing

The Black Cockatoo assessment was conducted on 22 November 2013 by Hayden Ajduk, and involved a foraging and breeding assessment of the survey area.

2.2.2 Black Cockatoo Foraging Habitat Assessment

The Black Cockatoo foraging assessment of the survey area was undertaken to determine the extent of foraging habitat for Black Cockatoos. The assessment included:

- Searches for known dietary trees and shrubs;
- General habitat suitability;
- Analysis of dentition marks in seed and nut material if found; and
- Opportunistic observations of Black Cockatoos.

Feeding trees and opportunistic observations were recorded and located using a hand held GPS unit (Appendix A).

2.2.3 Black Cockatoo Breeding Habitat Assessment

In order to determine if breeding habitat (potential breeding or breeding trees) were present, vegetated sections of the survey area were traversed and species of trees known to be used for nesting e.g. Tuart, Jarrah and dead trees were searched for. Once located, suitable trees (trees species known to be used for nesting) were assessed based on criteria found in the SEWPaC Black Cockatoo referral guidelines:

- Diameter at Breast Height (DBH) ≥ 500 mm (300 mm for Wandoo and Salmon Gum); and
- Hollows present and their size greater than 12 cm (entrance diameter).

The diameter of the trees was measured with a DBH tape measure. Trees with a DBH ≥ 500 mm are considered to have hollow bearing potential, and as such are deemed potential breeding habitat.

Other important information recorded included tree height, tree location (using a GPS) and signs of use, such as droppings and feathers were also searched for under each tree, particularly if hollows were noted.

If hollows were present each was viewed with the use of binoculars to determine its suitability for use by Black Cockatoo species as a breeding hollow (noting that for many hollows it is not possible to determine their suitability without climbing the tree and inspecting the hollow, as the hollows depth and internal width cannot be seen from ground level). Any suitable hollows that were seen were assessed to determine if they were being used by Black Cockatoo species as a breeding hollow. The assessment method takes into consideration the size and shape of the hollow, chew marks around the entrance, feathers or droppings nearby.

3 Results

The following summarises the results of the Black Cockatoo foraging and breeding assessments of the survey area.

3.1 Background Research

A search of the DotE protected matters search tool revealed that the Endangered Carnaby's Black Cockatoo, Vulnerable Baudin's Black Cockatoo and Forest Red-tailed Black Cockatoo potentially occur in the survey area. These Black Cockatoos are likely to occur in the survey area (based on the database search results and the foraging and breeding habitat present in the survey area).

3.2 Black Cockatoo Field Assessment

3.2.1 Black Cockatoo Foraging Assessment

Suitable foraging habitat was recorded in the survey area in the form of remnant Tuart trees .The understorey in survey area consisted of exotic garden species and therefore not considered suitable foraging habitat for Black Cockatoos.

No evidence of Black Cockatoo feeding was observed during the assessment.

A total of 0.88 ha of potential foraging habitat was identified in the survey area and is illustrated in Figure 2.

3.2.2 Black Cockatoo Breeding Habitat Assessment

A total of 19 Tuart trees that have the potential to be used for breeding were recorded within the survey area i.e. trees with a DBH ≥ 500 mm. The mean size was 848 mm ± 294 mm (standard deviation).

The locations of the potential breeding trees are listed in table x and illustrated in Figure 3.

Table 3: Potential Breeding Tree Data and Locations

Tree ID	Species	Tree Height	DBH	MGA Zone 50	
				Eastings*	Northings*
1	*Eucalyptus gomphocephala*	*18m*	87cm	387902	6424971
2	*Eucalyptus gomphocephala*	*28m*	111cm	387885	6424637
3	*Eucalyptus gomphocephala*	*32m*	136cm	387889	6424649
4	*Eucalyptus gomphocephala*	*28m*	118cm	387884	6424616
5	*Eucalyptus gomphocephala*	*21m*	57cm	387859	6424609
6	*Eucalyptus gomphocephala*	*26m*	102cm	387863	6424634
7	*Eucalyptus gomphocephala*	*28m*	130cm	387842	6424630

8	*Eucalyptus gomphocephala*	*25m*	59cm	387837	6424658
9	*Eucalyptus gomphocephala*	*25m*	52cm	387834	6424669
10	*Eucalyptus gomphocephala*	*18m*	51cm	387842	6424671
11	*Eucalyptus gomphocephala*	*31m*	60cm	387827	6424660
12	*Eucalyptus gomphocephala*	*29m*	54cm	387825	6424675
13	*Eucalyptus gomphocephala*	*30m*	53cm	387826	6424679
14	*Eucalyptus gomphocephala*	*28m*	58cm	387828	6424684
15	*Eucalyptus gomphocephala*	*31m*	83cm	387851	6424701
16	*Eucalyptus gomphocephala*	*35m*	82cm	387860	6424697
17	*Eucalyptus gomphocephala*	*28m*	90cm	387852	6424684
18	*Eucalyptus gomphocephala*	*25m*	108cm	387843	6424681
19	*Eucalyptus gomphocephala*	*29m*	121cm	387874	6424682

*GDA94

3.3 Black Cockatoo Opportunistic Observations

No Black Cockatoos were observed in the survey area during the survey.

4 Conclusion and Recommendations

A total of 19 Tuart trees were recorded in the survey area that meet SEWPaC's criteria (≥ 500 mm DBH) for the potential to develop suitable hollows for which Black Cockatoo species can nest in.

Suitable hollows can take from 120–150 years to develop (Pittman *et al.* 2007). The size of the tree (DBH) is a good indication of the hollow-bearing potential of the tree (Whitford 2002). Trees approaching 680 mm DBH are close to developing suitable hollows. Trees smaller than 680 mm DBH are considered to have the potential to develop hollows and are therefore also important resources for Carnaby's Black Cockatoos.

In addition to the breeding habitat, 0.88 ha of suitable foraging habitat was identified in the survey area. Despite the presence of suitable foraging species, no indirect foraging evidence in the way of chewed Tuart nuts was observed. The lack of foraging evidence could be explained by the high level of disturbance associated with construction works along Fifty road.

The results of the Black Cockatoo habitat assessment suggest that the survey area contains a range of low to good quality Black Cockatoo habitat due to the presence of forging species and the presence of potential breeding trees.

The *EPBC Act referral guidelines for three threatened black cockatoo species* (DotE, 2012) outlines the preferred habitat of each of the protected Black Cockatoo species, and provides guidance on when to refer a project that may potentially impact on these species. The guidelines state that there is a high risk of potential impacts for any proposal that will result in the following:

- Clearing of any known nesting tree.
- Clearing or degradation of any part of a vegetation community known to contain breeding habitat.
- Clearing of more than 1 ha of quality foraging habitat.
- Clearing or degradation (including pruning the top canopy) of a known night roosting site.
- Creating a gap of greater than 4 km between patches of black cockatoo habitat (breeding, foraging or roosting).

A referral to the DotE under the EPBC Act is recommended for any projects that are likely to result in any of the above impacts.

5 Limitations

This report is produced strictly in accordance with the scope of services set out in the contract or otherwise agreed in accordance with the contract. 360 Environmental makes no representations or warranties in relation to the nature and quality of biological results other than the visual observation and analytical data in this report.

In the preparation of this report, 360 Environmental has relied upon documents, information, data and analyses ("client's information") provided by the client and other individuals and entities. In most cases where client's information has been relied upon, such reliance has been indicated in this report. Unless expressly set out in this report, 360 Environmental has not verified that the client's information is accurate, exhaustive or current and the validity and accuracy of any aspect of the report including, or based upon, any part of the client's information is contingent upon the accuracy, exhaustiveness and currency of the client's information. 360 Environmental shall not be liable to the client or any other person in connection with any invalid or inaccurate aspect of this report where that invalidity or inaccuracy arose because the client's information was not accurate, exhaustive and current or arose because of any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to 360 Environmental.

Aspects of this report, including the opinions, conclusions and recommendations it contains, are based on the results of the investigation, sampling and testing set out in the contract and otherwise in accordance with normal practices and standards. The investigation, sampling and testing are designed to produce results that represent a reasonable interpretation of the general conditions of the Site that is the subject of this report. However, due to the characteristics of the Site, including natural variations in site conditions, the results of the investigation, sampling and testing may not accurately represent the actual state of the whole site at all points.

It is important to recognise that site conditions, including the extent and concentration of contaminants, can change with time. This is particularly relevant if this report, including the data, opinions, conclusions and recommendations it contains, are to be used a considerable time after it was prepared. In these circumstances, further investigation of the Site may be necessary.

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6 References

Abbott, I. (1998a). Counting cockatoos: The status of the Forest Red-tailed Black Cockatoo. *Landscope*. **13** (2):10-16.

Abbott, I. (1998b). Conservation of the Forest Red-tailed Black Cockatoo, a hollow-dependent species, in the eucalypt forests of Western Australia. *Forest Ecology and Management*. **109**,175-185.

Chapman, T. (2005). Forest Black Cockatoo (Baudin's Cockatoo Calyptorhynchus baudinii) and Forest Red-tailed Black Cockatoo (Calyptorhynchus banksii naso) Draft Recovery Plan, June 2005-June 2015 (Department of Conservation and Land Management: Perth). Perth: Department of Conservation and Land Management.

Conservation and Land Management, Department of (CALM) (2006). Records held in CALM's Declared Flora Database and rare flora files. Perth, Western Australia: WA CALM.

Department of Environment and Conservation (DEC) (2009). Carnaby's Black-cockatoo *Calyptorhynchus latirostris* (Carnaby 1948) www.dec.wa.gov.au/component/option,com_docman/Itemid,/gid,117/task,doc_download/ Accessed on 30/7/2012.

Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) (2012a). EPBC Act Referral guidelines for three threatened black cockatoo species. http://www.environment.gov.au/epbc/publications/pubs/referral-guidelines-wa-black-cockatoo.pdf Accessed on 30/7/2012.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC). (2012b). Interim Biogeographic Regionalisation for Australia, Version 7.

Higgins, P.J., ed. (1999). Handbook of Australian, New Zealand and Antarctic Birds Volume 4: Parrots to Dollarbird. Melbourne: Oxford University Press.

Johnstone, R.E. and Kirkby, T. (1999). Food of the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* in South-west Western Australia. *Western Australian Naturalist*. 22:167-177.

Johnstone, R.E., C. Johnstone, T. Kirkby & G. Humphreys (2006). Perth-Bunbury Highway (Kwinana Freeway Extension and Peel Deviation): Targeted Threatened Fauna Survey. Unpublished Report to Main Roads Western Australia.

Johnstone, R.E. and Storr, G.M. (1998). Handbook of Western Australian Birds Volume 1 – Nonpasserines (Emu to Dollarbird), Western Australian Museum.

Mawson, P. and Johnstone, R.E. (1997). Conservation status of parrots and cockatoos in Western Australia, *Ecletectus* **2**, 4-9.

Mitchell, D., Williams, K., & Desmond, A. (2002). Swan Coastal Plan 2 (SWA2 – Perth subregion). In A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions. Perth: Department of Conservation and Land Management.

Pittman, H., R, Scott., D, Stojanovic & L, McLellan (2007). Caring for Carnaby's. *Wingspan* **17** No. 4.

Saunders, D.A. (1974). Subspeciation in the White-tailed Black Cockatoo, *Calyptorhynchus baudinii*, in Western Australia. *Australian Wildlife Research* **1**, 55-69.

Whitford, K.R. (2002). Hollows in jarrah *(Eucalyptus marginata)* and marri *(Corymbia calophylla)* trees I. Hollow sizes, tree attributes and ages. *Forest Ecology and Management* **160**, 201-214.

Valentine, L. and Stock, W. (2008). Food resources of Carnaby's Black-Cockatoos in the Gnangara Sustainability Study Area. Technical report for the Forest Products Commission (Perth, Western Australia) in support of the Gnangara Sustainability Strategy (GSS).

FIGURES

Legend

Site Location

Roads

0 25 50 100 150 200

Metres

1:8,000 @ A4

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

a 10 Bermondsey St, West Leederville, 6007 WA
t (08) 9388 8360
f (08) 9381 2360
w www.360environmental.com.au

DRAWING ID	DATE
265_site_location.mxd	11-Dec-2013

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
CS	HA	RF	0

Burgess Design Group Pty Ltd
Lot 774, Fifty Road

Black Cockatoo Assessment

Figure 1 - Site Location

- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE 2012
- LOCALITY MAP SOURCED FROM LANDGATE 2006
- STREET DIRECTORY MAP SOURCED FROM STREETSMART 2008
- ROADS SOURCED MAIN ROADS WA 2012

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Legend

- Site Location
- Foraging Habitats

0 5 10 20 30 40

Metres

1:1,000 @ A4

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

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265_foraging_habitat.mxd	11-Dec-2013

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CS	HA	RF	0

Burgess Design Group Pty Ltd
Lot 774, Fifty Road

Black Cockatoo Assessment

Figure 2 - Foraging Habitat

- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE 2012
- LOCALITY MAP SOURCED FROM LANDGATE 2006
- STREET DIRECTORY MAP SOURCED FROM STREETSMART 2008
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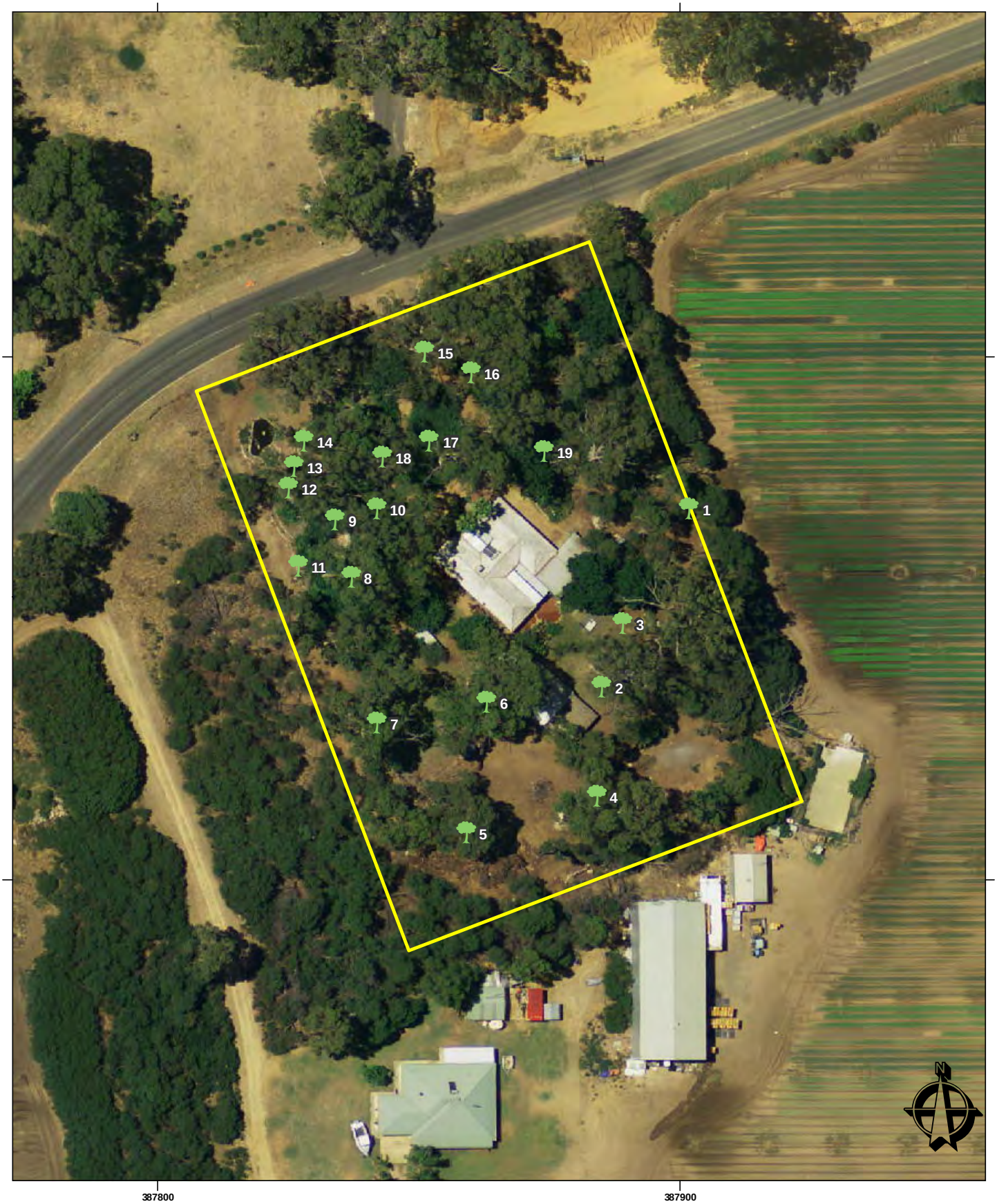

Legend

Site Location

Eucalyptus gomphocephala

0 5 10 20 30 40

Metres

1:1,000 @ A4

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

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DRAWING ID	DATE
265_breeding_habitat.mxd	11-Dec-2013

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
CS	HA	RF	0

Burgess Design Group Pty Ltd
Lot 774, Fifty Road

Black Cockatoo Assessment

Figure 3 - Potential Breeding Habitat

- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE 2012
- LOCALITY MAP SOURCED FROM LANDGATE 2006
- STREET DIRECTORY MAP SOURCED FROM STREETSMART 2008
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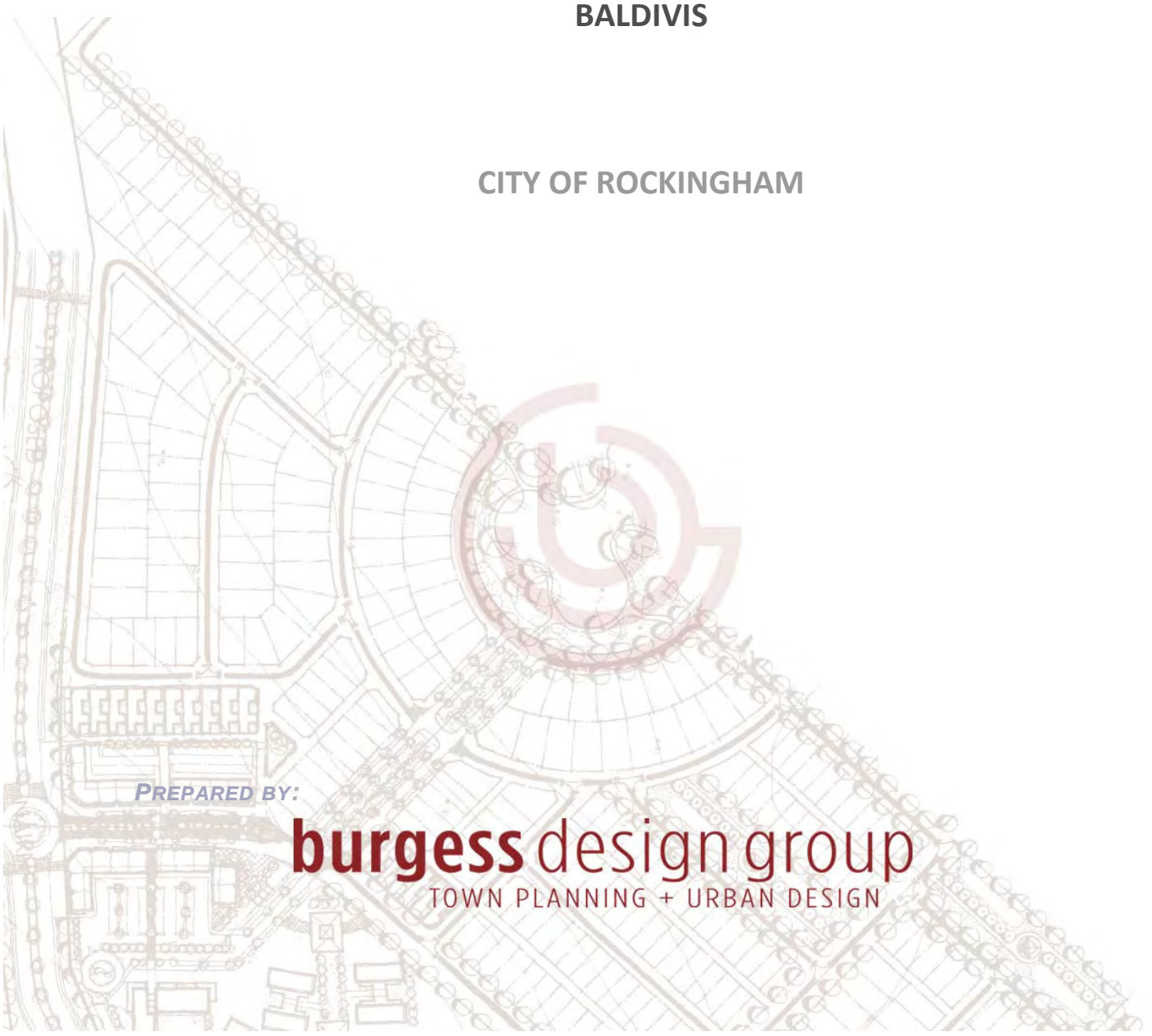
APPENDIX 3
FIRE MANAGEMENT PLAN ADDENDUM

FIRE MANAGEMENT PLAN
(ADDENDUM TO SPIRES ESTATE FMP)

LOT 774 (No. 125) FIFTY ROAD,

BALDIVIS

CITY OF ROCKINGHAM



PREPARED BY:

burgess design group

TOWN PLANNING + URBAN DESIGN

Lot 774 (No.125) Fifty Road
BALDIVIS

CITY OF ROCKINGHAM

Fire Management Plan
(Addendum to Spires Estate FMP)

ISSUE 1: July 2014

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Job code: CAS BAL
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Revision No: 01

Quality Assurance

Issue/Version:	Date:	Author:	Reviewer:
1	17 February 2014	Jaclyn DRUMMOND	Mark SZABO

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Any representations, statements, opinions and advice whether expressed or implied within this document are based on information contained within the Planning for Bush Fire Protection Guidelines ,Ed. 2, FESA & WAPC (2010), the Australian Standard for the construction of buildings in bushfire prone areas (AS3959-2009), and a desktop analysis of the land undertaken in 2013 & 2014

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1. INTRODUCTION

The orderly development of urban land and the protection of community safety necessitate the assessment of hazards and risks. In assessing development proposals at the strategic level, the emphasis is on preventing or minimising major hazardous incidents on-site, such as impacts from bush fire.

A Fire Management Plan has been prepared by Strategen as part of the Spires Estate Local Structure Plan. This subsequent Bush Fire Hazard Assessment (BFHA) has been prepared by Burgess Design Group, on behalf of Niroda Holdings Pty Ltd, as an addendum to the Spires Estate Fire Management Plan in support of a minor amendment to the Spires Estate LSP to include Lot 774 (No. 125) Fifty Road, Baldivis ('subject land' or 'subject site').

This BFHA has been prepared in accordance with the methodology for classifying bush fire hazards, performance criteria and acceptable solutions for bush fire management, and model fire management plan contained within in the WAPC/FESA Planning for Bush Fire Protection Guidelines, Edition 2, 2010 ('The Guidelines'). It takes into account the various physical attributes of the subject land including its topography; on-site and surrounding vegetation; local climate; past and current land uses; and fire history, to assess the potential threat from bush fire. It will then assess the proposed development and its land management practices, such as road access and water supply, to determine the suitability of the land for subdivision.

This is a preliminary BFHA provided to ensure the capability of the subject site for residential development, by classifying the bush fire hazard at the strategic level only. A final BFHA and Fire Management Plan may be required to be carried out by either the Developer at the subsequent subdivision stage, or landowners a the building permit stage, to determine site specific bushfire attack levels (BAL), and to ensure the BFHA remains up to date and reflects the most current fire protection and management procedures.

This BFHA addresses issues associated with bushfires within an urban development context only. It does not deal with the management of internal residential fires.

This document and the recommendations contained are aligned to the following policy and guidelines:

- WAPC Planning for Bushfire Protection (Edition 2 2010);
- AS 3959-2009 Construction of Buildings in Bushfire Prone Areas; *and*
- Bushfires Act 1954

Other documents that have been prepared for the subject land and are relevant to the future subdivision proposal, which should be consulted when reading this BFHA, include:

- Spires Estate Local Structure Plan (including technical appendices);
- Spires Estate Hazard Assessment and Fire Management Plan;
- Lot 774 Fifty Road Baldivis Local Structure Plan Amendment Report;
- Lot 774 Fifty Road Baldivis Environmental Assessment Report;
- Lot 774 Fifty Road Baldivis Preliminary Engineering Infrastructure Report;
- Lot 774 Fifty Road Baldivis Technical Note (Traffic).

2. AIM

The aim of this preliminary Bush Fire Hazard Assessment (BFHA) is to:

(a) provide a comprehensive assessment of the bush fire hazard level of the subject land and its surrounds;

(b) address the potential bush fire risk (i.e. whether natural or deliberate acts); and

(c) identify possible fire protection measures to reduce the occurrence of, and minimise the impact of bush fires, thereby reducing threat to life, property and the environment.

Generally, this BFHA reviews the capability of the subject land for development at a strategic level and identifies any additional considerations that may be required to mitigate the impact of bush fire on the community.

This BFHA will provide guidance as to how to plan for and manage potential bushfire threat on future residential housing and relevant community uses.

The final bush fire hazard assessment required at later stages of development will extend upon and update the preliminary BFHA with design information that becomes available as the project progresses and the Spires Structure Plan area develops.

3. OBJECTIVES

The objective of the Bush Fire Hazard Assessment is to develop a comprehensive understanding of the hazards and risks associated with the inclusion of the subject land within the Spires Estate Structure Plan and the subsequent development of land for urban purposes.

The main elements of hazard analysis to be achieved are:

1) Identification of hazards and potential risk to life and property posed by bushfires;

2) Analysis of the consequence of incidents on people, property and the environment;

3) Evaluation of the likelihood of such events occurring;

4) Evaluation of the location for zones, reserves and subsequent land uses; *and*

5) Identify opportunities for risk reduction such as:

- fire management strategies;
- ensuring development of land is in an area where the bush fire hazard level is manageable;
- Ensuring the safe movement of emergency and other vehicles through the development at all times;
- Ensuring the development is provided with a secure water supply that is sufficient for fire fighting purposes.

The BFHA seeks to ensure that hazards are identified, evaluated, eliminated or controlled to an acceptable level.

The BFHA also seeks to ensure the developer, future residents and relevant government agencies, such as the City of Rockingham and Department of Fire and Emergency Services (DFES), are fully aware of the level of risk and their responsibilities in implementing recommended strategies to mitigate risk.

4. DESCRIPTION OF THE AREA

4.1 General

This Bushfire Hazard Addendum Report applies to a single landholding, being Lot 774 (No. 125) Fifty Road, Baldivis. The subject land comprises a total area of 9,204m^2 and is zoned Urban under the Metropolitan Region Scheme (MRS) and Development under the subsequent Town Planning Scheme No.2.

Both the MRS and TPS zonings support future development of the land for urban purposes.

Lot 774 Fifty Road is located within the City of Rockingham's Baldivis North District Structure Plan (DSP) area and abuts the Spires Estate Structure Plan (SESP), to which an amendment is being sought to include the subject land.

The subject site is bound by Fifty Road to the north with rural and urban land uses adjacent. Lot 313 surrounds the site to the east, south and west, which falls within the SESP area and is identified for future urban and residential land uses.

Refer to Figure 1 for a Location Plan.

4.2 Land Use

The subject site currently accommodates a single residence with associated outbuildings (shed) as shown on the attached Aerial photograph (Figure 2). Majority of the site is covered by remnant vegetation however this will be cleared to accommodate future development.

Fifty Road adjoins the site to the north and provides an east west connection from Eighty Road west to Mandurah Road; it is classified as a local distributor road. It is currently constructed as a single carriageway, un-kerbed two-lane rural road to the west. Urban development within the DSP area requires an upgrade of Fifty Road to a Neighbourhood Connector 'A' standard, comprising two 5m carriageways, a 2m median and will include a round-a-bout intersection with McDonald Road.

Adjacent land uses on the north side of Fifty Road are zoned for urban development to accommodate future residential subdivisions. Upgrades to Fifty Road have already commenced east of the subject site as a part of subdivisional works.

Lot 313 (No. 187) Fifty Road surrounds the subject site on its eastern, southern and western boundaries. This land parcel has been primarily cleared to accommodate market gardening however some vegetation remains and provides screening between residences on the two properties.

Any retained vegetation will be removed to accommodate future development as prescribed by the SESP.

The Structure Plan Amendment proposes residential land uses at densities ranging from R25 to R40 for the subject site. The overall SESP connects the subject the site with existing surrounding local roads, providing access points to link the site with surrounding development.

Figure 3 shows the Proposed Structure Plan for the subject land, as integrated with the SESP.

4.3 Site Characteristics

When, where, whether and how a bushfire burns is influenced by daily weather and the seasonality of rainfall at any location, being a reflection of climate (Handmer *et al*, 2008). Wind, temperature, humidity and rainfall are all climatic elements that affect the behaviour of bushfires (Bureau of Meteorology, retrieved September 2013).

For a general overview and further information on local climate, temperature and rainfall statistics, landform and topography, and how they affect the risk of a bushfire occurring at the subject land, refer to the main Spires Estate Fire Management Plan report (Appendix 1).

4.3.1 Assets

The subject site is 9,204m^2 in size, and accommodates a residence with an associated shed and some remnant vegetation, as is evident in the Aerial Photograph (Figure 2).

All existing improvements will be demolished and removed from the subject land as part of future development works. As such, the existing improvements are not considered assets for the purpose of the Bush Fire Hazard Assessment.

The relevant Spires Estate Structure Plan Amendment proposes the subject land be zoned for residential uses. It is anticipated the site will accommodate up to 20 dwellings in the future.

The SESP also identifies an 18m 'Access Street C' road reserve within the subject site, connecting Fifty Road with the remainder of the Spires Structure Plan area. This proposed Access Street C dissects the subject site through its centre, resulting in any future residential development being located along the periphery of the subject land (refer Figure 3 Structure Plan Amendment Map)

There are no known unregistered or registered Aboriginal or European heritage sites located within the subject land and it is not registered or protected under the *Aboriginal Heritage Act (1972)* or on any local or State heritage inventory. The subject land is therefore not considered to contain any heritage assets for the purpose of this Hazard Assessment.

Once developed, a range of community and natural assets could be at risk. Those values which will be potentially affected by fire include:

1. **Human lives:** 52 people could be resident at the newly created subdivision; and
2. **Assets**: The development will contain an estimated 20 dwelling units and valuable public infrastructure.

4.3.2 Access

The proposed amendment area is located at the northern edge of the Spires Estate Structure Plan area, along Fifty Road. The proposed internal neighbourhood connector provides the key linkage for development to the existing road network and Spires Estate.

A comprehensive internal public road network will be provided throughout the Spires Estate project area to service the proposed development, to ensure there will be a high degree of connectivity between the subject site and surrounding residential developments.

The internal road will act as a cul-de-sac until such time as surrounding Lot 313 is developed.

The planned internal street network is considered sufficiently permeable to allow good site access and traffic circulation, allowing emergency and other vehicles to move through it easily and safely at all times. The internal street layout and points of egress/ ingress are highlighted in Figures 6 and 7.

4.3.3 Water Supply

As indicated in the Spires Estate FMP, there is currently no reticulated water supply. An extension of the existing reticulated water supply will be required as part of any subdivision approval.

Furthermore, the Developer will be required is to install fire hydrants in accordance with the specifications of the Water Corporation's No.63 Water Reticulation Standard' as deemed to be the baseline criteria for development in this regard.

All fire hydrants are to be located to the satisfaction of Department of Fire and Emergency Services (DFES) and the Water Corporation and will be road marked and sign posted to a standard acceptable to the Department and the City of Rockingham.

5. FIRE PROBLEM

Bushfires can occur every summer; they can start suddenly and without warning. People have been killed or seriously injured, and many homes destroyed due to bushfires. The basic factors which determine whether a bushfire will occur include the presence of fuel, oxygen and an ignition source. More specifically, fire intensity and the speed at which a bushfire spreads will depend on ambient temperature, fuel load, fuel moisture, wind speed and slope angle (GeoScience Australia, retrieved September 2013).

5.1 Bush Fire History

Bushfires can originate from both human activity and natural causes with lightning the predominant natural source. Fires of human origin are classified as either accidental or deliberate (GeoScience Australia, retrieved September 2013) and many of the bushfires that plague Australia every season, destroying land, property and lives, are deliberately lit (Handmer et al 2008).

According to the Spires Estate Fire Management Plan (V. 4), the most recent bush fire in the vicinity of the estate occurred in 2012, being a prescribed burn to reduce fuel loads within Baldivis Nature Reserve.

Refer to Appendix 1 for more details on Bush Fire History related to the site.

5.2 Bush Fire Hazard

The main fuel for a bushfire comprises vegetation, litter and debris that accumulates on the ground. The type and extent of fuel on the ground depends on the type of vegetation that produces the fuel. The level of hazard also depends on fuel continuity (horizontal and vertical), height, amount (weight), proportion of dead material, thickness of the foliage and twigs, and flammability of the live foliage (McCarthy *et al*, 2010).

Depending on the predominant vegetation (type and class), fuel load (in tonnes per hectare) and the slope of the land, bush fire hazard levels designated as low, moderate or extreme are applied to different locations within and surrounding the subject site, in accordance with the WAPC Guidelines. The Spires Estate Structure Plan FMP (refer Appendix 1) has provided an assessment of the surrounding hazards, including the subject land, which is located at Figures 4 and 5.

This hazard assessment provides an indication of the fire intensity and likelihood of fire attack on the proposed residential development of Lot 774 Fifty Road. The assessment evaluates the suitability of the land for residential uses and takes into account:

1. Vegetation Assessment – type and class in each direction;
2. Distance - between the predominant vegetation class and proposed building;
3. Topography and slope – with reference to accessibility; and
4. Land use – current and proposed.

5.2.1 Bushfire Hazard Ratings

A vegetation classification map has been prepared for the Spires Estate Structure Plan, including the subject site and landholdings within 100m (Figure 5). This assessment classifies the fuels and ultimately determines the hazard rating associated with each vegetation complex.

In accordance with the WAPC Guidelines (2010), the hazard levels are determined based on the predominant vegetation and are identified as being either of low, moderate or extreme bush fire hazard risk.

For the purposes of the Guidelines, all areas within 100m of a moderate or extreme bush fire hazard level are considered to be Bush Fire Prone Areas for planning purposes and for determining appropriate building controls (WAPC, 2010).

Images 1 to 6 below provide a visual representation of the fuel loads for each relevant vegetation type (refer Illustration 4) as they relate to Lot 774 Fifty Road.

Whilst the Bushfire Hazard Ratings (Low, Moderate or Extreme) are based on the vegetation classification mapping, the risk assessment has also taken into consideration the ultimate landscape of the subject land and surrounding land parcels.

The Spires Estate Bushfire Hazard Rating Map, which relates to the subject land is attached at Figure 5.

5.3 On-site Vegetation Assessment

The Environmental Assessment carried out by 360 Environmental provides an overview of the vegetation within the subject land and along its periphery. The regional vegetation complex on the site is mapped as ‘representative of the ‘Cottesloe (Central and South)’ complex which is described as *a mosaic of woodland and open forest.*

The assessment further determined that apart from 19 larger remnant trees, the understorey and remaining vegetation consisted of exotic garden species, holding no significant environmental value. These species will therefore be removed as part of any future development.

Image 1. Northern boundary of subject land (Open Forest)

5.4 Off-site Vegetation Assessment

Some vegetation that exists outside the subject site (refer Figure 2 Aerial) which should be considered as part of the FMP is described below and is further assessed under the relevant Spires Estate Fire Management Plan report:

Image 2. Eastern boundary of subject site and adjoining market garden.

Image 3. Looking west towards the eastern boundary of subject site from adjoining market garden.

Images 2 and 3 above highlight the transition of vegetation from Open Forest along the eastern boundary of the subject land to Grassland vegetation that exists on the adjoining market garden. Evidence of the Woodland vegetation within the SPES area to the south of the subject site can be seen in the background.

Images 4 and 5 below depict the area of screening vegetation between the residences of Lots 774 and 313 Fifty Road. Vegetation along this western boundary of the subject site and within Lot 313 is classified as Closed Scrub.

Image 4. Closed Scrub along western boundary of subject site

Image 5. Closed Scrub and surrounding market garden (Grassland) within Lot 313, as viewed from Fifty Road, looking east towards the subject site

5.5 Bush Fire Risk

In accordance with the Spires Estate FMP, the level of risk adjacent vegetation poses needs to be considered as either permanent or temporary.

Importantly, land along the western boundary within Lot 313 is considered an Extreme Hazard. Development along this western boundary has therefore been classified as being within the Flame Zone and is not suitable for habitation until such time as the Hazard has been removed or is reduced and no longer a threat.

As such, the Closed Scrub along the western boundary of the site and within Lot 313 is not considered a permanent threat as the land is zoned urban and designated for residential uses under the Spires Estate Structure Plan.

Land to the north-west of the subject site and north of Fifty Road is considered a permanent bush fire risk. This is a result of the rural zoning and the extent of classified vegetation within these land parcels.

Whilst the majority of vegetation within the subject land and surrounding Lot 313 will be removed to accommodate residential development, existing vegetation within 100m of the site does pose an immediate level of risk and development staging needs be considered as a result. Any land within 100m of vegetation will need to comply with the development performance criteria as set out in Table 6 of the Spires Estate FMP (refer Appendix 1).

5.5.1 Managing Risk

Residents who live in areas which may be exposed to bush fires must also take responsibility to manage bushfire risk. Responsible bushfire management includes many aspects including, but is not limited to,

- being well informed about bushfire risk and management;

- leaving well before an area is affected by a bushfire or actively protecting a property; *and*

- adequately maintaining a property.

Land use planning, development controls and building standards have a central role in reducing the risk to people and property from bushfire. Modification of elements of the landscape is an important means of reducing risks to assets. Among the objectives of landscape modification are reducing the probability of a bushfire starting, slowing its spread, limiting its intensity so that it might be controlled, and maintaining ecological processes and biodiversity.

Section 4.2.5 of the Spires Estate FMP shall be adhered to for Lot 774 which requires "compliance with performance criteria for a 'Moderate' bush fire hazard level to be achieved, focussing on the key areas of development location, vehicular access, water supply, siting of development and design of development".

6. BUSH FIRE HAZARD MANAGEMENT

Given the subject land falls within an area with some Moderate and Extreme bushfire hazard ratings, development needs to be supported by an assessment of the fire risk and compliance with the performance criteria and acceptable solutions set out in the WAPC Planning for Bushfire Protection Guidelines (2010).

In accordance with the Guidelines (WAPC, 2010), a performance-based approach to fire hazard management has been adopted. The management issues and the desired outcome of each issue to be addressed are:

1. **Location** - To ensure that development/intensification of land use is located in areas where the bush fire hazard does not present an unreasonable level of risk to life and property ;

2. **Vehicular Access** - to ensure that the vehicular access serving a subdivision / development is safe in the event of a bush fire occurring ;

3. **Water** - to ensure that water is available to the development to enable life and property to be defended from bush fire ;

4. **Siting of Development** - to ensure that the siting of development minimises the level of bush fire impact ; and

5. **Design of Development** - to ensure that the design of the development minimises the level of bush fire impact .

The following assessment of the management issues is provided to show how the performance criteria are to be met through acceptable solutions.

6.1 Location

Majority of the subject land has a bushfire hazard rating of “Low” due to the predominantly parkland cleared open woodlands and grassland surrounding the site. Fifty Road provides an acceptable separation distance to permanent hazards located in adjacent rural properties to the north-west.

An area of temporary concern is the western end of the subject land where undeveloped portions of Lot 313 are classified as having an “Extreme” fire rating due to Shrubland vegetation on-site. Hazard reduction measures will need to be implemented to reduce the rating level along the western boundary to low or moderate.

Future subdivision staging will need to take into consideration the location of these adjoining Extreme Fire Hazards. Development will only be permitted once the hazard has been permanently removed, a 20m Building Protection Zone achieved and dwelling construction standards can meet a BAL rating of BAL-29 or lower.

Overall, the Structure Plan is located in an area where the bush fire hazard level is considered manageable and adequate setbacks can be achieved through appropriate subdivision design, staging and by achieving hazard separation requirements.

6.2 Vehicular Access

The ultimate internal layout, design and construction of vehicular access in the Spires Estate project area will allow emergency vehicles to move through it easily and safely. All lots will have direct access to the public road network for which provides for two-way traffic and allows conventional two-wheel drive vehicles to travel safely on them.

The standalone development of Lot 774 will result in the temporary cul-de-sacing of the proposed internal access road. This will not exceed 200m in length and will need to be designed to ensure turn around areas comply with the minimum standards for emergency vehicles.

Road pavement standards shall apply to this development; these standards are discussed in the related Spires Estate Traffic Report and shall meet the 6m minimum trafficable surface requirements as set out under the Planning for Bushfire Protection Guidelines (Edition 2, 2010) where required. Roads will be constructed as per Table 4 'Function and Characteristics of Local Streets' under the Liveable Neighbourhoods policy. These standards shall be included in the engineering design of the future subdivision.

Separate dedicated Fire Service and Emergency Access is not required as access will afforded via the public road network.

Other Access Considerations

- The Structure Plan design indicates all lots will have direct frontage to the public road network;
- No rural lots are proposed and as such future dwellings will not be situated further than 50m from a public road;
- Fire Service Access routes will be along the proposed public road network and therefore do not require further signage to define the access ways;
- Gates will not be required for this subdivision;
- Internal fire breaks are not required in an urban landscape.

6.3 Water

The subdivision will be provided with a permanent reticulated water supply as per the requirements of the Water Corporation and Department of Water for urban developments. This will ensure water is available to enable life and property to be defended in the event of a bushfire.

Fire Hydrants are to be installed by the developer in accordance with the Water Corporation's *No. 63 Water Reticulation Standard*, being deemed the baseline criteria for developments, and are to be identified by standard pole and/or road markings.

6.4 Siting of Development

The Spires Estate Bushfire Hazard Rating Map, located at Figure 5, identifies the subject land as being within 100m of temporary and permanent Moderate and Extreme bush fire hazards.

Any proposed development within 100m of a Moderate or Extreme bushfire hazard level is subject to meeting the minimum separation setback distances and/or construction standards as set out under the Guidelines (WAPC, Ed2 2010).

All requirements set out under Part 5.4 of the Spires Estate FMP (Appendix 1) pertaining to Hazard Separation Zones and the Application of AS3959-2009 that address bush fire risk apply to Lot 774 Fifty Road. This includes:

- Hazard Separation Zones;
- Application of AS 3959–2009 to address the permanent bush fire risk;
- Application of AS 3959–2009 to address temporary bush fire risk; and
- Development staging.

In this regard, a 100m wide Hazard Separation Zone has been depicted around both permanent and temporary bush fire hazard areas rated as 'Moderate' or 'Extreme' (refer Figures 6 and 7) to inform implementation of AS 3959–2009 and application of increased building construction standards.

A 20m Building Protection Zone (BPZ) must be maintained around all buildings abutting, or adjacent to areas that pose a Moderate or Extreme bush fire hazard level. The existing Fifty Road reserve provides an adequate Building Protection Zone separation to permanent classified vegetation located within adjacent rural properties and further ensures BAL-40 and BAL-FZ construction standards do not apply. Notwithstanding, as residential development is proposed within 100m of identified hazards, BAL construction standards will still be imposed.

Site specific hazard assessments will be further required at the subdivision and/or building permit stages to accurately determine applicable BAL standards once any on-site or surrounding vegetation has been removed and building locations determined. These later stages will ultimately identify the separation setbacks of buildings to both existing permanent and temporary hazards and any shielded elevations.

Overall, the Structure Plan Amendment area is located in an area where the bush fire hazard level is considered manageable and adequate setbacks can be achieved through appropriate subdivision design, hazard reduction methods and staging of development.

Figures 6 and 7 assess current and future land uses to determine the temporary or permanent nature of hazards and to identify portions of the site that are subject or likely to be subject to bush fires. These figures also help demonstrate that the land is capable of development and that future development may be subject to staging, where lots cannot be created until such time as the temporary hazard within Lot 313 is removed, and identify dwellings likely required to meet BAL-12.5, BAL-19 and BAL 29 standards.

6.5 Design of Development

The Local Structure Plan Amendment identifies the subject area as being subject, or likely to be subject, to bush fires.

The proposed Amendment to the Spires Estate Structure Plan complies with the performance criteria and acceptable solutions of A4.1, A4.2, A4.3 and A4.4 of Element 4 'Siting of Development' of the WAPC Planning for Bushfire Protection Guidelines (2010) and therefore meets the acceptable criteria under Element 5 'Design of Development'.

All buildings located within 100m of a Moderate or Extreme hazard ratings will require compliance with AS-3959 construction standards.

The construction standard that shall apply is shown below in Table 1 'Minimum Setback Distances and Construction Standards'. A minimum 20m BPZ must apply to all dwellings and an additional HSZ is required; this dictates the BAL construction standard depending on the distance as shown in Table 1.

Distance of dwelling to egetation	**egetation Type**	**AL Rating**	**Construction**
Permanent Ha ards (north of Fifty Road)			
<17m Vegetation is downslope and >0 to 5 Degrees	Woodland Type B	BAL-FZ / BAL-40	Residential Development Not Recommended
17-<25m Vegetation is downslope and >0 to 5 Degrees	Woodland Type B	BAL 29	AS3959-2009 to apply
25-<35m Vegetation is downslope and >0 to 5 Degrees	Woodland Type B	BAL 19	AS3959-2009 to apply
35-<100m Vegetation is downslope and >0 to 5 Degrees	Woodland Type B	BAL 12.5	AS3959-2009 to apply
>100 metres	All Vegetation	No BAL Rating Required	No construction standards required
Temporary Ha ard (within Lot 313)			
<10m Vegetation is downslope and >0 to 5 Degrees	Scrub Type D	BAL-FZ / BAL-40	Residential Development Not Recommended
10-<15m Vegetation is downslope and >0 to 5 Degrees	Scrub Type D	BAL 29	AS3959-2009 to apply
15-<22m Vegetation is downslope and >0 to 5 Degrees	Scrub Type D	BAL 19	AS3959-2009 to apply
22-<100m Vegetation is downslope and >0 to 5 Degrees	Scrub Type D	BAL 12.5	AS3959-2009 to apply
>100 metres	All Vegetation	No BAL Rating Required	No construction standards required

Table 1 – Minimum Setback Distances and Construction Standards

Some houses/dwellings within the subject land area will be setback from hazards (i.e. Woodland Vegetation) >100m and are able to be constructed without building to AS3959 standard.

Some dwellings may also have the potential to be shielded from the threat of fire. Shielding can be achieved through careful design and placement other dwellings and fencing to give separation or barriers to fire so as to reduce the BAL required by up to one level. The construction requirements for a shielded elevation shall be not less than that required for BAL-12.5, except where the exposed elevations have been determined as BAL-LOW**.**

6.5.1 Calculating the Bushfire Attack Level (BAL)

In the Australian Standards (AS3959-2009), they have classified different bushfire intensity levels that a home may experience during a bushfire. These are referred to as Bushfire Attack Levels, or BAL's. There are 6 bushfire attack levels in total, these are:

- BAL Flame Zone (FZ)
- BAL 40
- BAL 29
- BAL 19
- BAL 12.5
- BAL Low

These individual levels are based on (a) the region, (b) the vegetation type around a property, the distance from a dwelling to individual vegetation types and the topography of the subject area. A slope analysis of fire hazards will need to be conducted at future subdivision stages to assist with determining Bushfire Attack Levels (BAL) applicable at the building permit stage.

Given that the siting of development in the BAL-FZ and BAL-40 zone is not recommended by FESA and the WAPC, the Maximum BAL that will be permitted for any future development is BAL-29.

6.5.2 Minimum construction standards

As noted above, in order to comply with the WAPC Guidelines, some lots may be required to reduce the threat of a bushfire by way of constructing dwellings to a higher standard. This standard is known as the AS-3959.

Those lots requiring construction standards in accordance with AS-3959 will be determined at subdivision once detailed design and engineering drawings have been prepared and approved by the relevant authority. As such, a more detailed bush fire hazard assessment is required at the subdivision and development stage to determine building separation zones, hazard separation zones and the required construction standard as specified in AS-3959 for individual residential lots.

6.6 Fire Fighting Facilities

The subject area is within the City of Rockingham. The Baldivis Volunteer Bush Fire Brigade is the closest emergency service, located at 801A Eighty Road (corner Eighty Road and Tranby Drive), Baldivis. Telephone: (08) 9524 2970 or (08) 9524 2971

The Department of Fire and Emergency Western Australia (DFES, previously known as FESA) is WA's leading hazard management agency and performs a critical role coordinating emergency services for a range of natural disasters and emergency incidents threatening life and property.

Service response times can vary depending on commitments of volunteers, fire events current at the time and priority of the fire services in the south west of Western Australia during summer periods. DFES recommend that homeowners take care to prepare their individual dwellings for fire season and take precautions against fire as per the FESA 'Bushfire Preparedness – Prepare. Act. Survive' booklet (Attached at Appendix 1).

DFES provides a range of hazard prevention campaigns and programs to raise safety awareness in the community and the DFES website (http://www.dfes.wa.gov.au) provides clear advice, resources and practical actions for how to prepare for and cope during a range of emergencies.

During a bushfire the safest place to be is away from the fire. If a fire starts, leaving hours before a fire can reach you will always be the safest option. During a bushfire, roads will be closed for your safety and for safe access to the fire by emergency services. These road closures are managed by police and they will not allow you to return home under any circumstance.

In cases of emergency, always call 000.

7. IMPLEMENTATION

Inherent in Fire Management Plans is that bushfire safety is a shared responsibility between the government and a range of stakeholders. Individuals must take personal responsibility for reducing the threat of bushfires to themselves, their families and properties. The State Government must provide the policies and programs, professional expertise and resources to implement programs and support the community.

A key component of this Hazard Assessment is ensuring future residents have access to information on bushfire public education programs, to increase awareness and so they can make informed decisions and be adequately prepared for bushfires. This Plan relies heavily on providing information to the public and encouraging people to consider their potential personal and psychological losses.

7.1 Property Owners Responsibilities

Individuals are ultimately responsible for making their own decisions about how to respond to the bushfire risk. In communities susceptible to bushfires, household preparedness is a significant component of a bushfire risk management strategy. The majority of houses can survive most bushfires with preparation and planning. There are many ways that you can improve the chance of your property surviving a bushfire even if you are not there to defend it.

Household preparation can include, for example, active management of vegetation and landscaping, clearing leaves from guttering and ensuring access to equipment resources such as hoses and buckets for extinguishing spot fires (Handmer et al, 2008). It is the property owner's responsibility to reduce the risks and take actions to survive a bushfire.

It is recommended the Future Property Owners shall be responsible for the following:

- Compliance with minimum building construction standards in accordance with AS3959, as required by any subsequent Fire Management Plan;
- Take measures to maintain property in good order to minimise the risk of fire and to protect their own assets on their property;
- Ensure that during summer months grassed areas throughout the property (and verge) are maintained below 5 cm in height;
- To maintain in good order and condition individual Building Protection Zones, Hazard Separation Zones and driveway standards. This may include maintenance of the verge;
- Owners must comply with any subsequent Fire Management Plan, FESA "Prepare. Act. Survive" booklet and the City of Rockingham annual Fire Control Notice.

Where to get information during a bushfire:

- You can subscribe to receive DFES's alerts and warnings as RSS feeds;
- DFES information line on 1300 657 209;
- Radio, television, newspapers and news websites - each media outlet determines how often they will broadcast information;
- ABC local radio broadcasts updates at quarter to and quarter past the hour in addition to news bulletins during an Emergency Warning. You may receive an Emergency Alert if the situation is life threatening.

7.2 Developers Responsibilities

Prior to development of the subject site commencing, the Developer shall be required to carry out works, in respect to individual stages of development. The Developer shall have no further responsibilities to the provision of fire fighting facilities and fire management on individual lots that pass from their management and/or ownership.

It is recommended that the Property Developer shall be responsible for the following:

- The Developer is to confirm the threat of a bushfire at subdivision stage, once further details relating to temporary vegetation, slope, landscaping and lot configuration is known;
- Prepare Detailed Area Plans for any lots that require building protection zones contained within the lot boundary;
- Reduce bush fire hazard levels to the extent that the development can be constructed to the lowest BAL possible; The developer must construct Road Reserves within a Hazard Separation Zone in accordance with the acceptable solutions criteria A4.4 of the WAPC Guidelines (Edition 2, 2010) to ensure a standard which reduces bushfire attack level of those abutting or adjacent lots to at most a BAL-29 level.
- Comply with standards as outlined by the City of Rockingham and WAPC conditions of subdivision approval;
- Ensure that potential property owners are aware of any relevant Fire Management Plan; The developer must lodge a section 70A notification on all certificates of titles within the area depicted on the Bushfire Hazard Assessment Plan as requiring a notification on the title for the purpose of alerting purchasers to the possible threat of bushfire and the responsibilities contained within this hazard assessment;
- The developer must supply a copy of this Fire Management Plan and a copy of the latest of DFES Bushfire Survival Guide (currently called 'Prepare.Act.Survive' V4: November 2012, attached at Appendix 1) to prospective purchasers of the lots subject to the notification.
- The developer shall install and mark all fire hydrants to Department of Fire and Emergency Services standard road and pole specifications and Water Corporation No.63 Water Reticulation Standard.
- The developer shall install internal access roads in accordance with the approved Local Structure Plan and/or subdivision approval.

7.3 City of Rockingham Responsibilities

At approval and endorsement of the Spires Estate Structure Plan Amendment, the City of Rockingham has statutory control and responsibility to ensure that aspects of this Hazard Assessment and community fire safety are maintained.

It is recommended the City of Rockingham shall be responsible for the following:

- Endorse the Section 70A notification on each CT of the proposed lots requiring notification under the Fire Management Plan.

- Endorse Detailed Area Plans required to identify Building Protection Zones within individual lots.

- Enforce the annual Fire Control Notice to all surrounding lots.

- Apply the relevant Australian Standards to all building approvals on the new lots subject to the Section 70A notification. The level of construction which is to be applied to each building should be determined through a specific site assessment as outlined in the standard.

- Ongoing management and maintenance of any public areas to appropriate standards will be the responsibility of the City of Rockingham after the Developer has relinquished construction/maintenance responsibility.

7.4 Fire & Emergency Services Authority

It is recommended the Department of Fire and Emergency Services (DFES) shall be responsible for:

- Developing and maintaining district fire fighting facilities, apparatus and district water sources, including fire hydrants under its control, for the purposes of fire fighting.

8. REFERENCES

Australian Government Geoscience Australia, *What Causes Bushfires,* Retrieved September 2013 from: http://www.ga.gov.au/hazards/bushfire/bushfire-basics/causes.html.

Bureau of Meteorology, *Bushfire Weather: Weather and Fire,* Retrieved September 2013 from: http://www.bom.gov.au/weather-services/bushfire/about-bushfire-weather.shtml#weather.

Bureau of Meteorology, *Fire Weather Warnings,* Retrieved September 2013 from: http://www.bom.gov.au/weather-services/bushfire.

Bureau of Meteorology, *Monthly Climate Statistics: Medina Research Centre*, Retrieved September 2013, from: http://www.bom.gov.au/climate/averages.

CSIRO, *Bushfires – Types, Measurement and Fuels*, Retrieved September 2013 from: http://www.csiro.au/resources/BushfireTypes.

Council of Australian Governments (COAG) 2009 *National Inquiry on Bushfire Mitigation and Management*, Retrieved September 2013, from: http://coagbushfireenquiry.gov.au/report/summary.htm

Department of Fire and Emergency Services (DFES), *Bushfire: Survive During a Bushfire*, Retrieved September 2013, from: http://www.dfes.wa.gov.au/safetyinformation/fire/bushfire/Pages/default.aspx

Fire Services Commission Victoria, 2012, *Bushfire Safety Policy Framework*, Retrieved September 2013 from: http://www.firecommissioner.vic.gov.au/wp-ontent/uploads/Bushfire_Safety_2012.pdf

Handmer, J; Haynes, K, 2008. *Community Bushfire Safety*. CSIRO Publishing, Melbourne, ISBN 9780643095618

Perth Now, Prestipino, D, 2010. *Arson blamed as Karnup residents under threat from wildfire*. Retrieved September, 2013 from: http://www.news.com.au/breaking-news/karnup-golden-bay-secret-harbour-on-bushfire-alert/story-e6frfkp9-1225963791880#ixzz2eXpRH1Z4.

Strategen, 2014. Spires Estate Local Structure: Fire Management Plan

Victorian Government Department of Sustainability and Environment, 2010, Overall Fuel Hazard Assessment Guide (4th edition) *Fire and adaptive management, report no. 82*, By Francis Hines, Kevin G Tolhurst, Andrew AG Wilson and Gregory J McCarthy

Figure 1
Location Plan

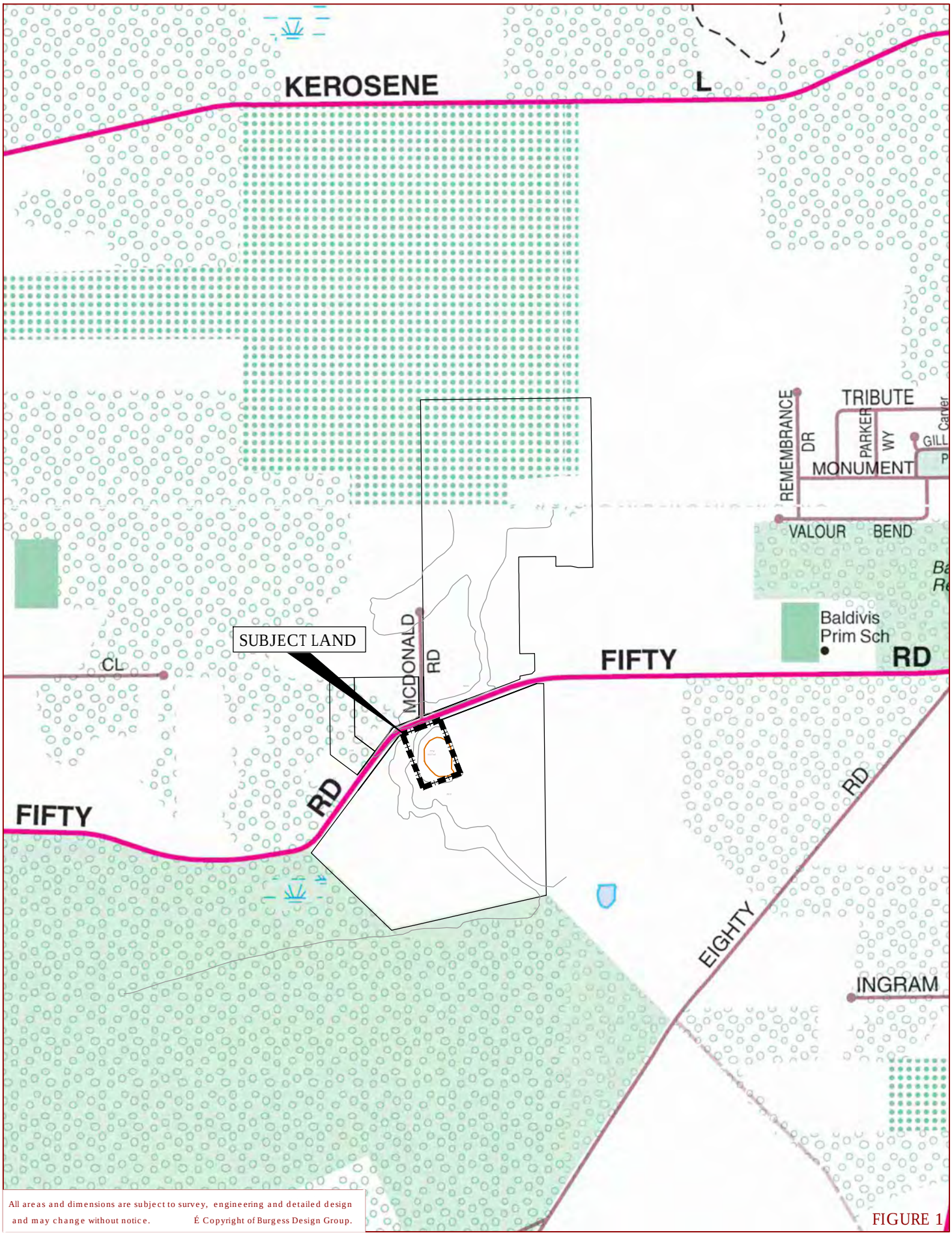

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FIGURE 1

NORTH

0 50 100 150 200 250m

SCALE 1:10,000 (A4)

LOCAL LOCATION

Lot 774 Fifty Road

BALDIVIS

Planner: JD/MB
Client: CASELLA
Date: 28.03.14
Plan No: CAS BAL 9-01

CITY OF ROCKINGHAM

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Figure 2
Aerial Photograph

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FIGURE 2

LEGEND

Subject Land

NORTH

AERIAL PHOTOGRAPH

Lot 774 Fifty Road

BALDIVIS

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P (08) 9328 6411
F (08) 9328 4062

Plan No: CAS BAL 9-01 Client: CASELLA
Date: 28.03.14 Planner: JD/MB

0 10 20 30 40 50m
SCALE 1:1,500 (A3)

Figure 3
Proposed SESP Amendment

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PLAN 1

NORTH

0 10 20 30 40 50m

SCALE 1:1,500 (A4)

PROPOSED STRUCTURE PLAN MODIFICATION

SPIRES ESTATE LOCAL STRUCTURE PLAN

BALDIVIS

Planner: MB/JD
Client: Niroda Holdings

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Plan No: CAS BAL 2-01a
Date: 25.06.14

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Figure 4
SESP Vegetation Assessment

Appendix D: Vegetation Class Map

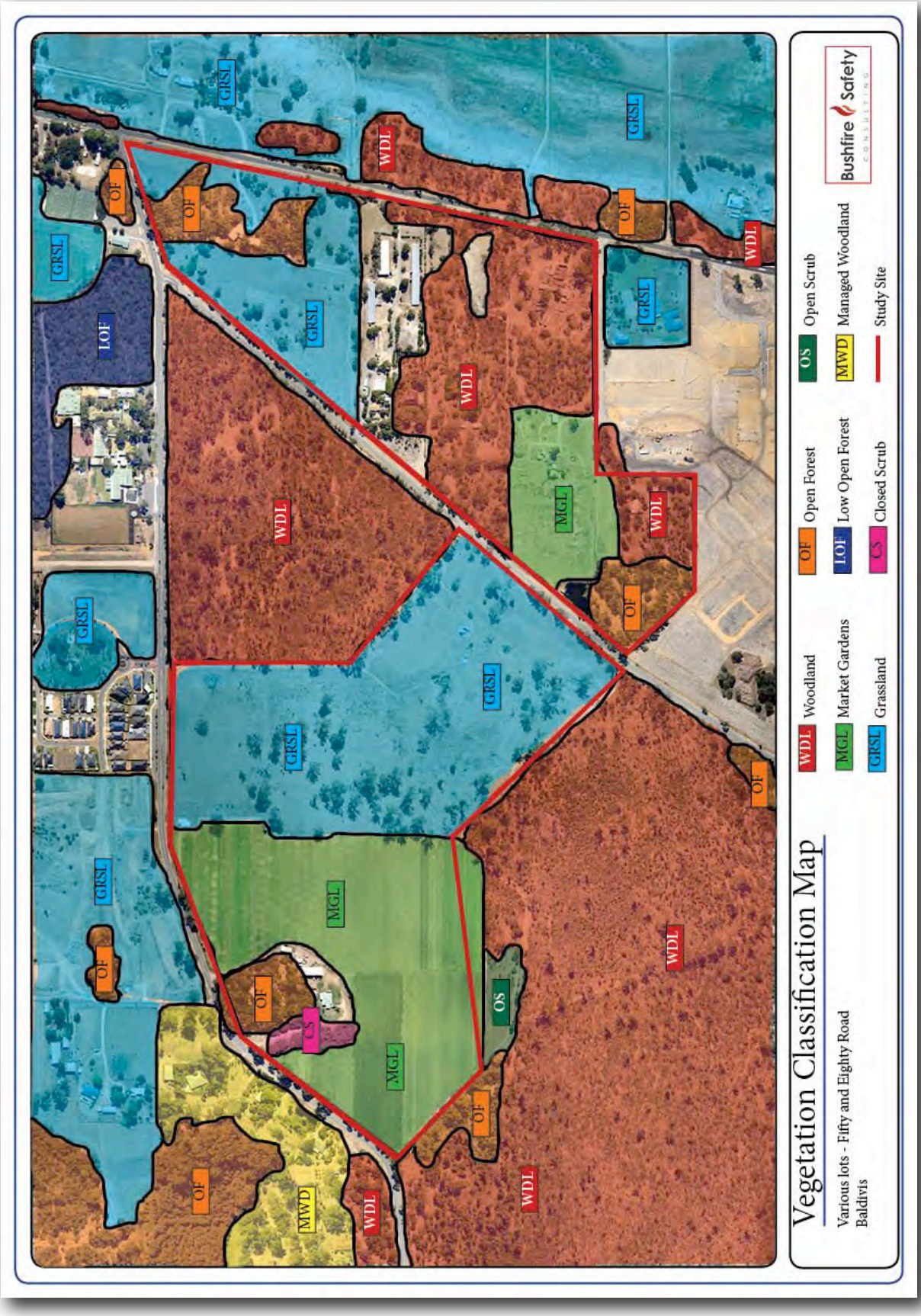

Figure 5
SESP Bush Fire Hazard Rating Map

Appendix E: Bushfire Hazard Rating Map

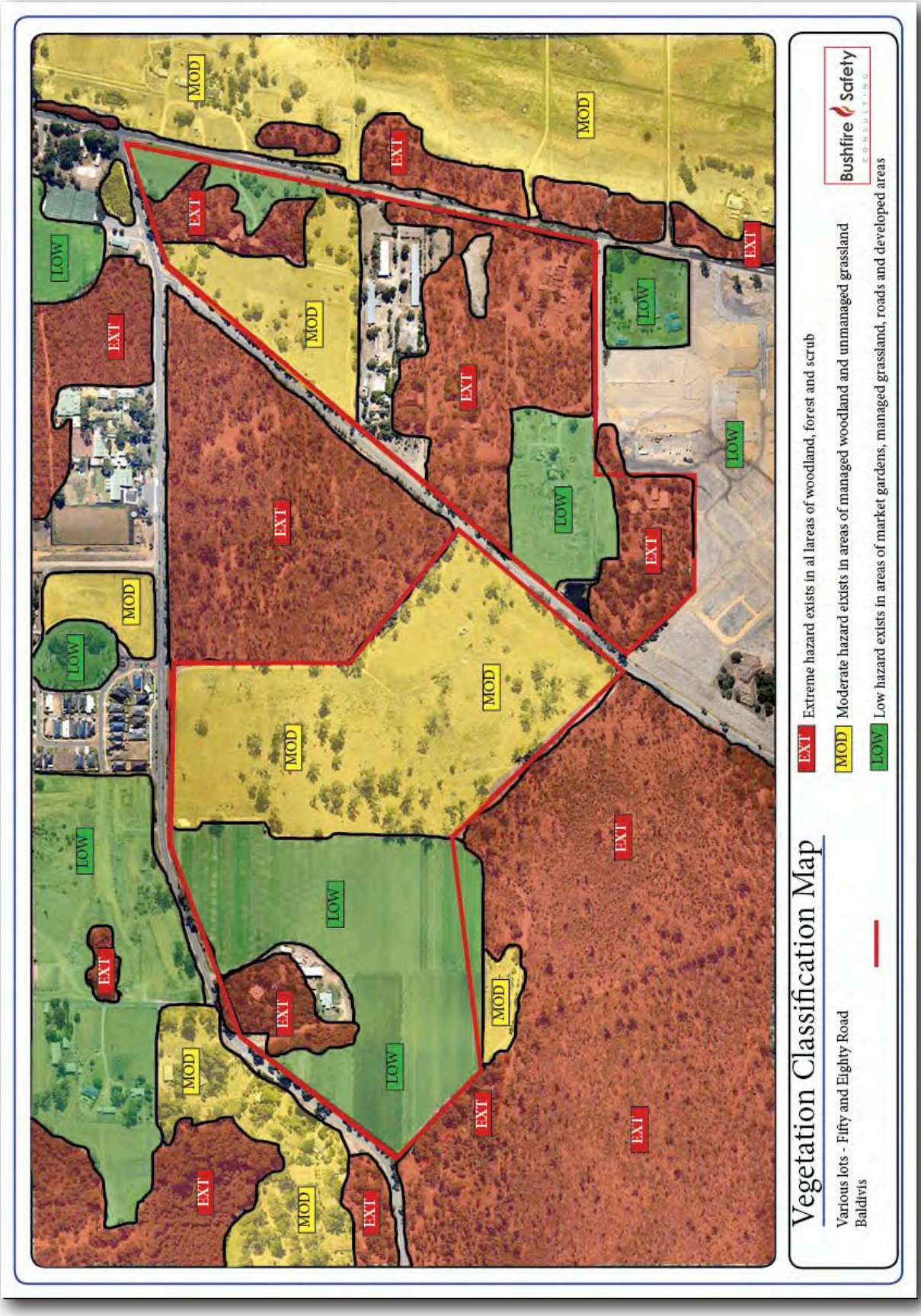

Figure 6
Bush Fire Hazard Assessment (Current Land Uses)

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FIGURE 6

HAZARD ASSESSMENT - CURRENT LAND USES

Lot 774 Fifty Road

BALDIVIS

CITY OF ROCKINGHAM

NORTH

0 10 20 30 40 50m

SCALE 1:1,500 (A3)

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Plan No: CAS BAL 9-02 Client: CASELLA
Date: 15.07.14 Planner: JD/MB

Figure 7
Bush Fire Hazard Assessment (Ultimate Land Uses)

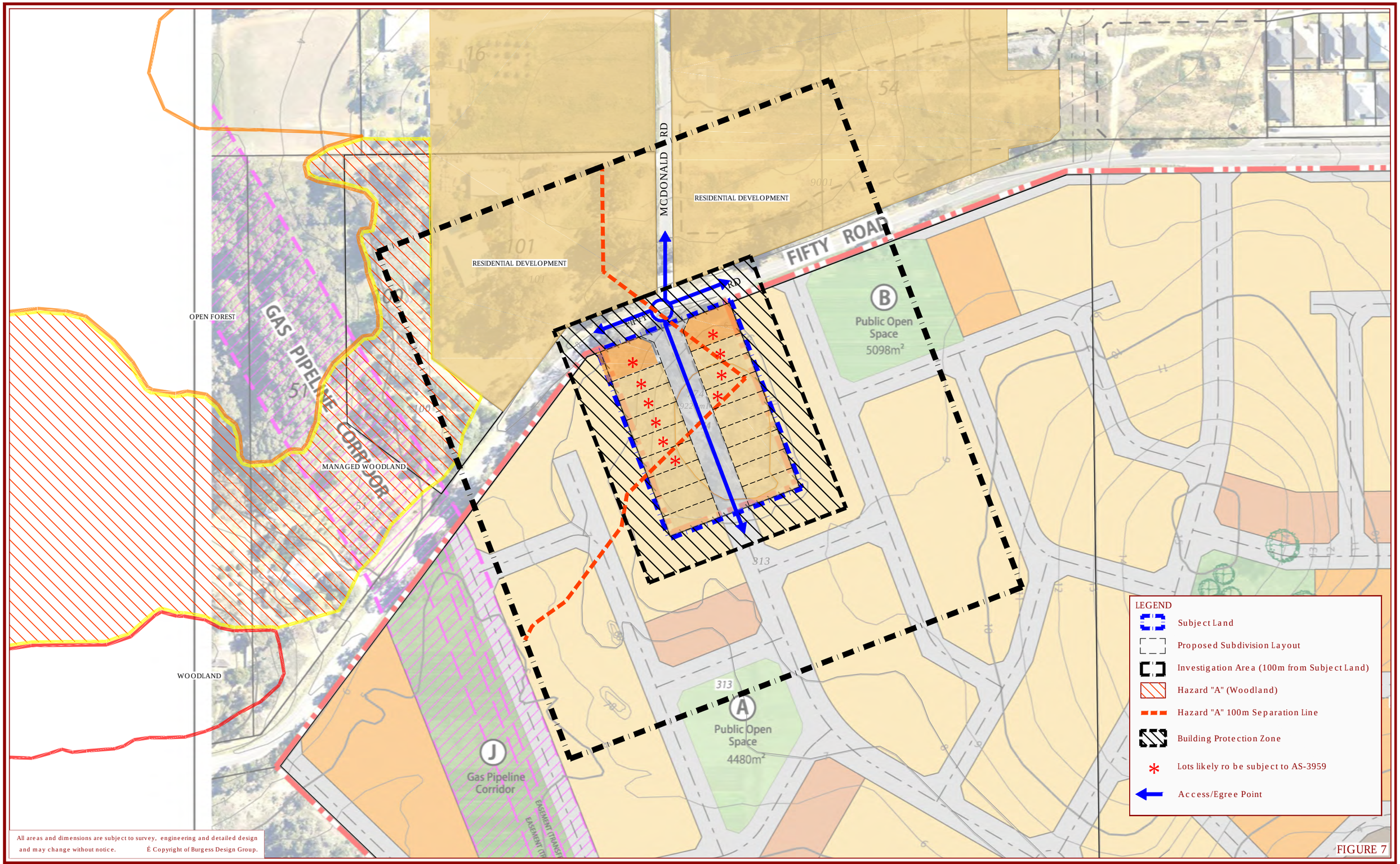

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FIGURE 7

HAZARD ASSESSMENT - FUTURE LAND USES

Lot 774 Fifty Road

BALDIVIS

NORTH

SCALE 1:1,500 (A3)

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Date: 15.07.14
Client: CASELLA
Planner: JD/MB

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Appendix 1

Spires Estate Fire Management Plan v.4 (Strategen: March, 2014)

APPENDIX 4
TRAFFIC ASSESSMENT

Excellence in Transport Engineering
tarsc

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Burgess Design Group
101 Edward Street
PERTH WA 6000

Attention: Kelley O'Neill

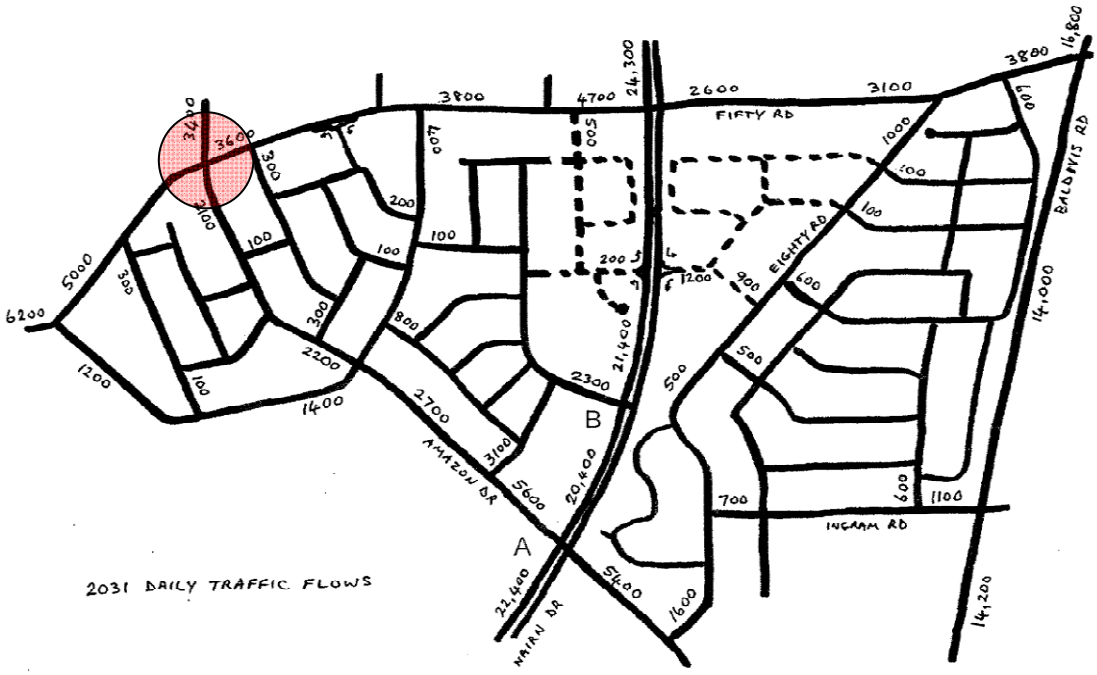
19th November 2013

Dear Kelley

RE: Lot 774 Fifty Road aldivis

I refer to your request to prepare a technical note in support of the proposed development of Lot 774 Fifty Road in Baldivis.

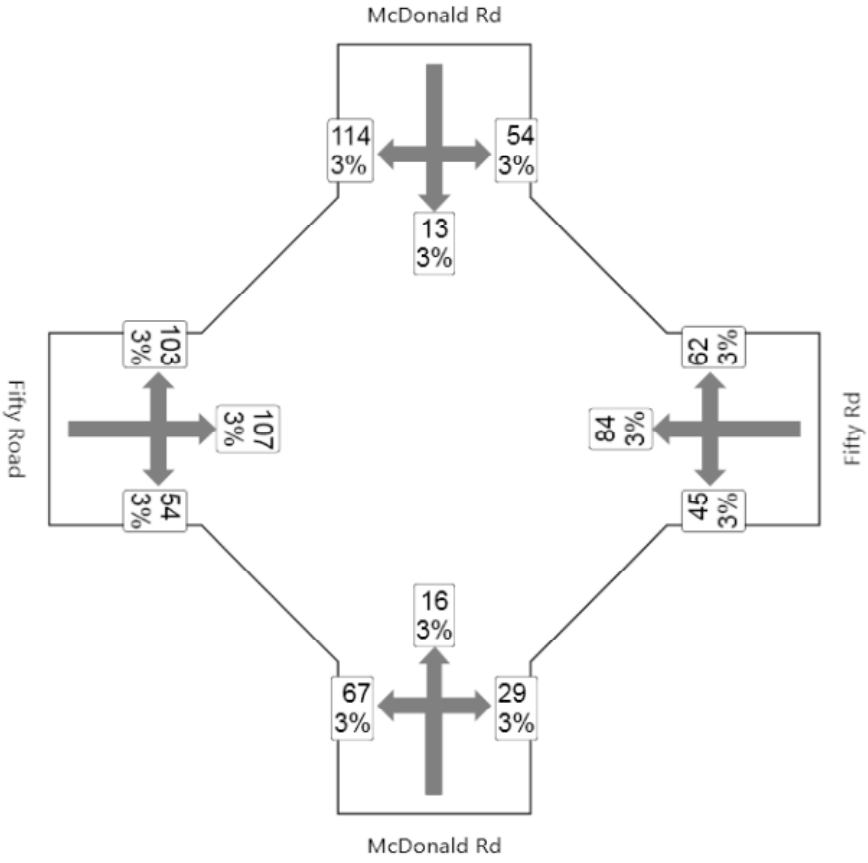
An assessment of the proposed four-way intersection was undertaken based on the outputs from the Spires report Figure 1 of the Addendum dated 18 December 2012, refer below. The intersection is shown highlighted.



Sidra Intersection (Version 5.1) was utilised with the input turn volumes derived from the above 2031 midblock volumes.

The assessment assumed a single lane roundabout with single lane approaches and departures on all legs of the intersection. It also assumed a 30 minute assessment, thus the hourly peak hour volumes (assumed to be 10% of the values shown in the above figure and split evenly in each direction) are slightly higher than a simple 10% of the above values.

The resultant assessment flows are shown below.



The resultant output of the assessment is summarised below in the following table.

	Demand Flows				HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Length	SL Type	Cap. Adj.	Prob. Block.
	L	T	R	Total							Vehicles	Distance				
	veh/h	veh/h	veh/h	veh/h	%	veh/h	v/c	%	sec		veh	m	m		%	%
South: McDonald Rd																
Lane 1	67	16	29	113	3.0	1234	0.091	100	7.9	LOS A	0.5	3.4	500	–	0.0	0.0
Approach	67	16	29	113	3.0		0.091		7.9	LOS A	0.5	3.4				
East: Fifty Rd																
Lane 1	45	84	62	192	3.0	1303	0.147	100	7.6	LOS A	0.8	5.7	500	–	0.0	0.0
Approach	45	84	62	192	3.0		0.147		7.6	LOS A	0.8	5.7				
North: McDonald Rd																
Lane 1	54	13	114	180	3.0	1295	0.139	100	9.9	LOS A	0.7	5.3	500	–	0.0	0.0
Approach	54	13	114	180	3.0		0.139		9.9	LOS A	0.7	5.3				
West: Fifty Road																
Lane 1	103	107	54	264	3.0	1424	0.186	100	6.6	LOS A	1.0	7.3	500	–	0.0	0.0
Approach	103	107	54	264	3.0		0.186		6.6	LOS A	1.0	7.3				
Intersection				748	3.0		0.186		7.9	LOS A	1.0	7.3				

The above shows that this intersection should operate at a very good level of service A for all movements in peak conditions. The degree of saturation of all approaches is no worse than 0.186 (this for the western approach of Fifty Road) with minimal queuing and delays. This are well above the overall target level of service D for an intersection and E for an individual movement for new intersections.

A sensitivity test was undertaken assuming a doubling of the above flows on all approaches. This showed that The intersection should still operate at level of service A with the worst individual approach level of service being the western approach of Fifty Road where the level of service is expected to be B.

The various concepts in the above table are described in more detail below and on the following page.

Table Interpretation

Demand Flows in vehicles per hour

These columns show the demand flows used in the assessment. They are not the actual flows as they are factored up by about 5% to allow for more arrivals over a shorter period in the hour of assessment. For example, more traffic arrive in a half hour period than the remaining half hour period of the analysis hour. Columns are headed “L”, “T” and “R” for Left Turn, Through and Right Turn movements.

Total Flows in vehicle per hour

This column totals all the flows for the particular lane. For example, in the western approach of Fifty Road (Lane 1 under "West: Fifty Road" there is a left turn flow of 103, through movement flow of 107 and right turn movement flow of 54, tallying to 264 for that lane.

Percentage of Heavy ehicle

This column shows the proportion of the traffic volumes that are classified as heavy vehicles and this adjust the assessment accordingly.

Capacity in vehicle per hour

This is the capacity for the lane in question. Again, using the above example, the capacity is 1,424 vehicles per hour for Lane 1 on the western approach on Fifty Road.

Degree of Saturation

Degree of saturation (x) is defined as the ratio of *demand (arrival/total) flow* to *capacity* (also known as *volume / capacity, v / c, ratio)*. Degrees of saturation above 1.0 represent oversaturated conditions (demand flows exceed capacity), and degrees of saturation below 1.0 represent undersaturated conditions (demand flows are below capacity).

Lane Utilisation

This is either a user of program derived value representing if the lane is used to full capacity. This figure may be impacted on by upstream or downstream short lanes, parking of bus stop movements.

Average Delay

Average Delay is the average of all travel time delays for vehicles through the intersection for that movement, approach or total for the intersection, depending on the row of the table.

Level of Service

The level of service concept describes the quality of traffic service in terms of six levels, designated A to F, with level of service A (LOS A) representing the best operating condition (i.e. at or close to free flow), and level of service F (LOS F) the worst (i.e. forced flow). More specifically:

- *LOS A*: Individual drivers are virtually unaffected by others in the traffic stream. Their freedom to select their own desired speed and to manoeuvre in the traffic

stream is extremely high, and the general level of comfort and convenience is excellent;

- *LOS B*: Individual drivers still have reasonable freedom to select their desired speed and to manoeuvre in the traffic stream, although the general level of comfort and convenience is less than at LOS A;
- *LOS C*: Most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre in the traffic stream;
- *LOS D*: All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre in the traffic stream. Traffic is close to the upper limit of stable flow, the general level of comfort and convenience is poor, and small increases in traffic flow will usually cause operational problems;
- *LOS E:* Traffic volumes are at, or close to capacity, and drivers have virtually no freedom to select their desired speed or to manoeuvre. Traffic flow is unstable and minor disturbances will result in stop-start conditions; and,
- *LOS F*: Flow is forced and the amount of traffic approaching the point under consideration exceeds that which it can handle. Stop-start conditions apply and queuing and delays result.

5 ac of Queue

This measure is the queue length below which 95% of all observed queue lengths fall and is the worst queue that could be expected. The average queue is typically 40 to 50% of the values shown. The 95% back of queue is used for design purposes of turn pockets. Two values are shown, one in vehicles and one in distance, metres.

Lane Length

These values represent the length of the corresponding lane. In this case there are no short lanes (turn pockets).

SL Type Capacity Adjustment and Probability loc ed

SL Type refers to the type of Short Lane. The other measures and values are derived from the assessment either describing the Capacity Adjustment factor and Probability of a lane being blocked due to queuing in an adjacent lane.

Based on this assessment the proposed roundabout at the intersection of Fifty Road and McDonald Road should operate satisfactorily during peak conditions in 2031.

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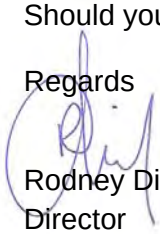
Should you have any queries please contact me on 9471 9991.

Regards



Rodney Ding
Director
TARSC Pty Ltd

APPENDIX 5
SERVICING REPORT

LOT 774 FIFTY ROAD, BALDIVIS

Preliminary Engineering Infrastructure Report

Nearmap 2014

January 2014

CLIENT: NIRODA HOLDINGS

PROJECT: LOT 774, FIFTY ROAD

TITLE: PRELIMINARY ENGINEERING INFRASTRUCTURE REPORT

DOCUMENT REVIEW				
Revision	Date Issued	Prepared By	Reviewed By	Approved By
Rev0	20/01/2014	JBSMALL	JBSMALL	CCBITMEAD
Rev1	20/01/2014	JBSMALL	JBSMALL	CCBITMEAD

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FIGURE 5 13

1 INTRODUCTION

This report has been prepared by TABEC Pty Ltd to provide broad servicing and infrastructure advice for the proposed subdivision of Lot 774 Fifty Road, Baldivis.

This report has been based on the civil engineering aspects of residential related land uses and summarises the availability of existing infrastructure assets in proximity to the landholding and the potential engineering infrastructure requirements to support urban development within the study area.

The investigation and preparation of the report are largely based on preliminary advice from the various service authorities. The information is current as of January 2014 and is subject to change as the development process proceeds and more information becomes available from the various authorities.

2 THE STUDY AREA

The proposed development site is approximately 0.923 hectares and is located on the southern side of existing Fifty Road and about 1.3km west of Baldivis Road. The site is approximately 80 metres wide and 114 metres in depth from the existing road frontage. Approximately 120 metres to the west of the site is the gas pipeline corridor which is aligned north-south and contains high pressure gas pipelines.

The site is partly cleared and there is an existing home and associated sheds. Some large trees remain however it is not densely vegetated. The site is surrounding by areas used for market gardening purposes. There is an existing subdivision currently under construction on the northern side of Fifty Road within close proximity to the site.

The attached Preliminary Local Structure Plan in Figure 1 provides the basis for preliminary development assessment. This plan may be refined further as the planning detail is progressed.

2.1. Topography

Preliminary survey information is available which demonstrates the site forms a localised highpoint to the sounding landform, with levels rising from the site boundaries toward the centre, where the existing house is currently located. The elevation of Fifty Road along the frontage of this lot is approximately 8 metres AHD and from here, the site rises to approximately 10 metres AHD. The natural elevations on site appear to be fairly consistent with the development levels of the existing urban subdivision on the opposite side of Fifty Road.

2.2. Acid Sulphate Soils

The Perth Groundwater Atlas indicates that there is no known risk of any acid sulphate soils occurring within the site.

It also appears the elevation of annual average maximum groundwater levels (AAMGL) are approximately 1.75 metres AHD in the vicinity of Lot 774. Therefore, at least 6 metres of clearance is provided on site between estimated development levels and AAMGL.

Given that excavations on site for service installation and earthworks to re-contour and shape the land for development are not expected to intersect the ground water table, the risk of encountering acid sulphate soils is further reduced. It is therefore not expected that any management plan would be required or dewatering licenses in the subdivision of Lot 774.

3 SITEWORKS

3.1. General

Site works for urban development comprises the clearing of existing vegetation, stripping topsoil on site and earth working of existing ground surfaces to facilitate a required form of development. Strict clearing requirements will be enforced to ensure the desired trees for retention are identified and suitably protected during civil works. Some tree retention may be possible in the road verges and if any POS or drainage areas are nominated in the subdivision plan.

3.2. Earthworks

Earthworks to prepare the site suitably for urban development would comprise of stripping topsoil on site and completing cut to fill activities to achieve level building lots. Due to the varied levels within Lot 774 and in regard to the preliminary concept subdivision plan available, it is anticipated that some retaining walls would be required to manage the level differences on site. Retaining walls would be constructed from reconstituted limestone as is common industry practise.

The earthworks design for Lot 774 should be undertaken in view of the surrounding landform and development levels also. Cutting of the high point and battering into adjoining lands may provide a more efficient overall earthwork design and avoid unnecessary retaining walls on the boundary.

Earth working of the site, particularly lot areas and road reserves will be required to ensure the positive drainage of the lots toward the road reserves.

Due to the expected sandy nature of the site, earthworks would be undertaken such that foundations for residential development on the created lots within the proposed development can be designed for the Australian Standard Classification "A", as set out in AS2870-1996. It should be noted however that this is subject to the geotechnical investigations and any necessary site preparation requirements.

4 ROADWORKS

Access to the development is available from Fifty Road to the immediate north which is a City of Rockingham asset. The current concept development plan proposes a single intersection onto Fifty Road and an access road through the centre of Lot 774 which would provide a connection to the greater local structure plan. Internal development would front the subdivision road and it is not anticipated that residential access would be provided directly from Fifty Road.

Fifty Road is currently being upgraded along the frontage to Lot 774 which will provide a widened pavement and boulevard treatment. A review of the proposed intersection should be completed to ensure adequate sight distances are maintained to the west where Fifty Road bends to the south.

The proposed internal subdivision road within Lot 774 would be paved with asphalt and kerbed in accordance with relevant City of Rockingham guidelines. Alternative treatments such as brick paving and coloured asphalt may be incorporated which will be resolved at the design stage. The road reserves will also include pedestrian and dual use path networks. Pavements will be designed and constructed to the City of Rockingham's engineering standard specifications.

5 STORMWATER DRAINAGE

Due to the expected sandy nature of soils within the site, good drainage through soak wells within subdivided lots should be available. As Lot 774 forms a localised natural high point, stormwater drainage collected in the road reserves will be likely graded naturally toward the boundaries of the site.

Lot 774 has previously been included in catchment planning for the Local Water Management Strategy (LWMS) in view of the greater structure plan for surrounding land. Stormwater modelling has been undertaken and the sizing of POS and drainage facilities includes the contributing catchments generated by Lot 774. From the previously published LWMS (Lot 774 Fifty Road Water Management, Coterra 2013), it is confirmed the 100 year top water level in downstream drainage catchments is 5.6 metres AHD and therefore adequate freeboard is maintained to Lot 774. The previously completed stormwater catchment plan for surrounding land including Lot 774 is included in Figure 2.

The detailed drainage management measures will ultimately be defined and implemented through an Urban Water Management Plan (UWMP) under both Department of Water and City's approval. It is expected that a UWMP will be a Western Australian Planning Commission (WAPC) condition of subdivision.

The piped stormwater system would be designed and constructed according to City of Rockingham guidelines and specifications to capture and direct flows for the 1 in 5 year storm event. Events greater than the 1 in 5 will be directed through overland flood paths to appropriate drainage facilities.

6 WASTEWATER

Lot 774 falls within the catchment of the existing McDonald Road waste water pump station which is located approximately 140 metres to the immediate north of the site. This existing pump station serves development to the east and is fed by a 375mm diameter gravity main.

Currently, this pump station has limited capacity of only 15 litres per second and discharges through a temporary pressure main running east along Fifty Road, with an outfall provided to the existing Baldivis Road North pump station which is located approximately 350m south of the intersection between Baldivis Road and Fifty Road. From here, waste water flows are currently directed toward the Kwinana WWPS on Bertram Road.

Provision has been made for the future development of this land containing Lot 774 in the Water Corporation's conceptual wastewater conveyance planning and in the more detailed planning for the McDonald Rd WWPS catchment.

Copies of Water Corporation's long term scheme planning for this area is included in Figures 3 and 4 which demonstrate the ultimate strategies for the area.

Ultimately, the McDonald Road waste water pump station will be upgraded to a Type 90 with a flow rate capable of approximately 85 litres per second. The McDonald Road pump station also lies in the catchment of the East Rockingham Waste Water Treatment Plant (ERWWTP) so the ultimate pressure main will be directed north along McDonald Road, and then gravity fed toward a future Type 180 waste water pump station near Kerosene Lane. There will be a 450mm diameter pressure main from this pump station discharging to the ERWWTP.

It is advised by Water Corporation these facilities to provide for the ultimate waste water servicing strategy in the area, including the ERWWTP may be constructed by 2016.

Due to the current limited capacity of the McDonald Road waste water pump station and temporary outfall nature of the existing pressure main toward Baldivis Road, further detailed planning with Water Corporation is

required with confirmed development timing to assess the viability of interim arrangements prior to ERWWTP being available.

Within the subdivision of Lot 774, the development would be served via a gravity fed network designed in accordance with the Water Corporations specifications. Additional fill beyond the naturally occurring levels to facilitate waste water design would not be required as there is sufficient cover currently available. Standard Water Corporation headwork's contributions are expected to apply to the project.

7 WATER SUPPLY

Currently there is an existing 250mm diameter water main from the Tamworth Hill reservoir which runs along Eighty and Fifty Roads to provide water services to the existing development areas north and east of Lot 774.

Initial supply may be possible from the existing 250 main on Fifty Road, but full development together with demands from adjacent subdivisions to the north and east will likely require the other upgrades and new large distribution mains.

Water Corporation's scheme planning indicates that an additional water main along Fifty Road will be required, which is proposed to be 375mm diameter and would be subject to prefunding arrangements.

Water Corporation's ultimate planning provides additional major water distribution mains to augment the proposed assets within Fifty Road and provide the wider area with distribution mains from which reticulated services may be connected.

From the Tamworth Reservoir, Water Corporation ultimately intend to construct a 1400mm diameter steel water main along Eighty Road to Fifty Road. Timing for this project is expected to be completed within 4 to 5 years and it is understood some funding has been allocated on the 5 year capital works program. To complete the connection to Baldivis Road, a 230m long steel main of 1000mm diameter along Fifty Road will be constructed, however timing is not confirmed.

Significant up-front head works may be required but should be considered in relating to timing and demand for other surrounding proposed developments for contributions to be negotiated.

The subdivision will be reticulated with small water mains in the road reserve of nominally 100mm and 150mm diameter size. The reticulation mains will provide water service connections to each lot within the subdivision which will be subject to Water Corporation confirmed approval. It is advised that standard Water Corporation head works contributions are expected to apply.

8 POWER SUPPLY

There are existing high voltage 22kV Western Power overhead aerials along the northern side of Fifty Road, which provide services to surrounding areas from the Safety bay Zone substation. As these aerials are on the opposite side of Fifty Road to Lot 774, there would not be any requirement to remove and relocate underground if Lot 774 were subdivided.

There is also an existing 240mm low voltage cable from a 100kVA pole top transformer to a universal pillar either on or next door to the lot.

The network capacity mapping tool on the Western Power website does not show this as a critical area, so it is unlikely any major upgrades or network reinforcement would be required for Fifty Road.

Works within the subdivision boundary would be designed with consideration to the surrounding proposed development areas. Therefore, the standard HV pool and subdivision policies will apply. Street lights would be required as per the City of Rockingham policy.

The effects of any earth potential rise (EPR) issues have not been investigated, however if any high pressure steel Water Corporation or gas pipelines are in the vicinity extra investigation and reporting would be required.

The details in this report are only indicative. Further in-depth study and analysis can only be required to determine the exact requirement of any (if required) reinforcement works once a formal application to Western Power has been lodged.

Western Power will neither reserve capacity nor guarantee supply to this development without a formal request being lodged.

9 TELECOMMUNICATIONS

NBN Co is responsible for the installation of fibre in all broad acre developments of 100 or more premises within the long term optic fibre footprint. A developer agreement will be necessary prior to any construction works commencing. However, as Lot 774 is unlikely to qualify independently, it may be possible to create a developer agreement based on the greater surrounding developments proposed and view the project in terms of area demand.

With the National Broadband Network rollout, the developer is responsible for providing pit and pipe infrastructure throughout the subdivision for the fibre to be installed. NBN Co will cover the costs of installing fibre infrastructure in the development, including backhaul.

The communications design will require the inclusion of Fibre Distribution Hub (FDH) within road reserves which is an unpowered, street side cabinets used to provide an optical connection point between the distribution and local network.

As part of the developer agreement conditions, NBN will take over ownership of the assets upon completion and ensure that fibre is ready 3 months prior to the first occupancy for a new development.

10 GAS SUPPLY

There is an existing 160PE high pressure gas main in the northern verge of Fifty Road, from which reticulated services are provided to the area. Existing development on the northern side of Fifty Road are currently served from this trunk main and Lot 774 may be connected to provide gas services to each home within the subdivision.

Internal gas supply will be provided to each lot through common trenching at no additional cost to the project.

The existing ATCO assets are shown in Figure 5.

11 FIGURES

FIGURE 1

Preliminary Local Structure Plan (Development Planning Strategies)

FIGURE 2

Stormwater Catchment Plan (Coterra)

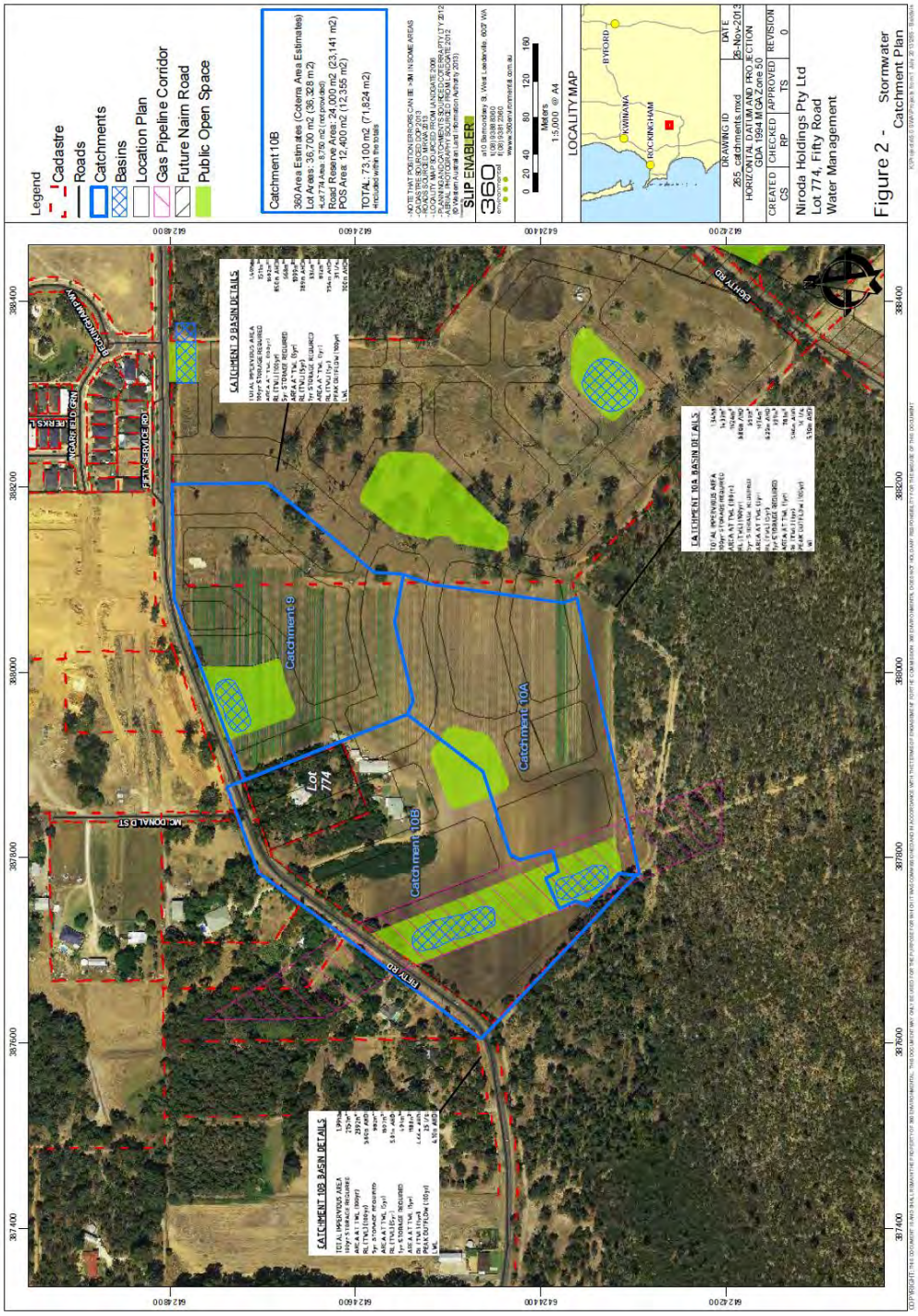


FIGURE 3

Baldivis North Long Term Scheme Planning (Water Corporation)

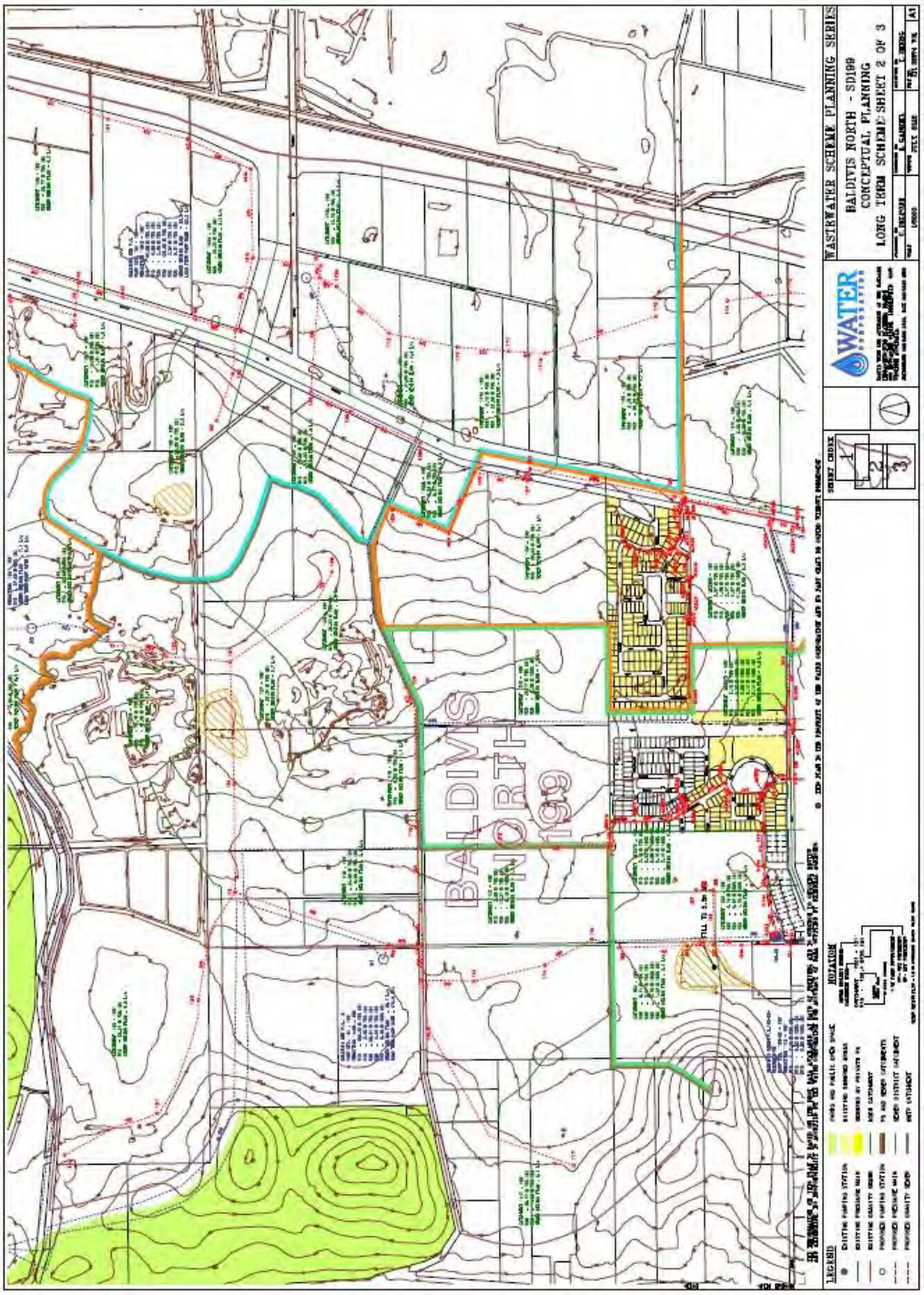


FIGURE 4

Baldivis North Long Term Scheme Planning (Water Corporation)

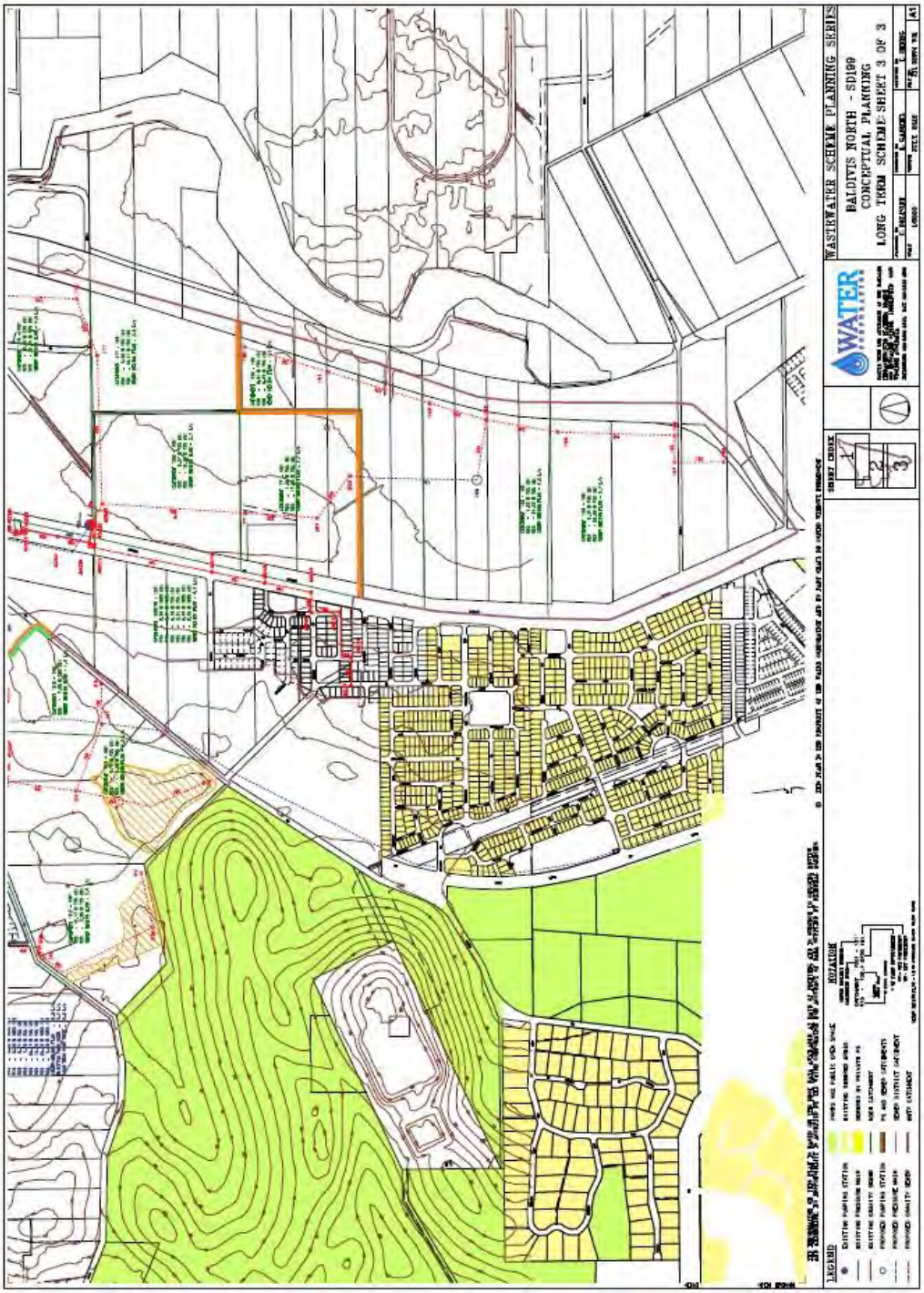
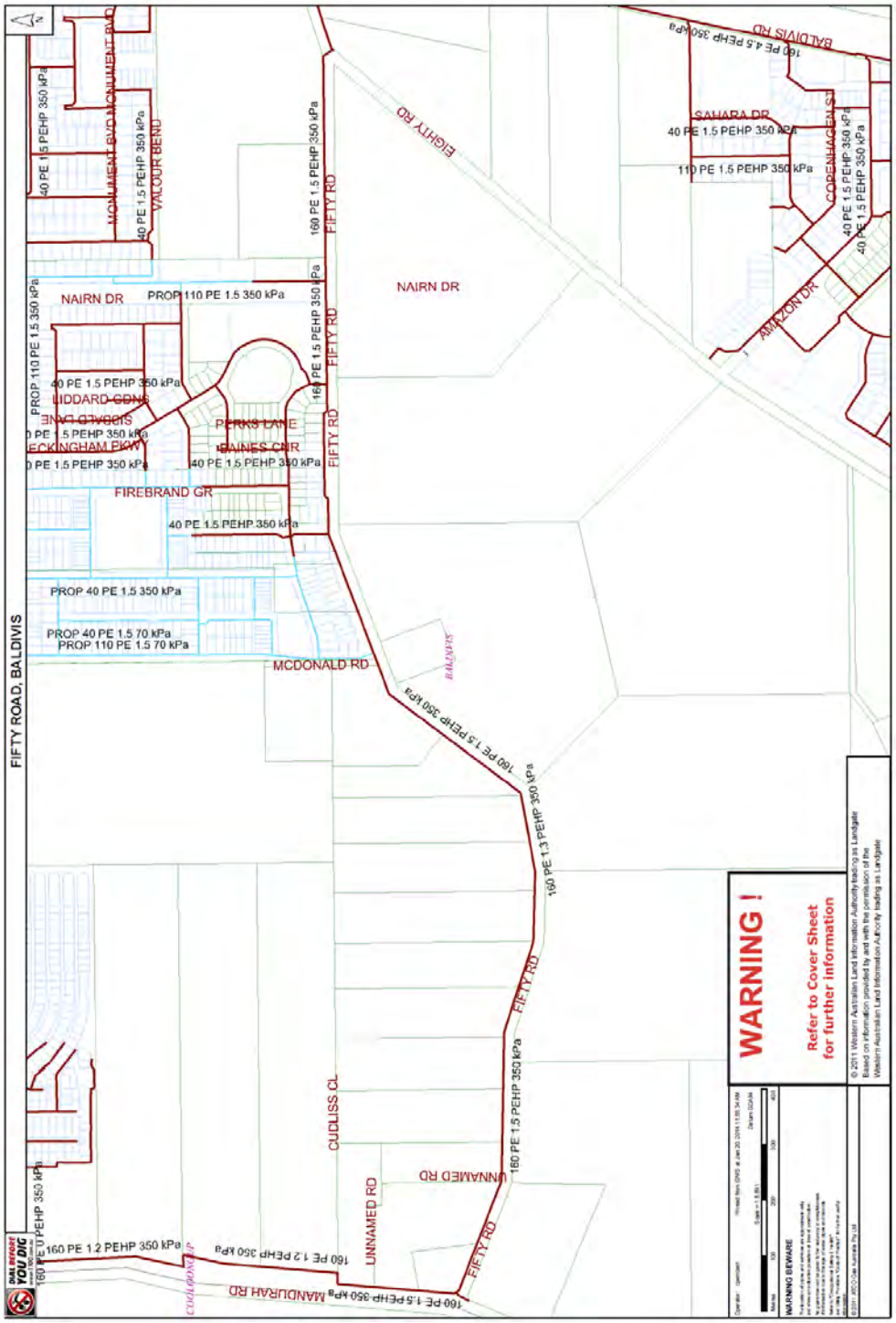


FIGURE 5

Gas mains (ATCO Gas, January 2014)



Addendum 2. Amendment No. 4: Inclusion of R100 Residential Density Coded land surrounding the Neighbourhood Centre

SPIRES ESTATE (PHASE 2) MAJOR STRUCTURE PLAN AMENDMENT – R100

Lots 312 & 313 Fifty Road, Lots 2, 4, 7, 8 Eighty Road, Lot 5 Baldivis Road, Baldivis

WAPC REF: SPN0522M-1

January 2017

Spatial Property Group

DOCUMENT STATUS

VERSION	COMMENT	PREPARED	REVIEWED	REVIEW DATE	APPROVED	ISSUE DATE
0	Draft - WAPC	TV	KB	06.12.2016	KB	07.12.2016
1	Mods - WAPC	CH/TV	KB	30.01.2017	KB	31.01.2017

SPIRES ESTATE (PHASE 2) STRUCTURE PLAN

JANUARY 2017

WAPC REF: SPN0522M-1

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APPROVAL OF STRUCTURE PLAN

This structure plan is prepared under the provisions of the City of Rockingham Town Planning Scheme No.2.

IT IS CERTIFIED THAT THIS STRUCTURE PLAN WAS APPROVED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

_____ Date

Signed for and on behalf of the Western Australian Planning Commission:

_____

an officer of the Commission duly authorised by the Commission pursuant to section 16 of the *Planning and Development Act 2005* for that purpose, in the presence of:

_____ Witness

_____ Date

_____ Date of Expiry

Table of Amendments

AMENDMENT NO.	SUMMARY OF AMENDMENT	AMENDMENT TYPE	DATE APPROVED BY WAPC
1	Inclusion of Lot 774 Fifty Road, Baldivis into the Structure Plan area and for the purpose of residential development. Bdg Ref: 141028_Spires Estate LSP (Part One Only_Updated To Include Lot 774)	Minor	Does not require WAPC endorsement under Clause 4.2.7 of TPS2
2	Update the POS Schedule within Part Two (relevant to Lots 312 & 313 Fifty Road, Lots 2, 4, 7, 8 Eighty Road, and Lot 5 Baldivis Road, Baldivis).	Minor	Does not require WAPC endorsement under Clause 4.2.7 of TPS2
3	Update the road network by replacing the cul-de-sac with a through road between land coded R40 and the northern portion of the land zoned Commercial and delete the nib road abutting the southern most area of land between R60 coded land and the public open space reserve.	Minor	Does not require WAPC endorsement under Clause 4.2.7 of TPS2
4	The inclusion of R100 Residential Density Coded land surrounding the Neighbourhood Centre.	Major	

Table of Density Plans

DENSITY PLAN NO.	AREA OF DENSITY PLAN APPLICATION	DATE ENDORSED BY WAPC

EXECUTIVE SUMMARY TABLE

ITEM	DATA	MODIFIED
Total area covered by the structure plan	54.57 hectares	No
Area of Amendment	1.19 hectares	Yes
Area of each land use proposed (approx): Nett Residential (excl roads & POS) Commercial 'Other Regional Roads' (Nairn Drive)	 31.36 hectares 2.8 hectares 1.01 hectares	No
Estimated lot yield	~ 600+ lots	No
Estimated number of dwellings	~ 900+ dwellings	Yes
Estimated residential site density	~ 28 Dwellings /site hectare [1] ~ 16 Dwellings/gross urban zone [2]	Yes
Estimated population@ 2.8pp/dwelling	~ 2,520+	Yes
Number of high schools	0	No
Number of primary schools	0	No
Estimate Commercial floor space	~ 5,500m^2	No
Estimated number and % of public open space given over to: Regional Open Space District Open Space Neighbourhood Parks (>3,000m^2) Local Parks (<3,000m^2)	 0ha 0ha 10 parks @ 5.75ha (97.7%) 1 park @ 0.13ha (2.3%)	No
Estimated percentage of natural area:	0ha	No

FOOTNOTES:

[1] *Gross Urban Zone' refers to the definition under WAPC's Directions 2031 and supporting documents.*
[2] *'Residential Site Hectare' refers to the definition under Element 1 of WAPC's Liveable Neighbourhoods.*
[3] *All figures above exclude Lot 774 Fifty Road*

CONTENTS

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2 Local Developments Plans 1
3 Spires Estate (Phase 2) Structure Plan (Plan 1) 3

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2 Residential Densities and Dwelling Forecasts 7
2.1 Dwelling Forecasts- Directions 2031 7
2.2 Dwelling Forecasts- Liveable Neighbourhoods 7
3 Streetscape and Built Form Environment 7
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PLANS

Plan 1: Structure Plan

FIGURES

Figure 1: R100 Indicative Development Plan

Figure 2: R100 Frontage Types

Figure 3: R100 Cross-Sections

TECHNICAL STUDIES (APPENDICES)

Appendix 4.1: Transport Technical Note

ABBREVIATIONS

AHD	Australian Height Datum
BMP	Bushfire Management Plan
CDTED	Crime Prevention Through Environmental Design
IDP	Indicative Development Plan
LDP	Local Development Plan
POS	Public Open Space
WAPC	Western Australian Planning Commission

PART ONE

Implementation

SPIRES ESTATE (PHASE 2) STRUCTURE PLAN AMENDMENT

1. Structure Plan Amendment
2. Local Development Plans
3. Spires Estate (Phase 2) Structure Plan (Plan 1)

PART ONE – IMPLEMENTATION

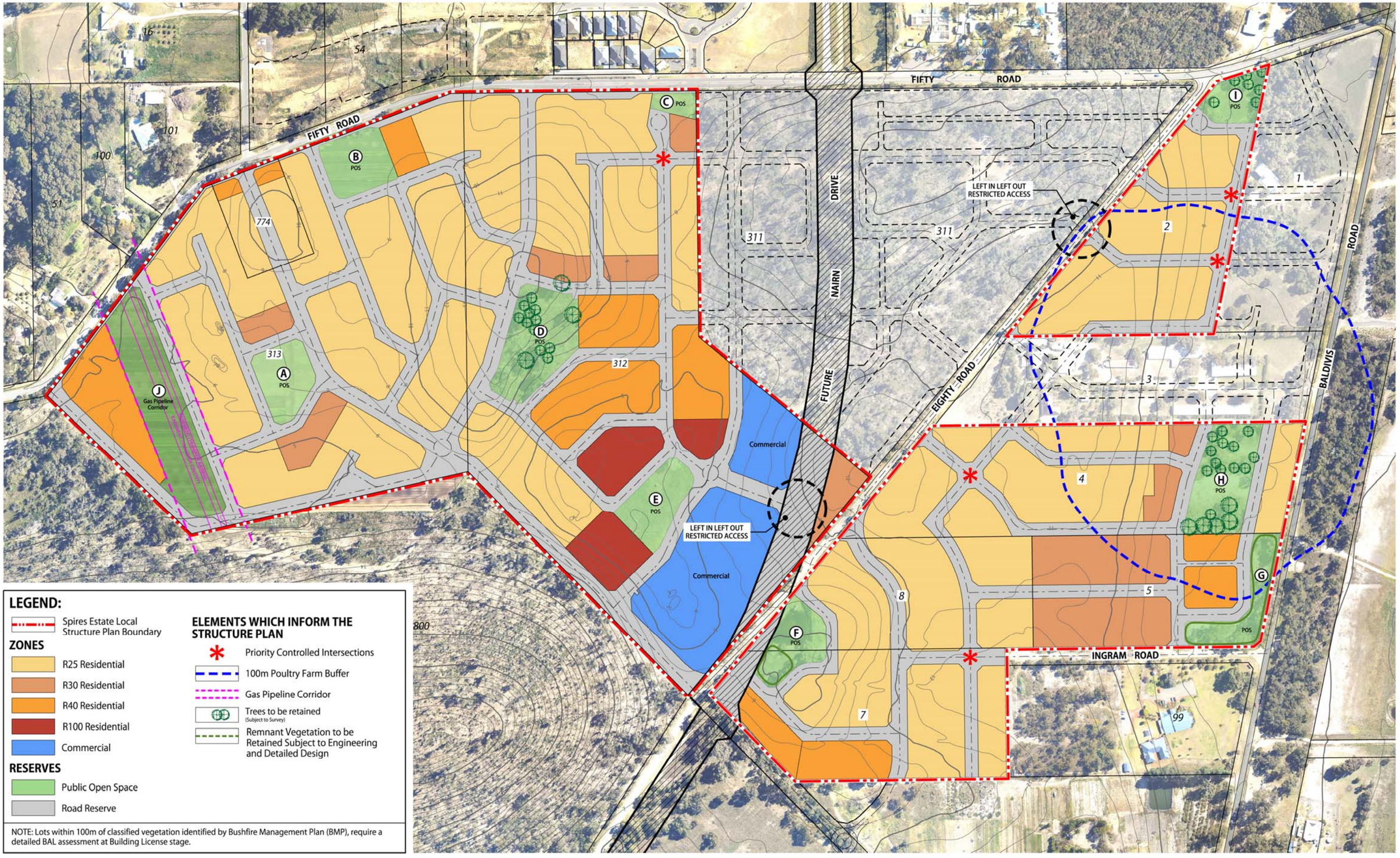
1 Structure Plan Amendment

The Amendment to the approved Structure Plan for Lots 312 & 313 Fifty Road, Lots 2, 4, 7 & 8 Eighty Road and Lot 5 Baldivis Road, Baldivis, is to support a recoding of the land which is adjacent to the Neighbourhood Centre and Public Open Space (POS) (Area E) from R60 to R100.

2 Local Developments Plans

Local Development Plan(s) will be prepared for the land coded R100 to inform applications for subdivision and development in regard to the following:

- The bushfire risk;
- The interface between public open space and the future built form for the amendment area;
- The built form in respect of bulk, scale, height, visual permeability and architectural expression;
- The facade of the proposed R100 zone that will abut land coded R25 and R40 (within two of the three proposed street blocks);
- Building setbacks;
- Private and public car parking; and
- Adequate provision for the City's rubbish collection vehicles to suitably manoeuvre in all circumstances.



LEGEND:

- Spires Estate Local Structure Plan Boundary

ZONES

- R25 Residential
- R30 Residential
- R40 Residential
- R100 Residential
- Commercial

RESERVES

- Public Open Space
- Road Reserve

ELEMENTS WHICH INFORM THE STRUCTURE PLAN

- Priority Controlled Intersections
- 100m Poultry Farm Buffer
- Gas Pipeline Corridor
- Trees to be retained (Subject to Survey)
- Remnant Vegetation to be Retained Subject to Engineering and Detailed Design

NOTE: Lots within 100m of classified vegetation identified by Bushfire Management Plan (BMP), require a detailed BAL assessment at Building License stage.

PLAN 1 - Spires Estate Structure Plan

Various Lots Fifty and Eighty Road, BALDIVIS

for: Spatial Property Group
ROCK/2016/...

SPATIAL Property Group™

NORTH

Scale 1:4000 @ A3

0 40 80 120 160 200m

DATE:	10/09/2015	DRAFTEE:	RF
REVISED:	09/11/2016	PLANNER:	TV
PROJECTION:	MGA 50	CHECK:	TV
DATUM:	AHD	PLAN NUMBER:	CARBD-2-001L

A 28 Brown St, East Perth WA 6004
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Creative DESIGN+PLANNING

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PART TWO

Explanatory Section and Technical Studies

SPIRES ESTATE (PHASE 2) STRUCTURE PLAN AMENDMENT

1. Planning Background
2. Site conditions and constraints
3. Land use and subdivision requirements
4. Technical Studies (Appendices) Index

PART TWO –
EXPLANATORY SECTION AND TECHNICAL STUDIES

1 Introduction and Purpose

The purpose of this Amendment to the approved Structure Plan for the Spires Estate (Phase 2) is to recode land from R60 to R100.

2 Residential Densities and Dwelling Forecasts

2.1 Dwelling Forecasts- Directions 2031

The Structure Plan Amendment still proposes in the order of 600+ lots, with the total dwelling yield increased from 800+ dwellings to be in the order of 900+ dwellings. The dwelling yield projections thus address the 15 dwellings per gross urban zone targets of *Directions 2031,* and will potentially accommodate a population in the order of 2,520+ people, at a rate of 2.8 persons per household.

2.2 Dwelling Forecasts- Liveable Neighbourhoods

Higher density (R100) residential development is proposed in proximity to (and potentially within) the future Neighbourhood Activity Centre adjacent the future Nairn Drive.

The R100 density code offers a minimum and average lot product considered suitable for this location within the outer-metropolitan area of Perth and adjacent to a neighbourhood centre. It is anticipated that the product will be predominantly multiple dwellings, where it is estimated that the three sites could accommodate approximately ~200+ dwellings, which is an increase from approximately 100 (R60) dwellings.

Based on the *Liveable Neighbourhoods* 'Site Hectare' definition, the overall density for the Structure Plan equates to ~28 dwellings per site hectare; thus exceeding the 22 dwellings per site hectare target of this document.

3 Streetscape and Built Form Environment

3.1 'High Density' – Residential R100

An Indicative Development Plan (IDP) has been prepared for the R100 sites (**Figure 1**). Development needs to incorporate and maintain the following elements:

a) Unless specified below, all development controls are to be as per the requirements of the Residential Design Codes.

b) The preferred Land Uses for the subject lots are as follows:
   i. Multiple Dwellings; and
   ii. Home Based Business.

c) The maximum building height permitted is 19.0m/ 5 storeys.

d) The buildings are to be located and configured to frame and address street frontages in a way generally consistent with **Figure 2 – Frontage Types** and **Figure 3 - Cross Sections**.
   i. Type 1
      - Minimum setback 2m, with a minimum of 2 storey (6.0m) or equivalent parapet height up to 3 storeys/12.5m high.
      - An additional 3.5m setback to 4-5 storeys/19m high.
   ii. Type 2
      - Minimum setback 2-4m, with a minimum of 2 storey (6.0m) or equivalent parapet height up to 3 storeys/12.5m high.
      - An additional 6m setback to 4-5 storeys/19m high.
   iii. Type 3
      - Minimum setback 2m, with a 2 storey (6.0m min/ 8.0m maximum) or equivalent parapet height.
      - An additional 10m setback to 3-5 storeys/19m high.

iv. Type 4

- Nil setback permitted for ground floor only.
- 2nd Storey setback as per R-codes (Table 2a and 2b).
- An additional 12.5m setback to 3-5 storeys/19m high).

e) Minimum Floor to Floor Heights are:

i. Ground floor to first floor - minimum 3.6m with a minimum floor to ceiling height clearance of 3m (to allow for adaptable ground floor uses i.e. home based business).

ii. Above Ground Floor - minimum 3.0m with a minimum floor to ceiling height clearance of 2.7m.

f) All service areas to be not visible from the street.

g) Car parking to be provided in accordance with the Residential Design Codes.

h) Parking is not permitted between the road reserve boundary and building frontages. Off-street car parking to be located behind, under or over ground floor street front buildings.

i) Visitor parking directly adjacent on-street parking can contribute to a developments visitor parking allowance. In addition, reciprocal parking rights with commercial site/s will be facilitated.

j) Vehicle entry/egress points shall be generally provided as per the IDP (**Figure 1**).

k) Buildings are to provide surveillance of all street frontages and areas of POS. All dwellings adjacent to a street or POS to provide a minimum of one major opening overlooking the street/POS.

l) Central areas of private open space are encouraged.

m) Developments between 6-12 dwellings to provide 40m² of communal open space; developments over 12 dwellings to provide 80m² of communal open space.

n) Fencing to street/POS frontages to be permeable, with a maximum solid wall to a height of 900mm.

o) CPTED principles (in accordance with the WAPC Designing out Crime Planning Guidelines) are to be incorporated into the developments.

p) Basic building finishes should favour materials which complement the colours and textures of the local landscape.

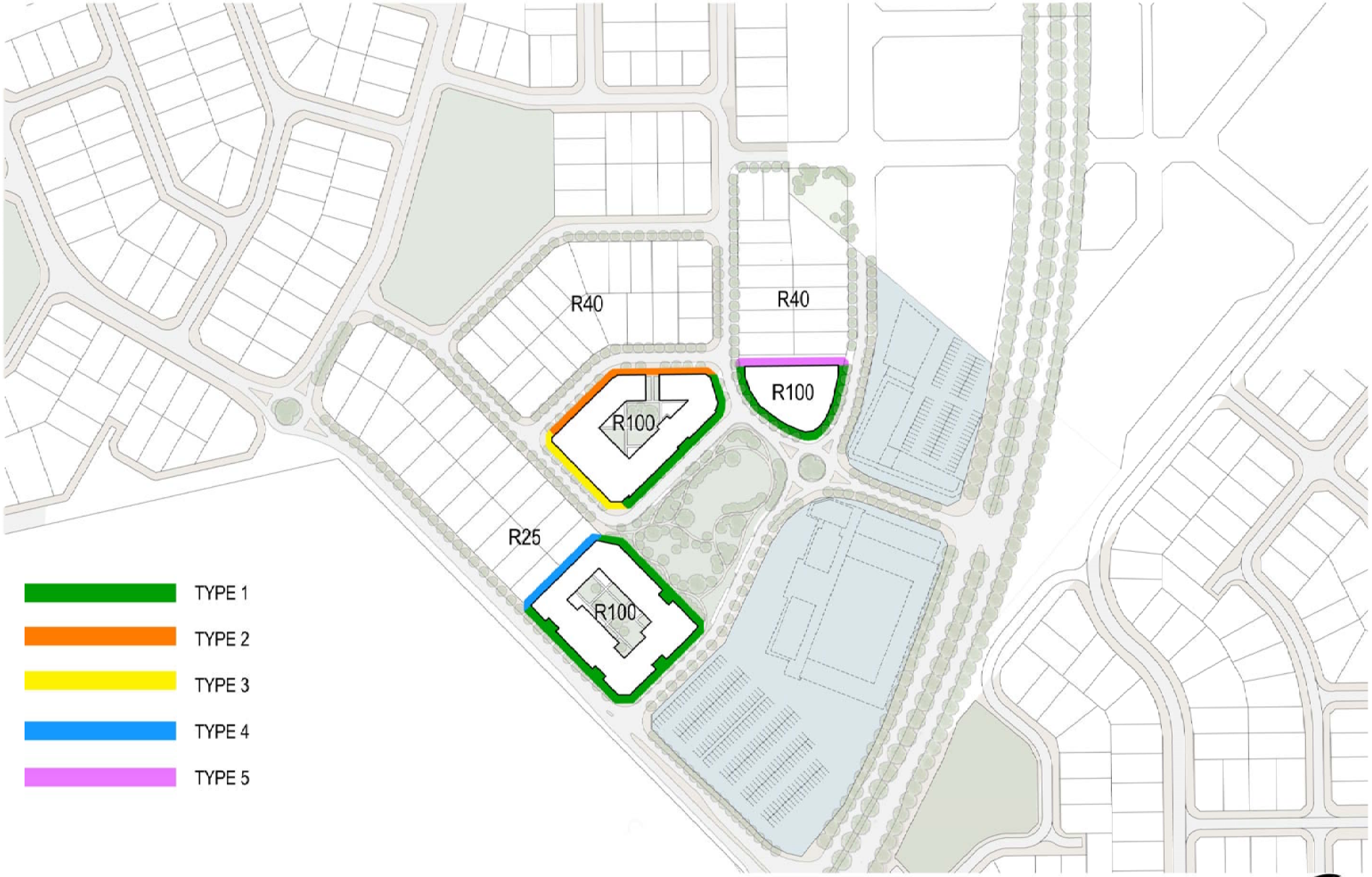
3.2 Local Development Plans

Local Development Plan will be prepared for the land coded R100 to inform applications for subdivision and development in regard to the following:

- The bushfire risk;
- The interface between public open space and the future built form for the amendment area;
- The built form in respect of bulk, scale, height, visual permeability and architectural expression;
- The facade of the proposed R100 zone that will abut land coded R25 and R40 (within two of the three proposed street blocks);
- Building setbacks;
- Private and public car parking; and
- Adequate provision for the City's rubbish collection vehicles to suitably manoeuvre in all circumstances.

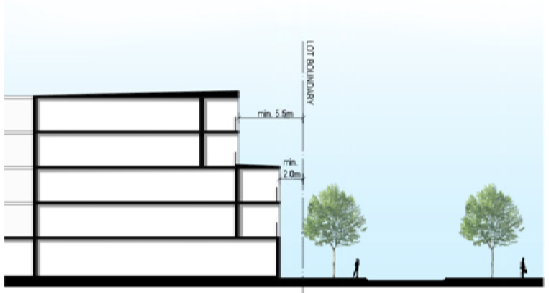
R100 INDICATIVE DEVELOPMENT PLAN

Figure 1

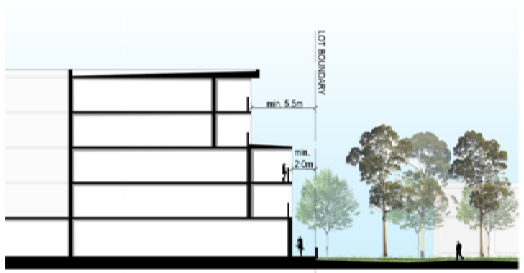


R100 FRONTAGE TYPES

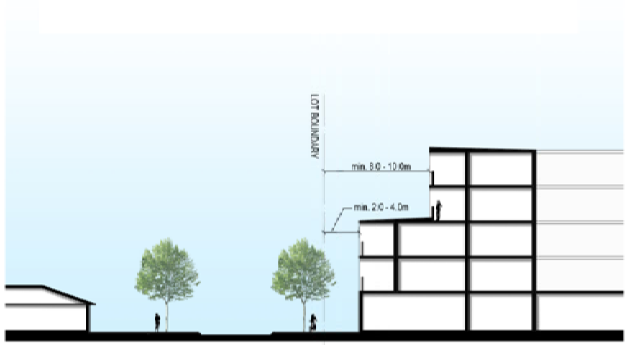
Figure 2



TYPE 1 - Street Interface



TYPE 1 - POS Interface



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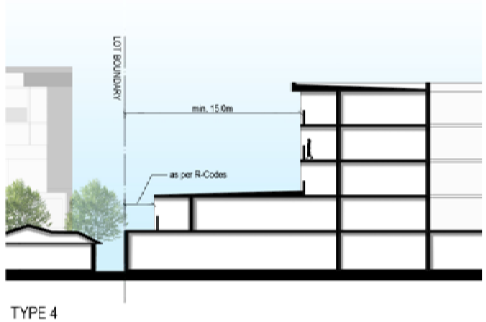

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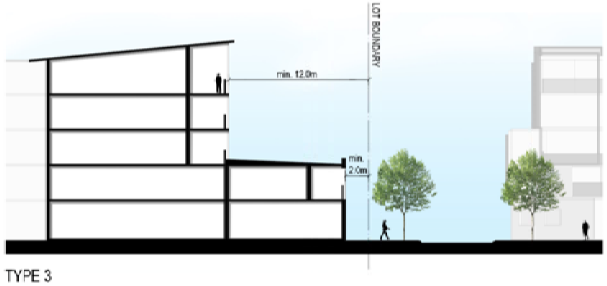

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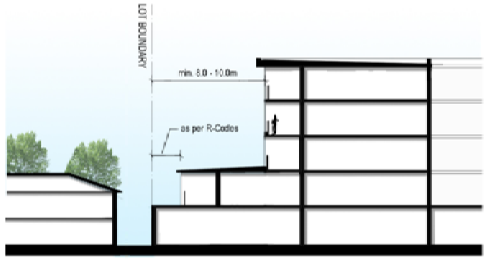

TYPE 5

R100 CROSS-SECTIONS

Figure 3

Scale: 1:200@A3 Date: 16/02/2016 Plan:

4 Transport Assessment

A technical note has been prepared by Transcore to assess the impact of the proposed increase in density from R60 to R100 (**Appendix 1** refers). A summary of the technical note is below.

Modelling and analysis undertaken indicates that the proposed modification to the residential density would not increase the projected traffic volumes on any of the Structure Plan roads by more than 100vph. Therefore, the traffic impact of the proposed increase in density is expected to be marginal and would not change the road hierarchy of the original Structure Plan area.

The updated Structure Plan shows a new connection from north of the proposed neighbourhood centre within the Structure Plan area to Lot 311. Transport modelling and analysis undertaken indicates that the impact of the proposed road network modification would be local and would reduce the projected traffic volumes from the parallel north-south road, within the Structure Plan area, to the west of this road by about 700vpd.

The SIDRA intersection analysis undertaken indicates that the proposed signalised intersection of Amazon Drive/ Nairn Drive would work satisfactorily and well within capacity with overall level of service B and can accommodate the additional traffic due to the proposed modification to the Structure Plan.

5 Technical Studies (Appendices) Index

Appendix Number	Title	Prepared by
4.1	Transport Technical Note	Transcore

APPENDICES

Appendix 4.1
Transport Technical Note

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Fax: +61 (08) 9382 4177
Email: admin@transcore.net.au
transport planning • traffic engineering • transport modelling
TRANSCORE PTY LTD ACN 094 951 318 ABN 19 094 951 318

Technical Note:	No. 1	Date: 02/12/2016
Project No:	t12.089	
Project:	**Baldivis LSP (Spires Estate)**	
Subject:	**Traffic impacts of the updated Structure Plan**	

1. Introduction

The original Spires Estate Local Structure Plan (LSP) included residential land ranging from R25 to R60 density with a neighbourhood centre located at the centre of the LSP area adjacent to Eighty Road.

Creative Design + Planning have recently lodged a request to up-code the R60 residential dwellings adjacent to the proposed neighbourhood centre area to R100 during the Phase 2 of the development. The updated LSP is provided in **Appendix A** of this technical note.

The updated LSP shows that the proposed access road, within the LSP area, which forms the western boundary of the neighbourhood centre, would connect to Lot 311. Figure 1 shows the proposed modifications to the original LSP area and Lot 311.

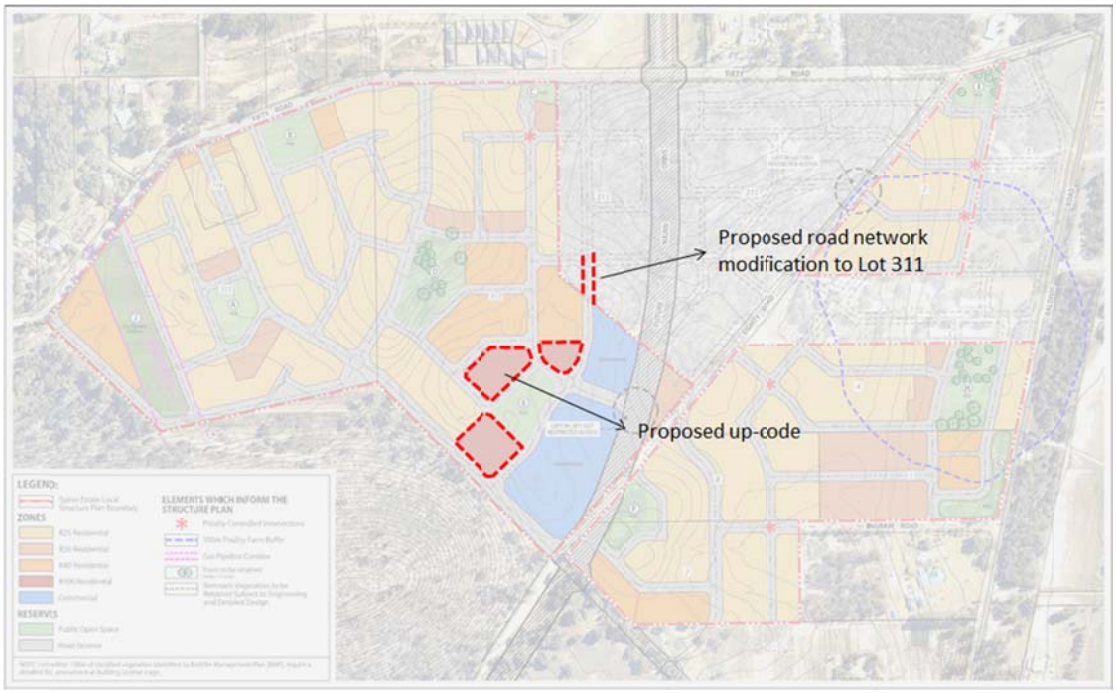


Figure 1: Proposed modifications to the original LSP area and Lot 311

The R100 residential area is located to the west of the proposed neighbourhood centre as shown in Figure 1 and the net increase in dwellings in this area due to the proposed up-code would be approximately 100 dwellings.

As a result of the increase in residential dwellings, the WAPC has requested that additional modelling and analysis should be undertaken to assess the impact of the proposed modifications to the LSP area.

The purpose of this technical note is to assess the impact of the proposed up-code (R60 to R100) under two Scenarios: with and without proposed road network modification to Lot 311.

2. Trip Generation and Distribution

The daily traffic generation rate used in the transport assessment of the original LSP is 8 vehicle trips per day (vpd) per dwelling, which corresponds to peak hour trip generation rates recommended in the Western Australian Planning Commission (WAPC) Transport Assessment Guidelines for Development.

In order to be consistent with the previous analysis, conservatively the same trip rate has been used for the additional 100 dwellings due to the proposed up-code. Accordingly, the anticipated additional 100 dwellings would generate approximately 800 additional trips per day.

Figure 2 shows the daily trip distribution of the proposed additional 100 dwellings without the road network modification to Lot 311. This figure also shows the original LSP traffic and the total traffic volumes on the LSP area and surrounding road network before the proposed up-code. Figure 3 shows the same analysis with the proposed road network modification to Lot 311.

Transport modelling and analysis undertaken indicates that:

- The proposed up-code would not increase the projected traffic volumes on any of the LSP roads by more than 100vph and therefore the traffic impact of the proposed up-code is expected to be marginal and would not change the road hierarchy of the original LSP area.
- The impact of the proposed road network modifications to Lot 311 would be local and would reduce the projected traffic volumes from the parallel north-south road, within the LSP area, to the west of this road by about 700vpd.

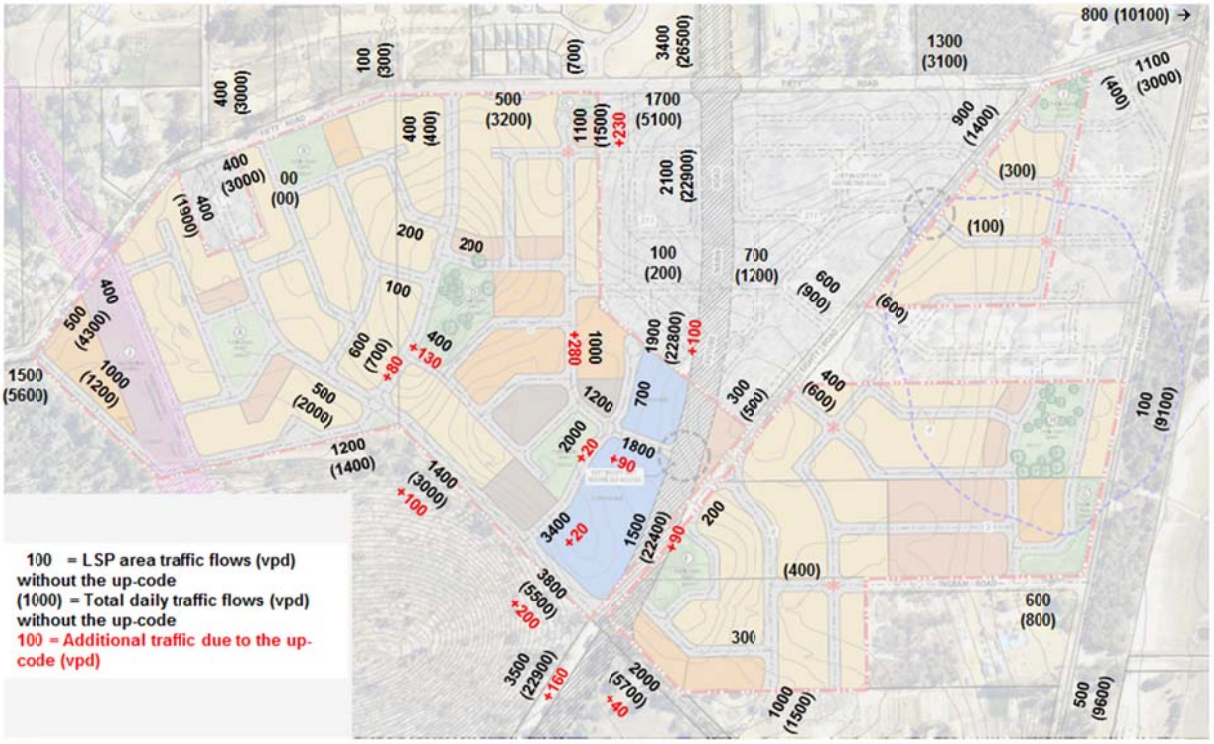


Figure 2: Distribution of the addiotional trips due to the proposed up-code (without the road network modification to Lot 311)

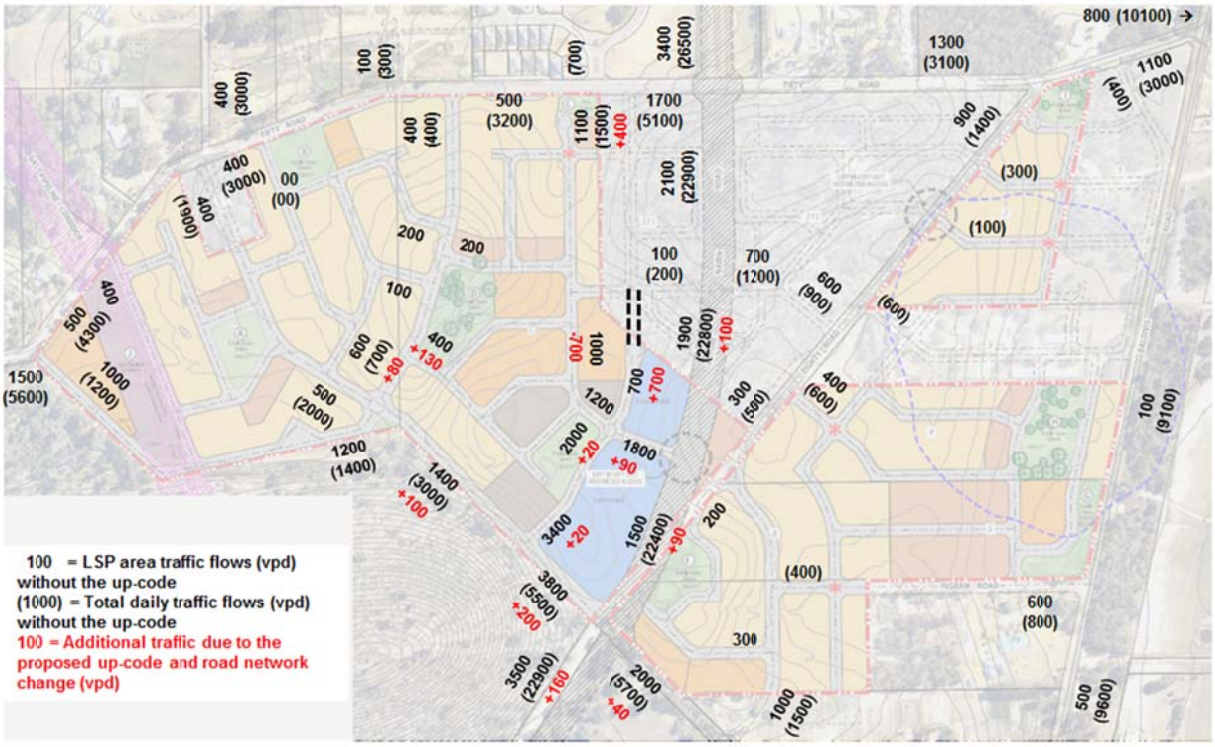


Figure 3: Distribution of the addiotional trips due to the proposed up-code (with the road network modification to Lot 311)

3. Intersection Analysis

The key intersection that would be affected by the proposed modification to the LSP area would the proposed signalised intersection of Nairn Drive and Amazon Drive. Therefore intersection analysis has been undertaken, based on the updated projected traffic volumes, to assess the operation of this intersection for both AM and PM peak hours.

Appendix B of this technical note shows the results of the intersection analysis.

The SIDRA intersection analysis undertaken indicates that the proposed signalised intersection of Amazon Drive/ Nairn Drive would work satisfactorily and well within capacity with overall level of service B and can accommodate the additional traffic due to the proposed modification to the LSP area.

4. Conclusion:

The updated LSP indicates an up-code of residential dwellings from R60 to R100 for the area to the west of the proposed neighbourhood centre.

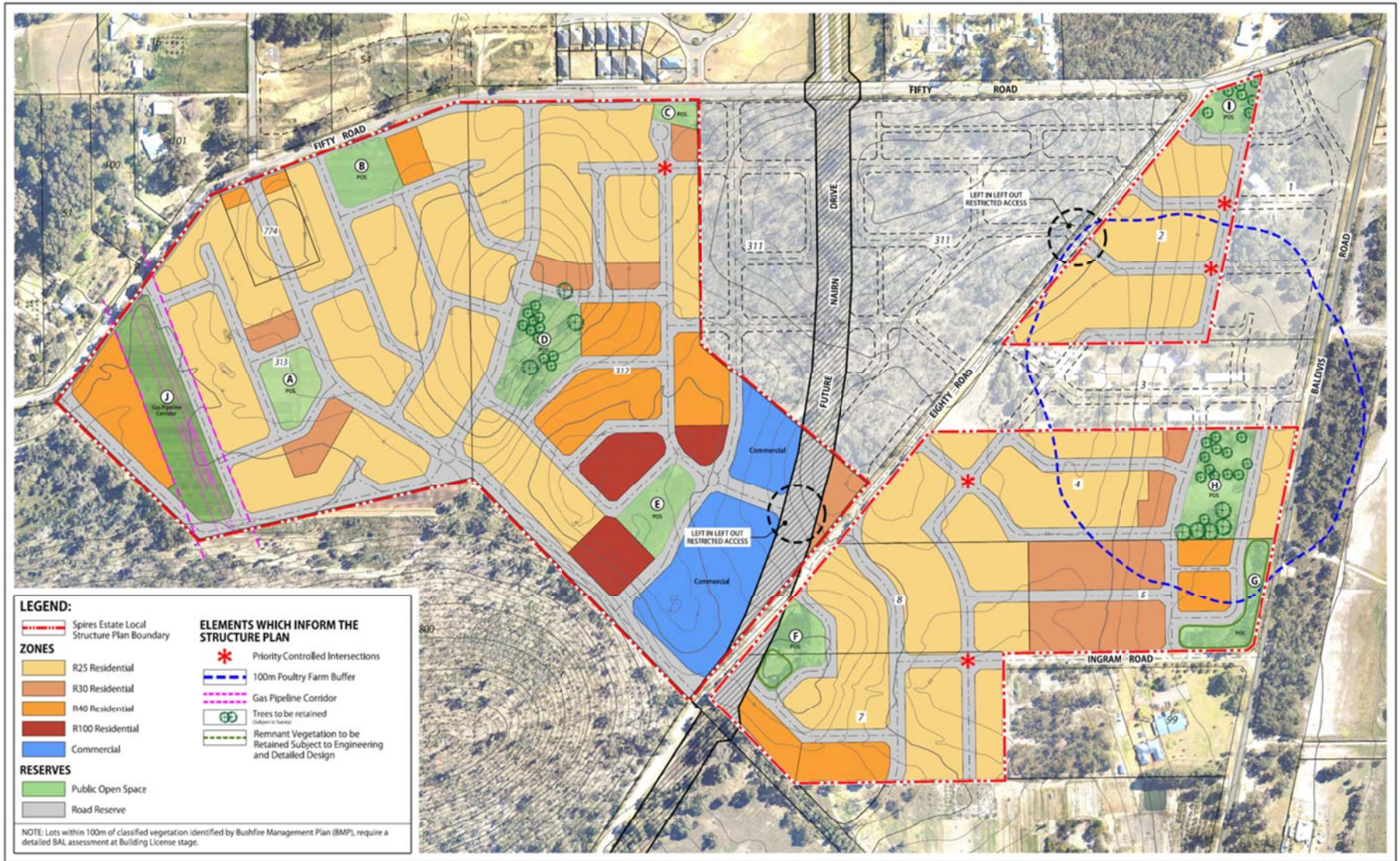
Modelling and analysis undertaken indicates that the proposed modification to the residential density would not increase the projected traffic volumes on any of the LSP roads by more than 100vph and therefore the traffic impact of the proposed up-code is expected to be marginal and would not change the road hierarchy of the original LSP area.

The updated LSP area shows a new connection from north of the proposed neighbourhood centre within the LSP area to Lot 311. Transport modelling and analysis undertaken indicates that the impact of the proposed road network modification would be local and would reduce the projected traffic volumes from the parallel north-south road, within the LSP area, to the west of this road by about 700vpd.

The SIDRA intersection analysis undertaken indicates that the proposed signalised intersection of Amazon Drive/ Nairn Drive would work satisfactorily and well within capacity with overall level of service B and can accommodate the additional traffic due to the proposed modification to the LSP area.

Appendix A

Spiers Estate Updated Local Structure Plan



PLAN 1 - Spires Estate Structure Plan

Various Lots Fifty and Eighty Road, BALDIVIS

for: Spatial Property Group

ROCK/2016/...

SPATIAL Property Group™

Scale 1:4000 @ A3

0 40 80 120 160 200m

DATE:	10/09/2015	DRAFTEE:	RF
REVISED:	08/11/2016	PLANNER:	TV
PROJECTION:	MGA 50	CHECK:	TV
DATUM:	AHD	PLAN NUMBER:	CARBO-2-001L

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Appendix B

Intersection Analysis

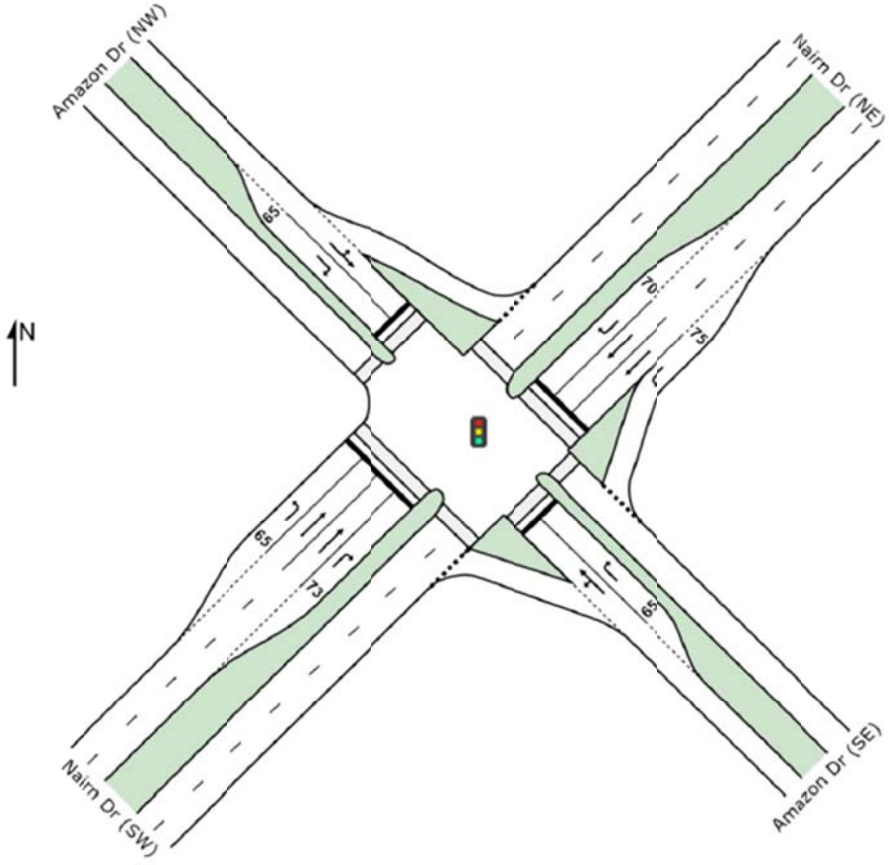


Figure B1. Nairn Drive / Amazon Drive intersection layout analysed in SIDRA

Table B1. SIDRA results – Nairn Drive / Amazon Drive signalised intersection – 2031 weekday AM peak with full development

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Amazon Dr (SE)											
4	L2	38	2.0	0.221	14.1	LOS B	1.9	13.3	0.74	0.64	48.0
5	T1	81	2.0	0.221	9.6	LOS A	1.9	13.3	0.74	0.64	43.5
6	R2	203	2.0	0.590	27.9	LOS C	5.6	40.0	0.94	0.82	39.2
Approach		322	2.0	0.590	21.7	LOS C	5.6	40.0	0.87	0.75	41.1
NorthEast: Nairn Dr (NE)											
7	L2	80	2.0	0.074	8.9	LOS A	0.6	4.1	0.39	0.66	51.3
8	T1	528	2.0	0.247	7.6	LOS A	4.0	28.7	0.55	0.47	61.1
9	R2	21	2.0	0.110	21.8	LOS C	0.4	3.2	0.70	0.71	43.1
Approach		629	2.0	0.247	8.2	LOS A	4.0	28.7	0.54	0.50	58.9
NorthWest: Amazon Dr (NW)											
10	L2	1	2.0	0.172	25.2	LOS C	1.9	13.5	0.82	0.66	42.6
11	T1	83	2.0	0.172	20.7	LOS C	1.9	13.5	0.82	0.66	39.0
12	R2	121	2.0	0.337	26.1	LOS C	3.1	22.0	0.87	0.76	40.0
Approach		205	2.0	0.337	23.9	LOS C	3.1	22.0	0.85	0.72	39.6
SouthWest: Nairn Dr (SW)											
1	L2	278	2.0	0.291	15.3	LOS B	4.7	33.2	0.60	0.75	46.5
2	T1	1228	2.0	0.574	9.6	LOS A	11.9	84.8	0.71	0.63	59.1
3	R2	60	2.0	0.128	15.9	LOS B	1.0	7.1	0.58	0.71	46.3
Approach		1566	2.0	0.574	10.9	LOS B	11.9	84.8	0.68	0.65	55.8
All Vehicles		2722	2.0	0.590	12.5	LOS B	11.9	84.8	0.68	0.63	52.6

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P2	SouthEast Full Crossing	50	11.4	LOS B	0.1	0.1	0.62	0.62
P3	NorthEast Full Crossing	50	24.4	LOS C	0.1	0.1	0.90	0.90
P4	NorthWest Full Crossing	50	11.4	LOS B	0.1	0.1	0.62	0.62
P1	SouthWest Full Crossing	50	24.4	LOS C	0.1	0.1	0.90	0.90
All Pedestrians		200	17.9	LOS B			0.76	0.76

Phase Timing Results

Phase	A	B
Reference Phase	Yes	No
Phase Change Time (sec)	0	39
Green Time (sec)	33	15
Yellow Time (sec)	4	4
All-Red Time (sec)	2	2
Phase Time (sec)	39	21
Phase Split	65 %	35 %

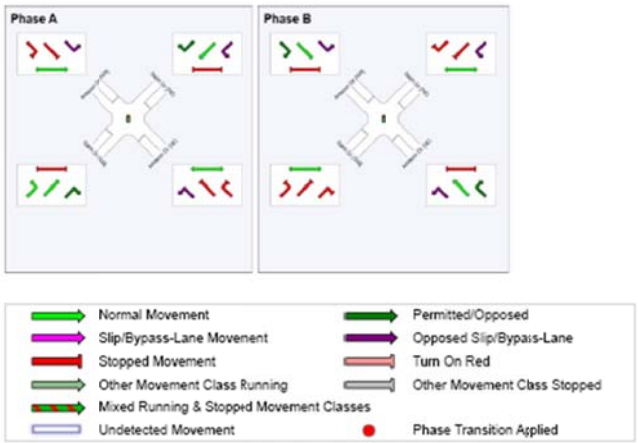


Table B1. SIDRA results – Nairn Drive / Amazon Drive signalised intersection – 2031 weekday PM peak with full development

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Amazon Dr (SE)											
4	L2	38	2.0	0.192	10.7	LOS B	1.6	11.6	0.65	0.59	50.2
5	T1	81	2.0	0.192	6.2	LOS A	1.6	11.6	0.65	0.59	45.3
6	R2	87	2.0	0.212	22.8	LOS C	2.0	14.3	0.80	0.73	41.5
Approach		206	2.0	0.212	14.0	LOS B	2.0	14.3	0.71	0.65	44.4
NorthEast: Nairn Dr (NE)											
7	L2	187	2.0	0.153	8.1	LOS A	1.0	7.4	0.34	0.67	51.9
8	T1	1233	2.0	0.634	12.0	LOS B	13.4	95.1	0.79	0.70	57.0
9	R2	8	2.0	0.020	17.1	LOS B	0.1	1.0	0.59	0.66	45.6
Approach		1428	2.0	0.634	11.5	LOS B	13.4	95.1	0.73	0.69	56.2
NorthWest: Amazon Dr (NW)											
10	L2	1	2.0	0.144	21.0	LOS C	1.7	12.5	0.76	0.61	44.8
11	T1	83	2.0	0.144	16.4	LOS B	1.7	12.5	0.76	0.61	40.9
12	R2	283	2.0	0.631	25.2	LOS C	7.6	53.8	0.92	0.83	40.4
Approach		367	2.0	0.631	23.2	LOS C	7.6	53.8	0.88	0.78	40.5
SouthWest: Nairn Dr (SW)											
1	L2	119	2.0	0.133	15.6	LOS B	1.9	13.7	0.58	0.72	46.4
2	T1	526	2.0	0.270	9.4	LOS A	4.5	31.8	0.61	0.52	59.3
3	R2	60	2.0	0.311	26.3	LOS C	1.5	10.7	0.82	0.76	40.9
Approach		705	2.0	0.311	11.9	LOS B	4.5	31.8	0.63	0.57	54.7
All Vehicles		2706	2.0	0.634	13.4	LOS B	13.4	95.1	0.72	0.67	52.0

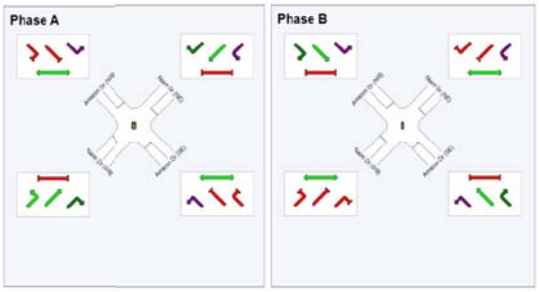
Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

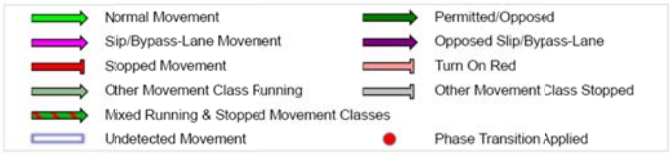
Movement Performance - Pedestrians

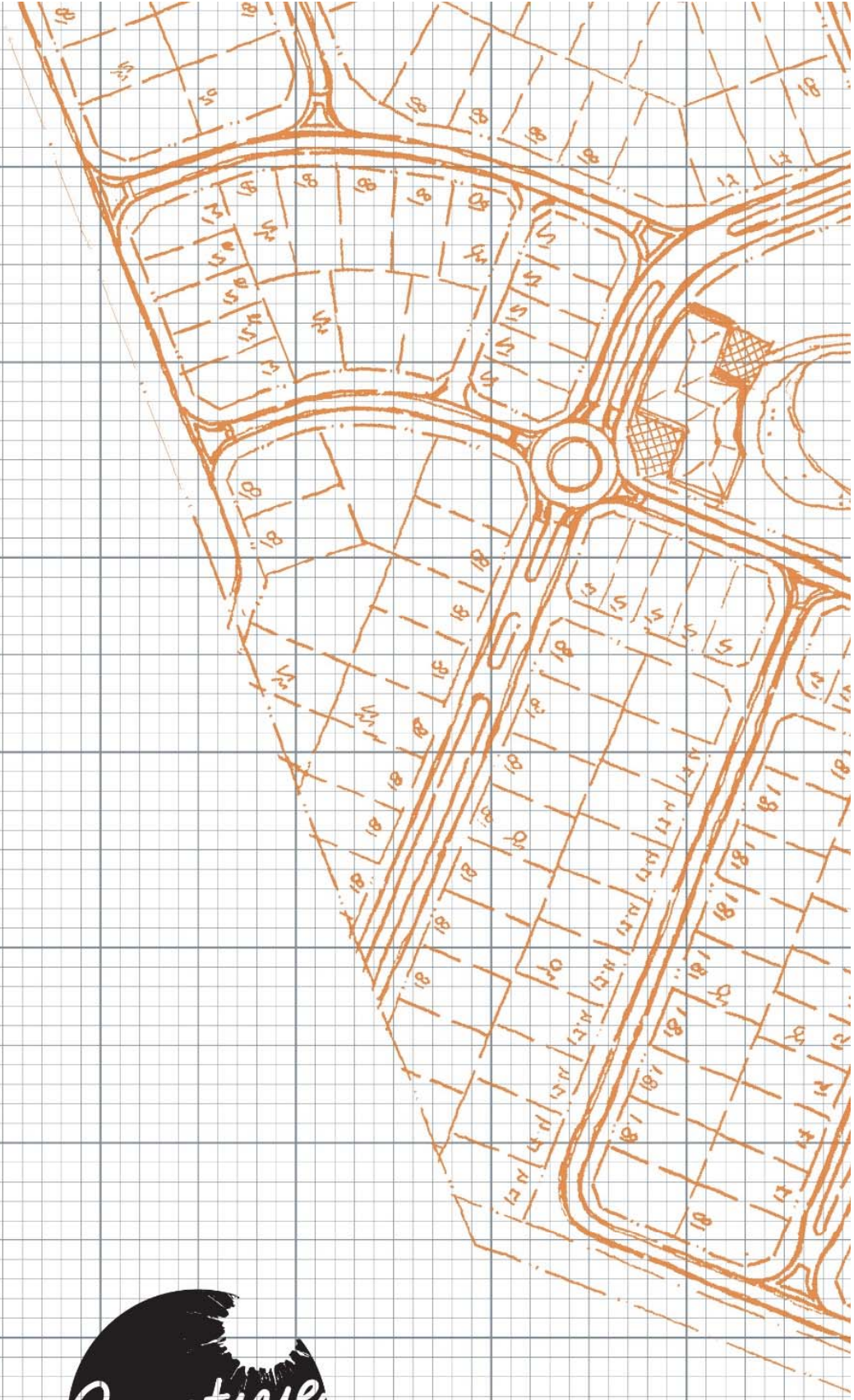
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P2	SouthEast Full Crossing	50	13.4	LOS B	0.1	0.1	0.67	0.67
P3	NorthEast Full Crossing	50	24.4	LOS C	0.1	0.1	0.90	0.90
P4	NorthWest Full Crossing	50	13.4	LOS B	0.1	0.1	0.67	0.67
P1	SouthWest Full Crossing	50	24.4	LOS C	0.1	0.1	0.90	0.90
All Pedestrians		200	18.9	LOS B			0.78	0.78

Phase Timing Results

Phase	A	B
Reference Phase	Yes	No
Phase Change Time (sec)	0	36
Green Time (sec)	30	18
Yellow Time (sec)	4	4
All-Red Time (sec)	2	2
Phase Time (sec)	36	24
Phase Split	60 %	40 %







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Addendum 3. Amendment No. 6: Introduction of a Special Use site and increase density of some land from R25 to R40 and R100

2. EXPLANATORY SECTION & APPENDICES

SPIRES ESTATE LOCAL STRUCTURE PLAN

2.1 PURPOSE

The purpose of this Amendment is to rezone land from R25 to R40 and R100 and from R100 to Special Use. The plan below compares the approved and the proposed landuses and residential densities.

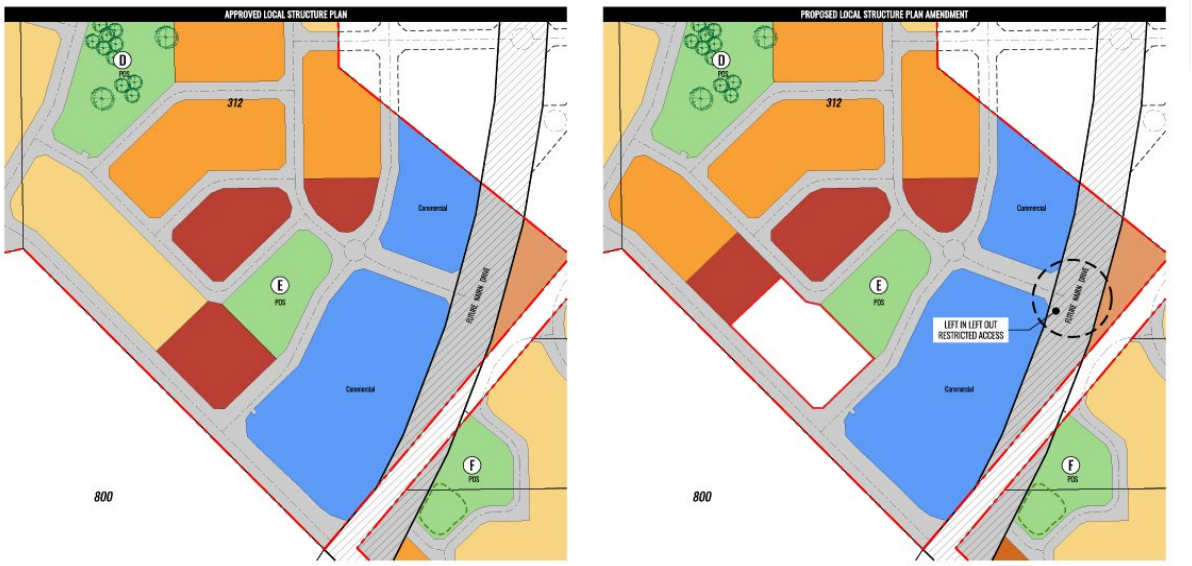

Figure 1: Comparison Plan

2.2 DESIGN CONSIDERATIONS

The design of the Neighbourhood Centre has progressed and the intent of the LSP modification is to facilitate the development of a 'Tavern' adjacent to the Public Open Space, whilst not impacting on the yield of the residential dwellings, the adjoining land has increased in density.

A concept plan demonstrating the future commercial building footprint is shown in Figure 2.

Whilst the southern R100 site has been relocated west of the Tavern site the design principles proposed previously will be retained.

Indicative Concept Plan

2.3 RESIDENTIAL

2.3.1 Density

The proposed change in the Residential Density does not alter the total dwelling yield for the estate. In this regard, the LSP modification still proposes in the order 900+ dwellings. The dwelling yield projections thus address the 15 dwellings per gross urban zone targets of Directions 2031, and will potentially accommodate a population in the order of 2,520+ people, at a rate of 2.8 persons per household.

Based on the Liveable Neighbourhoods 'Site Hectare' definition, the overall density for the Structure Plan equates to ~28 dwellings per site hectare; thus exceeding the 22 dwellings per site hectare target of this document.

2.3.2 Local Development Plans

A Local Development Plan for the Special Use lot will need to address the following design aspects:

- Built form;
- Interface and relationship with the public realm;
- Landscaping;
- Setbacks;
- Building orientation;
- Pedestrian circulation;
- Access;
- Car parking;
- Noise; and
- Waste and servicing.

Local Development Plans for R40 and R100 coded lots will need to address the following design aspects:

- Building Height;
- Nil or minimum front setbacks;
- Garage and access points;
- Built form orientation;
- Fencing (where abutting POS);
- Waste Collection (R100 sites)
- Landscaping;
- Visitor Parking/on-street parking provisions;
- Private and communal open space; and
- Noise attenuation (R100 site adjacent Tavern).

2.4 SPECIAL USE ZONE

As stated above, the intent of the LDP modification is to facilitate the including of Special Use zoned land to facilitate the development of a 'Tavern' adjacent to the Public Open Space.

The objectives for the Special Use site should include:

- To make provisions to incorporate an entertainment use to support the future role, character and purpose of the Neighbourhood Centre;
- To contribute to the overall main street environment;
- To provide activation adjoining the Public Open Space within the Neighbourhood Centre.
- To provide Built form that addresses and frames the adjoining Public Open Space by providing

- height and elevation,
- Active frontages with no blank facades with windows and entrances accessible or visible from the public realm;
- Maximise the use of glazing to provide visual engagement with the Public Open Space; and
- Visual interest through building articulation, architectural features and materials; buildings should be designed to emphasise street corners where applicable.

The Special Use zoned land equates to 5,000sqm. Taktics4 has provided a retail assessment of the additional Commercial land and the report is included as Appendix 1. The summary of the retail assessment provided below:

- A tavern represents an appropriate and suitable use for the Baldivis North Neighbourhood Centre.
- There is an established commercial and market demand for a tavern at the Baldivis North Neighbourhood Centre.
- A tavern at the Baldivis North neighbourhood Centre will not unduly impact on the sustainability of existing or planned taverns within the planned activity centre network.
- A tavern represents a desired diversity of commercial activity and contributes to the night-time economy and overall employment and economic sustainability of the Baldivis North District.
- A tavern represents a high trip frequency activity which is supported and encouraged for Neighbourhood centres in accordance with the relevant state and local planning policy.

2.5 TRAFFIC ASSESSMENT

Transcore has provided a Transport Assessment on the proposed LSP modification (Appendix 2 refers). A summary of the assessment is included below.

The information presented in the Transport Assessment Addendum documents anticipated future traffic flows with the addition of a tavern to the planned Neighbourhood Centre in accordance with this proposed LSP modification.

The proposed tavern is anticipated to increase traffic flows by approximately 1400 vehicles per day but the resultant traffic flows will still be within the capacity of the planned road network in and around the LSP area. The planned road network can accommodate the proposed LSP modification and will operate satisfactorily under the forecast future traffic flows.

2.6 UWMP

DEC has previously prepared and had approved an UWMP for the subject area of this LSP modification. DEC has subsequently prepared an addendum to the approved UWMP (Appendix 3 refers), which summarised the following:

- The UWMP provided criteria for storage requirements for higher density sites which resulted in the same outflow from standard residential lots.
- The impact of the proposed changes will mean that the increased in paved area will be countered by the increased storage provided on the higher density allotments.
- As a result, provided the criteria is applied as outlined in the UWMP, no change to the UWMP is required.

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Technical Note:	No. 2a	Date: 26/11/2021
Project No:	t15.185	
Project:	**The Spires LSP, Baldivis**	
Subject:	**Addendum to Transport Assessment (LSP Amendment)**	

1. Introduction

This Technical Note has been prepared as an Addendum to the Transport Assessment report dated April 2014 for The Spires Local Structure Plan (LSP) in Baldivis, in relation to a proposed LSP Amendment to zone an additional parcel of land as Commercial to accommodate a future tavern and bottle shop.

The proposed Amendment changes the zoning of that parcel of land from Residential to Commercial and increases the residential density of an adjacent parcel of land so that there should not be any net change in the total number of dwellings in this LSP area. The modelling in this Addendum is based on a total of 900 dwellings in this LSP area.

2. Background

Transcore prepared a Transport Assessment report in June 2012 and a revised version in April 2014 for the Spires Estate Local Structure Plan (LSP) in the City of Rockingham. The LSP area includes various lots east and west of Eighty Road in Baldivis, south of Fifty Road and west of Baldivis Road, as shown in Figure 1.

There have been several amendments to the LSP since 2014 and a technical note was prepared by Transcore in December 2016 to address the traffic impacts of an amendment that up-coded three residential cells from R60 to R100 within the LSP area, increasing the overall dwelling yield from 800 to 900 dwelling units.

The LSP area also includes a neighbourhood activity centre located on the western side of Nairn Drive, north of Amazon Drive. Current plans indicate this neighbourhood centre would entail approximately 6,200m^2 floor area (NLA).

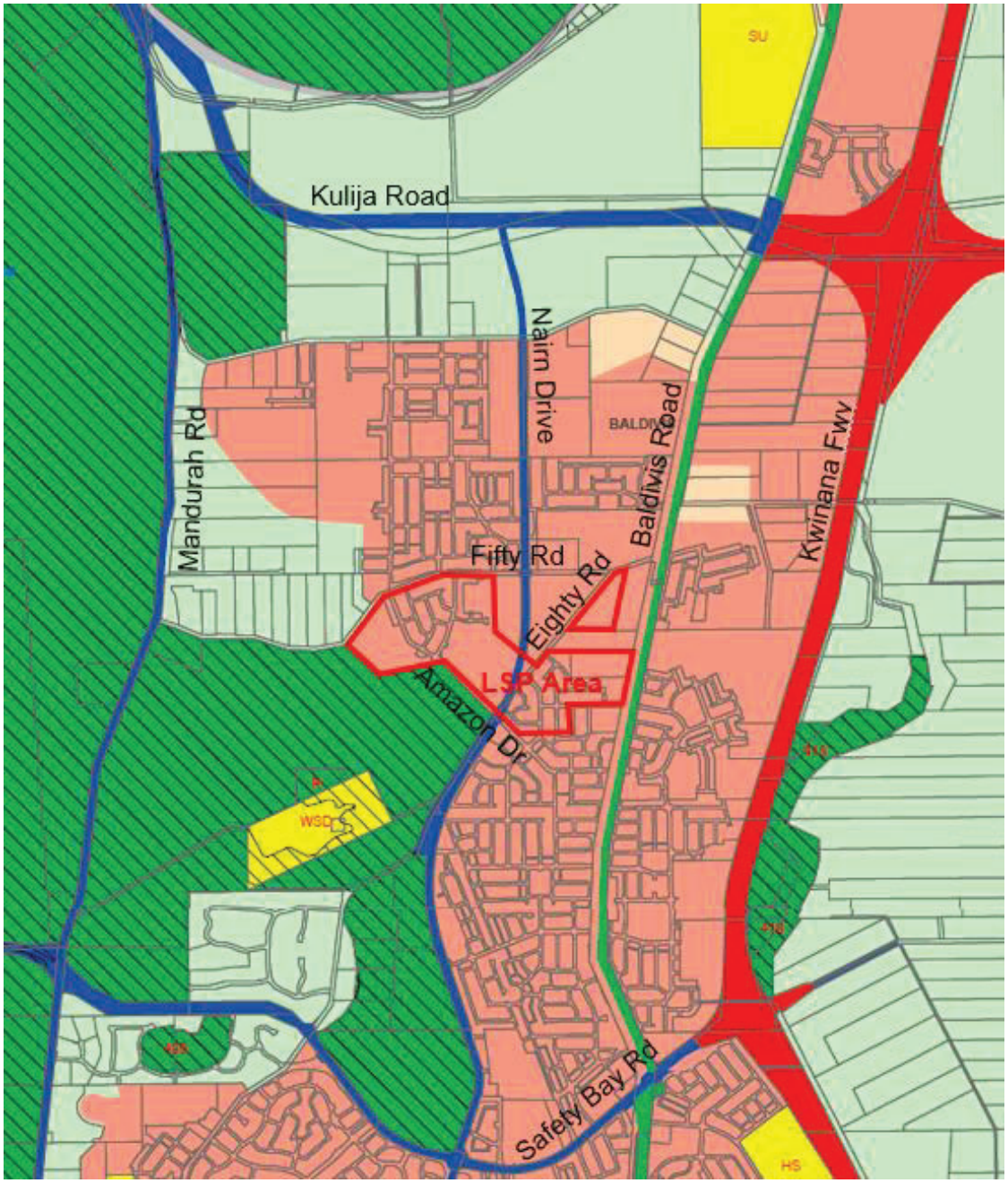


Figure 1: LSP area on MRS map

3. Proposed LSP Amendment

The proposed LSP Amendment will zone an additional parcel of land as Commercial to accommodate a future tavern (site indicated as "Tavern" on Figure 2) as a proposed expansion of the neighbourhood activity centre northwest along Amazon Drive. It is currently anticipated this site would be developed as a tavern and bottle shop totalling approximately 1,200m^2 floor area.

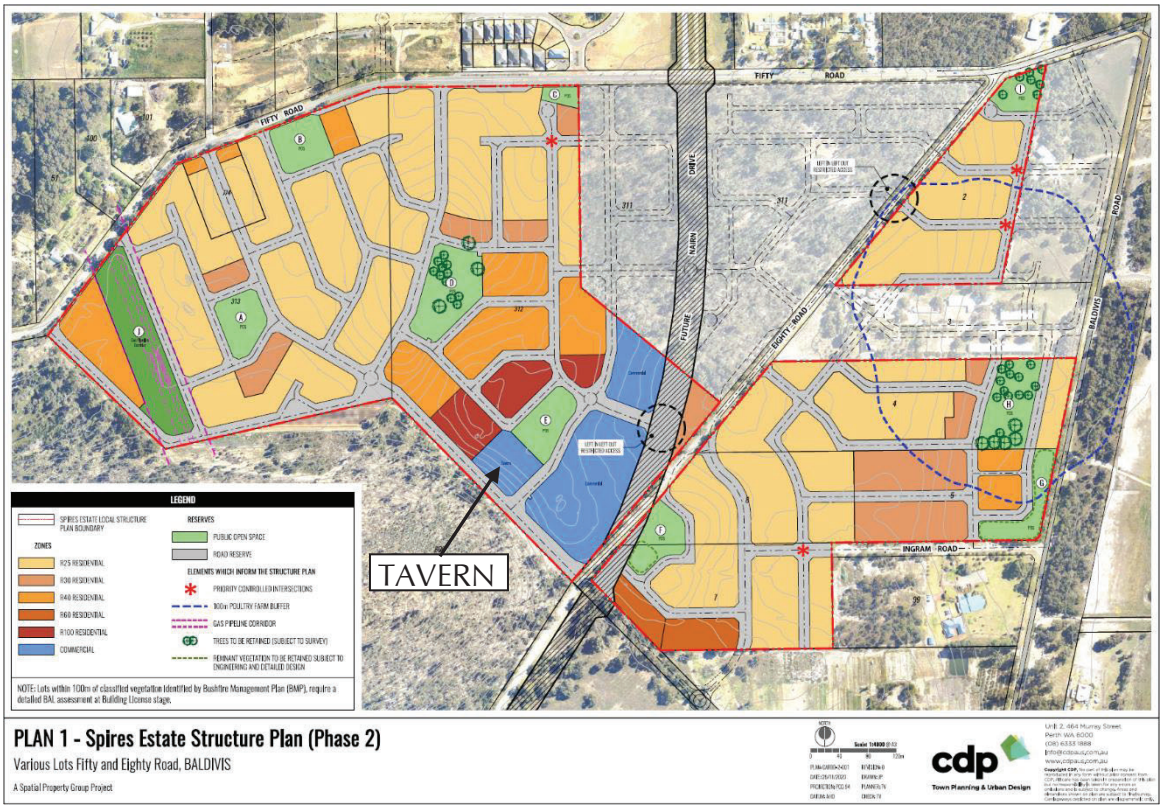


Figure 2: Spires LSP with Proposed Amendment

4. Traffic Model

Transcore has progressively developed a subregional traffic model of weekday traffic flows for future development of the Mandurah-Rockingham area using the EMME transport modelling software package. This model has been developed in more detail for various projects in the Baldivis area including this proposed LSP. The future traffic scenario modelled in this area reflects full development of the Baldivis area, which is assumed to occur by 2031.

5. Traffic Generation

The daily traffic generation rate used in the LSP area and surrounding residential areas for this traffic analysis is 8 vehicle trips per day (vpd) per dwelling (i.e. 4 in / 4 out), which corresponds to AM and PM peak hour trip generation rates of 0.8vph per dwelling as recommended in the Western Australian Planning Commission (WAPC) *Transport Impact Assessment Guidelines* (2016).

The anticipated 900 dwellings of the LSP area will therefore generate approximately 7,200vpd.

The neighbourhood shopping centre in the Spires LSP is anticipated to total approximately 6,200m^2 floor area. The New South Wales *Guide to Traffic Generating Developments* (2002) and their subsequent *Updated Traffic Surveys* (TDT 2013/04a) indicate a Thursday traffic generation rate of 121vpd/100m^2 GLFA and PM peak hour rate of 12.3vph/100m^2 for a shopping centre. Trip rates published in the ITE *Trip Generation Manual* (10th edition) indicate that shopping centre traffic generation is

significantly lower during the road network AM peak period (7-9AM) and is typically only about 25% of the PM peak hour rate.

Accordingly, the daily traffic attraction by this future neighbourhood shopping centre is estimated at approximately 7,500 vpd (daily). Peak hour traffic generation would be approximately 750vph in the weekday PM peak and approximately 190vph in the weekday AM peak period.

The proposed tavern and bottle shop are anticipated to be approximately 760m^2 and 460m^2 GFA respectively. The ITE *Trip Generation Manual* (10th Edition) provides trip rates for a "Drinking Place" during the road network PM peak of 12.23vph/100m^{2}GFA (converted to metric units). For this analysis it is conservatively assumed that the daily trip rate for the tavern is 10 times that PM peak rate. For a Liquor Store that document provides trip rates of 17.62vph/100m^{2}GFA during the road network PM peak and weekday trip rate of 109.25vpd/100m^{2}GFA (converted to metric units). These businesses do not open to the public during the road network AM peak period.

Accordingly, the daily traffic attraction by this future tavern and bottle shop is estimated at approximately 1,430 vpd (daily). Peak hour traffic generation would be approximately 174vph in the weekday PM peak.

6. Future Daily Traffic Volumes

The modelled future (2031) daily traffic flows in and around the LSP area are shown in Figure 3. Three sets of traffic flows are provided on this figure:

- Total daily traffic flows (in brackets)
- Traffic flows to or from the LSP area, including the proposed tavern & bottle shop (in black); and
- Traffic flows to or from the proposed tavern & bottle shop (in red).

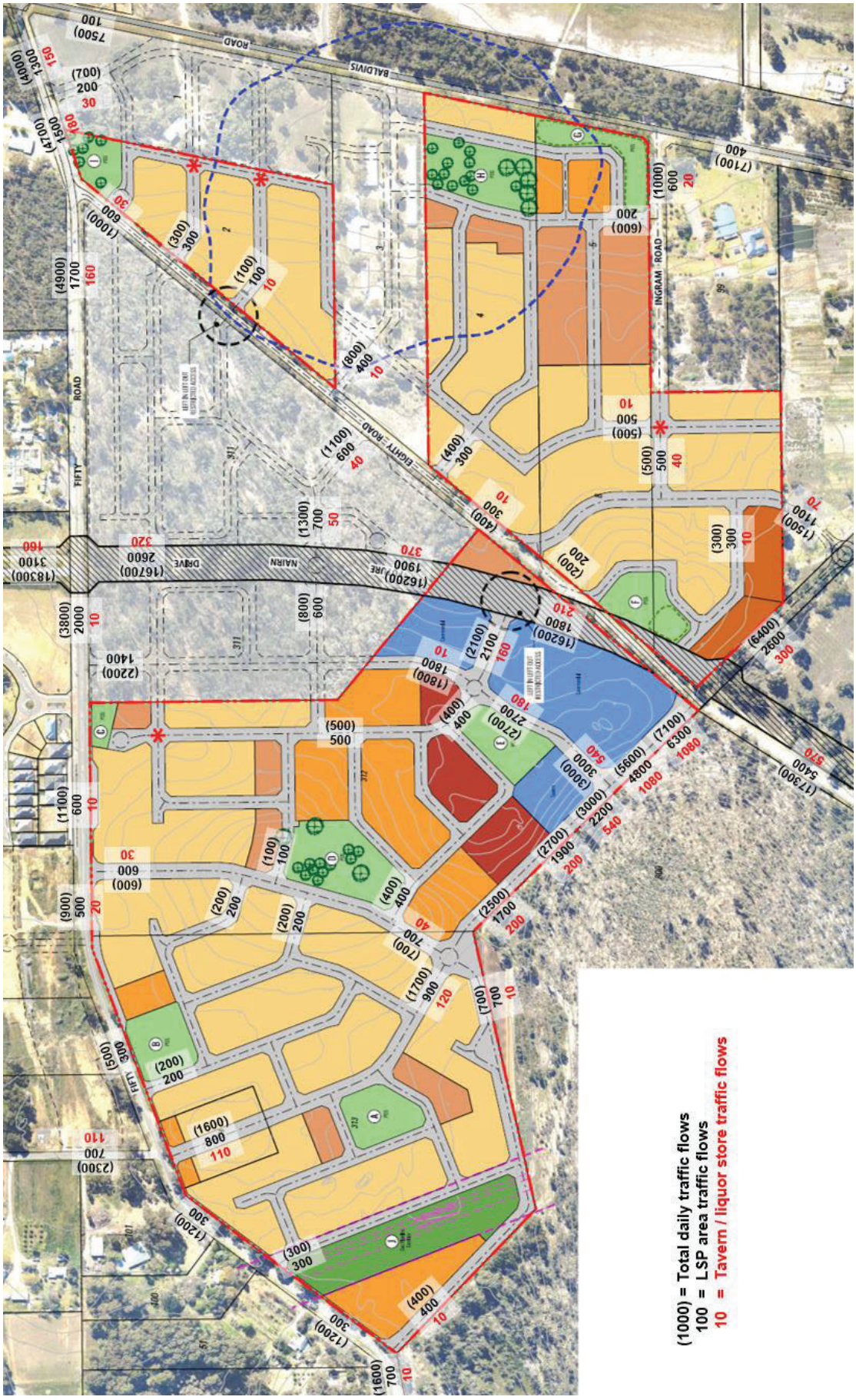


Figure 3: Future Daily Traffic Volumes with Proposed LSP Amendment

7. Roads and Intersections

As can be seen in Figure 3 the most significant concentration of traffic associated with the proposed tavern / bottle shop site is on the section of Amazon Drive between Nairn Drive and the proposed tavern site. This section would carry in the order of 1,080vpd of traffic associated with the proposed tavern and bottle shop but total future traffic volumes on this section would be up to approximately 7,000vpd, which is consistent with the planned Neighbourhood Connector A classification of this section of Amazon Drive.

The section of Amazon Drive adjacent to the proposed tavern site was classified as a Neighbourhood Connector B in the 2014 Transport Assessment report. As can be seen in Figure 3 this section would carry traffic flows up to approximately 3,000vpd, which is consistent with the planned Neighbourhood Connector B classification of this section of Amazon Drive.

The Transport Assessment report provided SIDRA intersection analysis of several key intersections including the Nairn Drive / Amazon Drive proposed signalised intersection. The current concept plan for this signalised intersection is as shown in Figure 4.

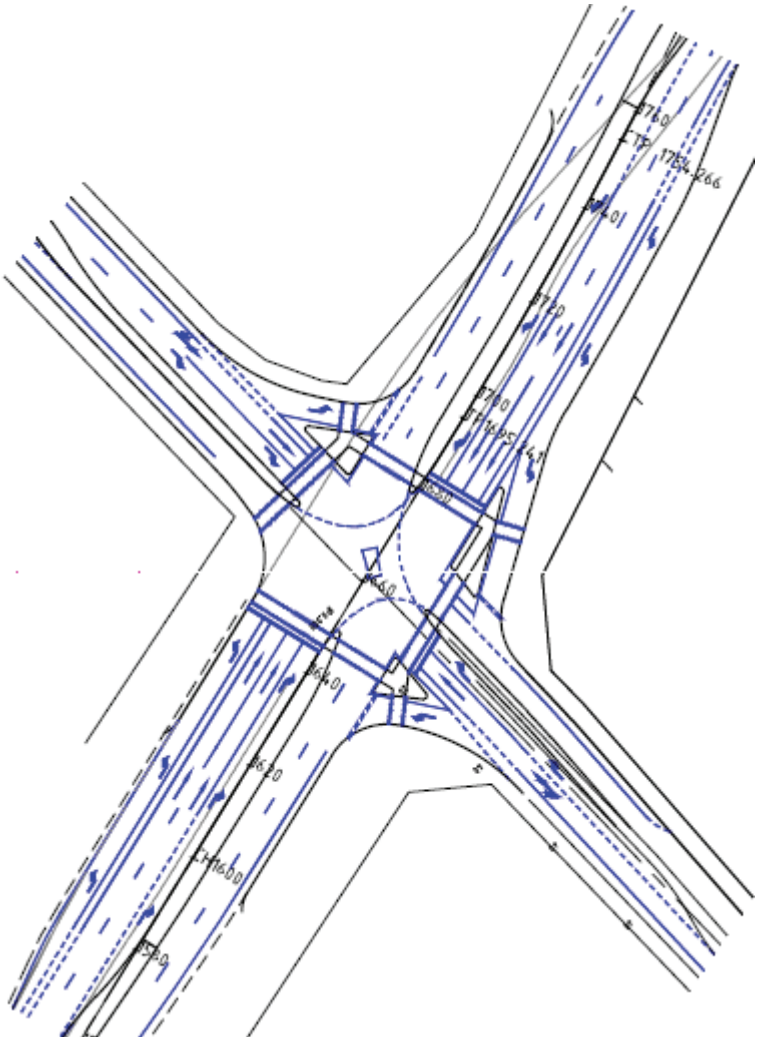


Figure 4: Proposed Nairn Dr / Amazon Dr Signalised Intersection

8. Intersection Analysis

Intersection capacity analysis has been undertaken for the planned Nairn Drive / Amazon Drive signalised intersection for the AM and PM peak hour flows that correspond to the modelled 2031 daily traffic flows in Figure 3.

Capacity analysis of this intersection has been undertaken using the SIDRA 9.0 computer software package and in accordance with Main Roads WA modelling guidelines.

SIDRA is an intersection modelling tool commonly used by traffic engineers for all types of intersections. SIDRA outputs are presented in the form of Degree of Saturation, Level of Service, Average Delay and 95% Queue. These characteristics are defined as follows:

- Degree of Saturation is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The Degree of Saturation ranges from close to zero for infrequent traffic flow up to one for saturated flow or capacity.
- Level of Service is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. In general, there are 6 levels of service, designated from A to F, with Level of Service A representing the best operating condition (i.e. free flow) and Level of Service F the worst (i.e. forced or breakdown flow).
- Average Delay is the average of all travel time delays for vehicles through the intersection.
- 95% Queue is the queue length below which 95% of all observed queue lengths fall.

The results of the SIDRA analysis are summarised in Appendix B and show that the planned signalised intersection will operate satisfactorily. The overall intersection degree of saturation is 0.818 in the AM peak hour and 0.883 in the PM peak hour. Overall intersection level of service is C and D in the AM and PM peak periods, respectively, with only one movement reaching level of service E (the right turn from Amazon Drive southeast in the PM peak hour).

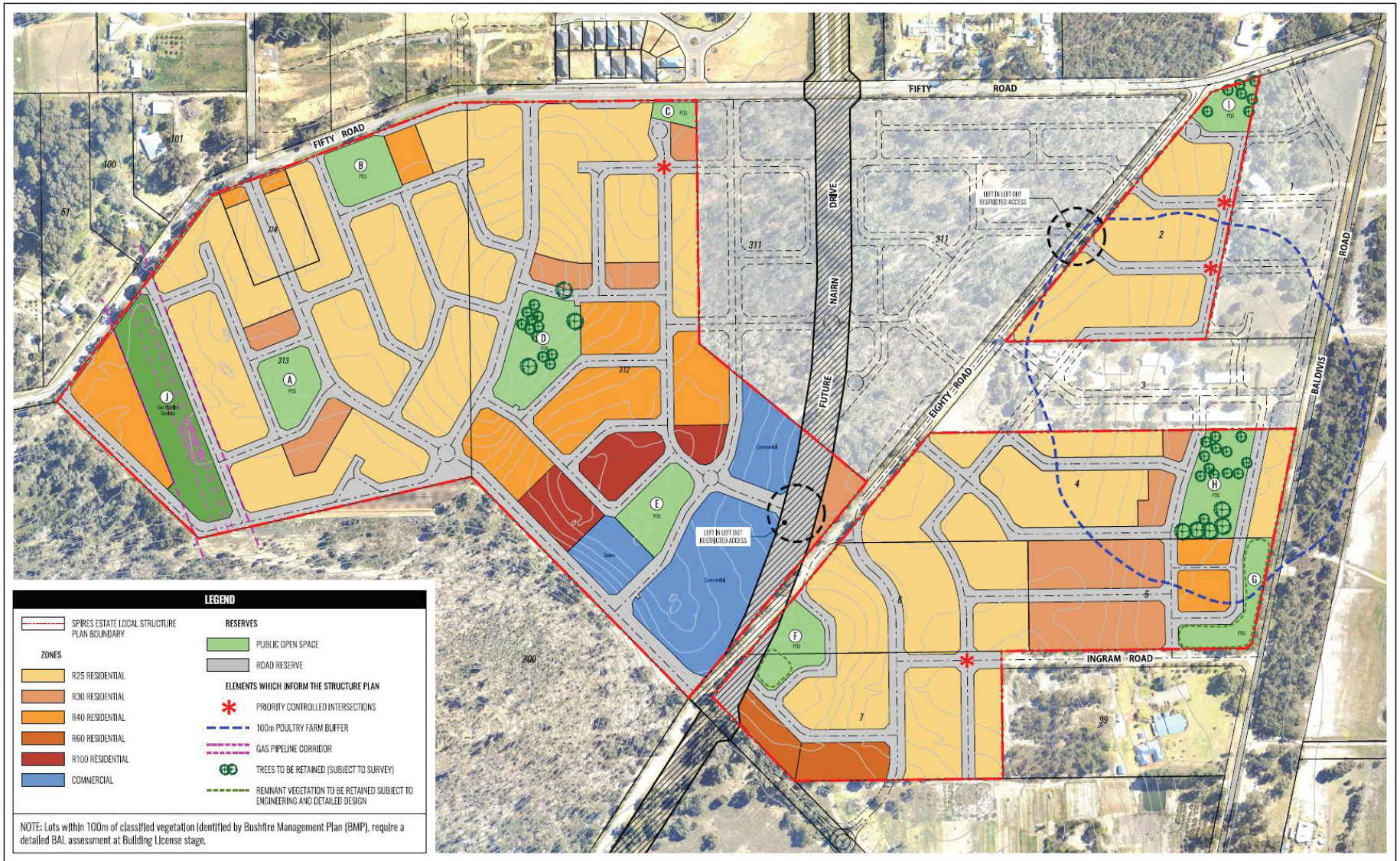
9. Conclusions

The information presented in this Transport Assessment Addendum documents the anticipated future traffic flows with the addition of a tavern and bottle shop site to the planned neighbourhood activity centre in accordance with this proposed LSP Amendment.

The proposed tavern and bottle shop are anticipated to increase traffic flows by approximately 1400 vehicles per day but the resultant traffic flows will still be within the capacity of the planned road network in and around the LSP area. The planned road network can accommodate the proposed LSP Amendment and will operate satisfactorily under the forecast future traffic flows.

Appendix A

Proposed Amended LSP Plan



PLAN 1 - Spires Estate Structure Plan (Phase 2)

Various Lots Fifty and Eighty Road, BALDIVIS

A Spatial Property Group Project

NORTH

Scale: 1:4000 @ A3

0 40 80 120m

PLAN: CARB/SP-001 REVISION: 0

DATE: 25/11/2020 DRAWN: JP

PROJECTION: PCG 94 PLANNER: TV

DATUM: AHD CHECK: TV

cdp Town Planning & Urban Design

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Appendix B

Sidra Intersection Analysis

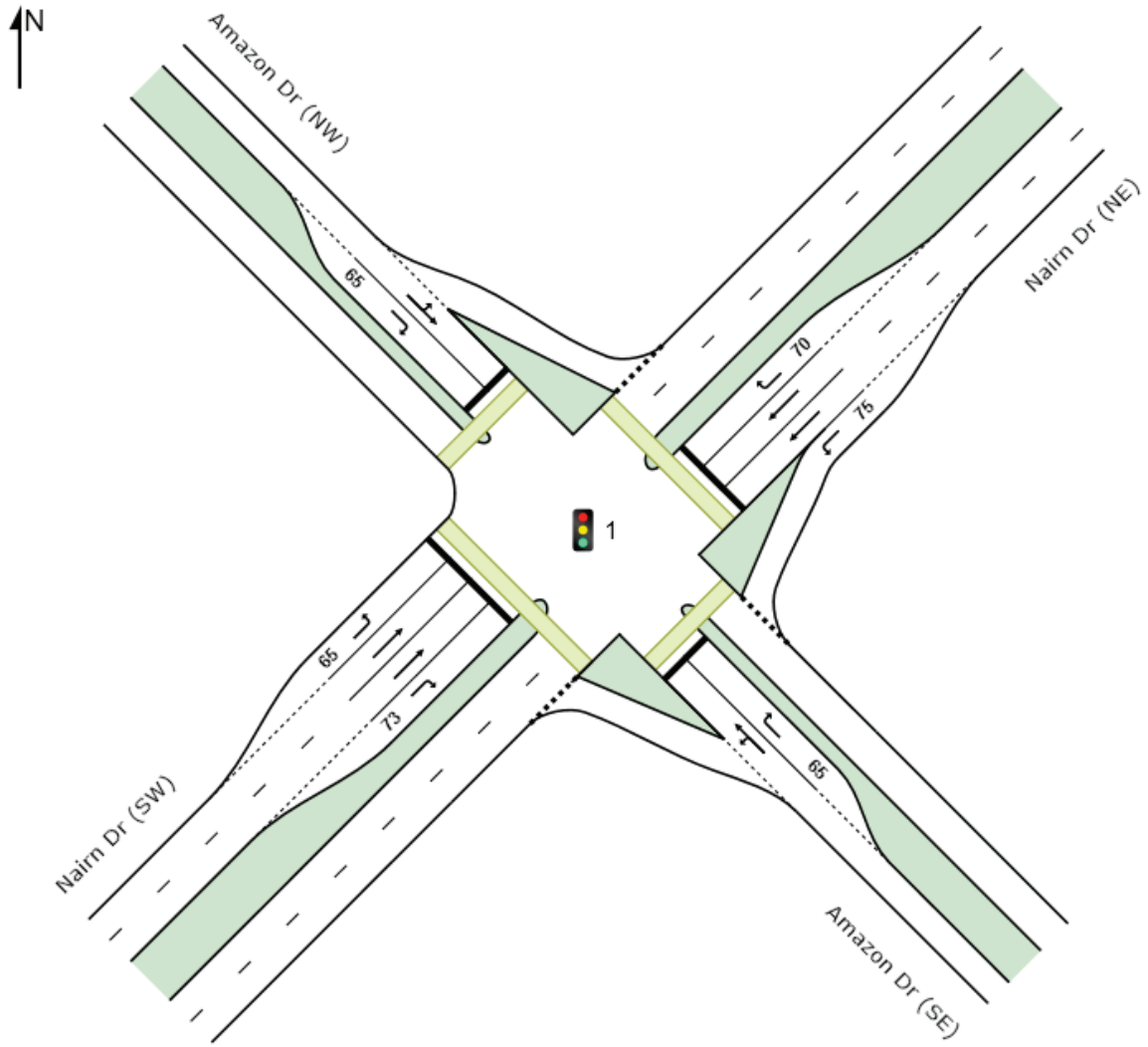

Figure B1. Nairn Drive / Amazon Drive intersection layout analysed in SIDRA

Table B1a. SIDRA results – Nairn Drive / Amazon Drive signalised intersection – 2031 weekday AM peak with full development

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Amazon Dr (SE)														
4	L2	33	6.3	35	6.3	0.133	24.2	LOS C	1.8	14.1	0.78	0.65	0.78	41.4
5	T1	36	6.3	38	6.3	0.133	19.6	LOS B	1.8	14.1	0.78	0.65	0.78	38.6
6	R2	233	6.3	245	6.3	*0.818	36.3	LOS D	8.2	64.1	1.00	1.01	1.35	35.5
Approach		302	6.3	318	6.3	0.818	33.0	LOS C	8.2	64.1	0.95	0.93	1.22	36.4
NorthEast: Nairn Dr (NE)														
7	L2	169	6.3	178	6.3	0.201	12.9	LOS B	2.4	18.7	0.59	0.72	0.59	48.5
8	T1	592	6.3	623	6.3	*0.778	28.0	LOS C	9.7	76.4	1.00	0.94	1.21	45.6
9	R2	10	6.3	11	6.3	*0.060	34.4	LOS C	0.3	2.3	0.93	0.67	0.93	37.5
Approach		771	6.3	812	6.3	0.778	24.8	LOS C	9.7	76.4	0.91	0.89	1.07	46.1
NorthWest: Amazon Dr (NW)														
10	L2	1	6.3	1	6.3	0.115	25.5	LOS C	0.8	6.5	0.85	0.66	0.85	41.7
11	T1	37	6.3	39	6.3	0.115	20.9	LOS C	0.8	6.5	0.85	0.66	0.85	38.9
12	R2	153	6.3	161	6.3	0.533	29.9	LOS C	4.5	35.5	0.95	0.79	0.95	37.8
Approach		191	6.3	201	6.3	0.533	28.1	LOS C	4.5	35.5	0.93	0.77	0.93	38.1
SouthWest: Nairn Dr (SW)														
1	L2	112	6.3	118	6.3	*0.673	38.1	LOS D	3.7	29.3	1.00	0.84	1.18	36.0
2	T1	526	6.3	554	6.3	0.359	13.1	LOS B	5.6	44.3	0.73	0.62	0.73	55.9
3	R2	22	6.3	23	6.3	0.044	22.7	LOS C	0.5	3.8	0.74	0.69	0.74	42.6
Approach		660	6.3	695	6.3	0.673	17.7	LOS B	5.6	44.3	0.77	0.66	0.81	50.6
All Vehicles		1924	6.3	2025	6.3	0.818	24.0	LOS C	9.7	76.4	0.87	0.80	0.99	44.6

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
SouthEast: Amazon Dr (SE)												
P2	Full	20	21	23.4	LOS C	0.0	0.0	0.88	0.88	202.8	215.3	1.06
NorthEast: Nairn Dr (NE)												
P3	Full	20	21	23.4	LOS C	0.0	0.0	0.88	0.88	208.8	222.5	1.07
NorthWest: Amazon Dr (NW)												
P4	Full	5	5	23.4	LOS C	0.0	0.0	0.88	0.88	202.8	215.3	1.06
SouthWest: Nairn Dr (SW)												
P1	Full	5	5	23.4	LOS C	0.0	0.0	0.88	0.88	211.7	226.0	1.07
All Pedestrians		50	53	23.4	LOS C	0.0	0.0	0.88	0.88	206.1	219.3	1.06

Table B1b. SIDRA results – Nairn Drive / Amazon Drive signalised intersection – 2031 weekday PM peak with full development

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Amazon Dr (SE)														
4	L2	22	6.3	23	6.3	0.233	33.7	LOS C	4.0	31.1	0.80	0.75	0.80	37.8
5	T1	83	6.3	87	6.3	0.233	29.2	LOS C	4.0	31.1	0.80	0.75	0.80	35.5
6	R2	218	6.3	229	6.3	*0.883	56.8	LOS E	12.1	95.2	1.00	1.07	1.44	29.6
Approach		323	6.3	340	6.3	0.883	48.1	LOS D	12.1	95.2	0.94	0.96	1.23	31.4
NorthEast: Nairn Dr (NE)														
7	L2	183	6.3	193	6.3	0.187	12.3	LOS B	3.0	23.7	0.45	0.70	0.45	48.9
8	T1	794	6.3	836	6.3	*0.867	43.4	LOS D	20.6	161.4	1.00	1.02	1.26	38.2
9	R2	35	6.3	37	6.3	*0.315	52.9	LOS D	1.7	13.0	0.99	0.73	0.99	31.5
Approach		1012	6.3	1065	6.3	0.867	38.1	LOS D	20.6	161.4	0.90	0.95	1.10	39.5
NorthWest: Amazon Dr (NW)														
10	L2	2	6.3	2	6.3	0.281	36.1	LOS D	4.3	33.8	0.85	0.71	0.85	37.2
11	T1	114	6.3	120	6.3	0.281	31.5	LOS C	4.3	33.8	0.85	0.71	0.85	35.0
12	R2	247	6.3	260	6.3	0.860	52.4	LOS D	13.2	103.5	1.00	1.02	1.34	30.7
Approach		363	6.3	382	6.3	0.860	45.8	LOS D	13.2	103.5	0.95	0.92	1.18	32.0
SouthWest: Nairn Dr (SW)														
1	L2	232	6.3	244	6.3	*0.836	53.1	LOS D	11.9	93.2	1.00	0.93	1.28	31.4
2	T1	462	6.3	486	6.3	0.263	13.8	LOS B	6.1	47.9	0.61	0.52	0.61	55.3
3	R2	37	6.3	39	6.3	0.074	30.8	LOS C	1.2	9.6	0.75	0.72	0.75	38.9
Approach		731	6.3	769	6.3	0.836	27.2	LOS C	11.9	93.2	0.74	0.66	0.83	43.8
All Vehicles		2429	6.3	2557	6.3	0.883	37.3	LOS D	20.6	161.4	0.87	0.86	1.05	38.0

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
SouthEast: Amazon Dr (SE)												
P2	Full	20	21	38.3	LOS D	0.0	0.0	0.92	0.92	217.7	215.3	0.99
NorthEast: Nairn Dr (NE)												
P3	Full	20	21	38.3	LOS D	0.0	0.0	0.92	0.92	223.7	222.5	0.99
NorthWest: Amazon Dr (NW)												
P4	Full	5	5	38.3	LOS D	0.0	0.0	0.92	0.92	217.7	215.3	0.99
SouthWest: Nairn Dr (SW)												
P1	Full	5	5	38.3	LOS D	0.0	0.0	0.92	0.92	226.6	226.0	1.00
All Pedestrians		50	53	38.3	LOS D	0.0	0.0	0.92	0.92	221.0	219.3	0.99

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West Perth WA 6005

Our Ref: BDVCAN20/13
BdvCan13AddtoUWMP190421

CARCIONE NOMINEES PTY LTD
LOTS 312 AND 313 FIFTY ROAD AND LOTS 4, 7 AND 8 EIGHTY ROAD, BALDIVIS
ADDENDUM TO URBAN WATER MANAGEMENT PLAN

1. General:

A UWMP for the above development now known as The Spires Estate was prepared for Stages 8, 9 and 10 and Revision 3 was approved by the City of Rockingham on the 27th October 2016.

The development consisted of varying densities across the site being commercial and residential from R25, R30, R40, R60, R80 and R100.

An amended development arrangement has been proposed as shown in Attachment 1 which proposes that the R25 area fronting Amazon Drive be amended to R60, R100 and further commercial site, which will increase the area of pavement within the development.

The purpose of this report is to review the drainage strategy for the site in light of the proposed changes to the density of the plan.

2. Drainage Assumptions

The catchment plan provided in the UWMP has been marked up to illustrate the comparison between the lot configuration at the UWMP in 2016 to the current arrangement and is included in Attachment 1.

The black hatched area illustrates that the areas of the plan that remain unchanged in all respects, being the road layout, the lot dimensions and areas. It is also understood that the built form product will be the same as anticipated at the UWMP stage. As a result there is no change to the area or the run-off from these areas.

The lot areas in red have been changed as noted from R25 to R40, R100 and a Tavern site which will result in less opportunities for soakage above ground and greater paved areas.

Rather than undertake calculations over all zonings of the site, the site was divided into two main areas being; commercial (meaning density and commercial sites) and lots, meaning single residential allotments. The changes to the plan mean that single residential lots will be swapped for higher density sites, these higher density sites will be treated as if they were commercial sites.

Within the approved UWMP calculations it was assumed that for a standard single

residential lot a total of some 4.24cubic metres in storage was provided as part of the building process. Following the installation of this storage, it was estimated that some 11% of the lot area would contribute to the flows to the downstream drainage basin for the 1% AEP storm.

Commercial and density housing assumed 90% of the area was paved and soakwells were provided to match the outflow from the standard residential lot at 11% of the lot area for the 1% AEP storm.

Given the potential for change across the area, it was proposed to provide additional storage to commercial and higher density areas than would usually be the case in areas such as this. As a result it was proposed that a storage of some 308 cubic metres per hectare of site would be provided which would match the outflow for the standard residential lot. This provided an estimated outflow of some 10% of the lot areas would contribute to the downstream drainage basin for the 1% AEP storm.

As a result, the increase in the density of the area will require a significant addition of storage to be installed within the developed areas which will ensure that the flows to the downstream drainage basins remain unchanged.

3. Response to the Comments by the City of Rockingham in correspondence dated 9th April 2021 (Refer Attachment 3)

a) *Include runoff for lots coded R40 and R100 densities*: As outlined above the strategy agreed in the UWMP was for lots to be classified as single residential or density sites. The single residential will remain the same as per the calculations in Attachment B and the R100 density sites were classified as commercial based on a 90% footprint and should be provided with storage of 308 cubic metres per hectare for the 1% AEP storm.

b) *Increase the percentage of impervious area attributed to all lot typologies to account for the additional site coverage allowable under the CITY's RMD coding (ie Lots ranging >300sqm to 450sqm average would have an impervious area percentage of 85%)*: It is understood that that this is not related to the amendment to the structure plan and hence should not be necessary to deal with this as part of this process. Despite this, it is noted that the on-site, the outcomes from the completed development is not materializing with the 85% effective footprint area as suggested by the City. The reason for this is twofold:

    a. The footprint area of the houses are not occupying the proportion of the site suggested by the City and:

    b. Most house are built across the lots meaning that the back yard areas are disconnected from the front yard areas with any resulting surcharge from 50% of the roof area will not flow to the roadway.

c) *Confirm whether the results of the lot runoff calculates will result in >10% run-off in major events*: The changes to the planning will not result in any change to the run-off for the major storm, (1% AEP) event.

4. Recommendations

The UWMP provided criteria for storage requirements for higher density sites which resulted in the same outflow from standard residential lots.

The impact of the proposed changes will mean that the increased in paved area will be countered by the increased storage provided on the higher density allotments.

As a result, provided the criteria is applied as outlined in the UWMP, no change to the UWMP is required.

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THIS REPORT IS DATED 19TH APRIL 2021

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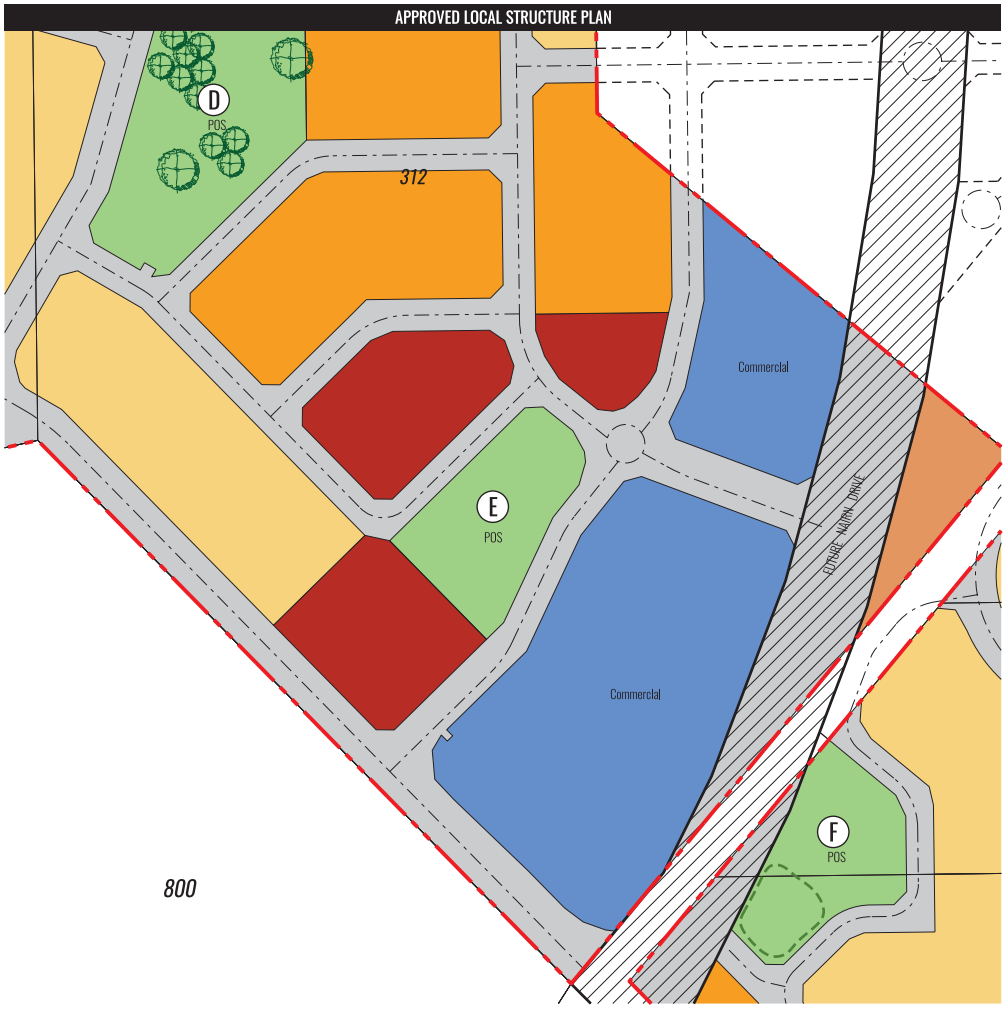
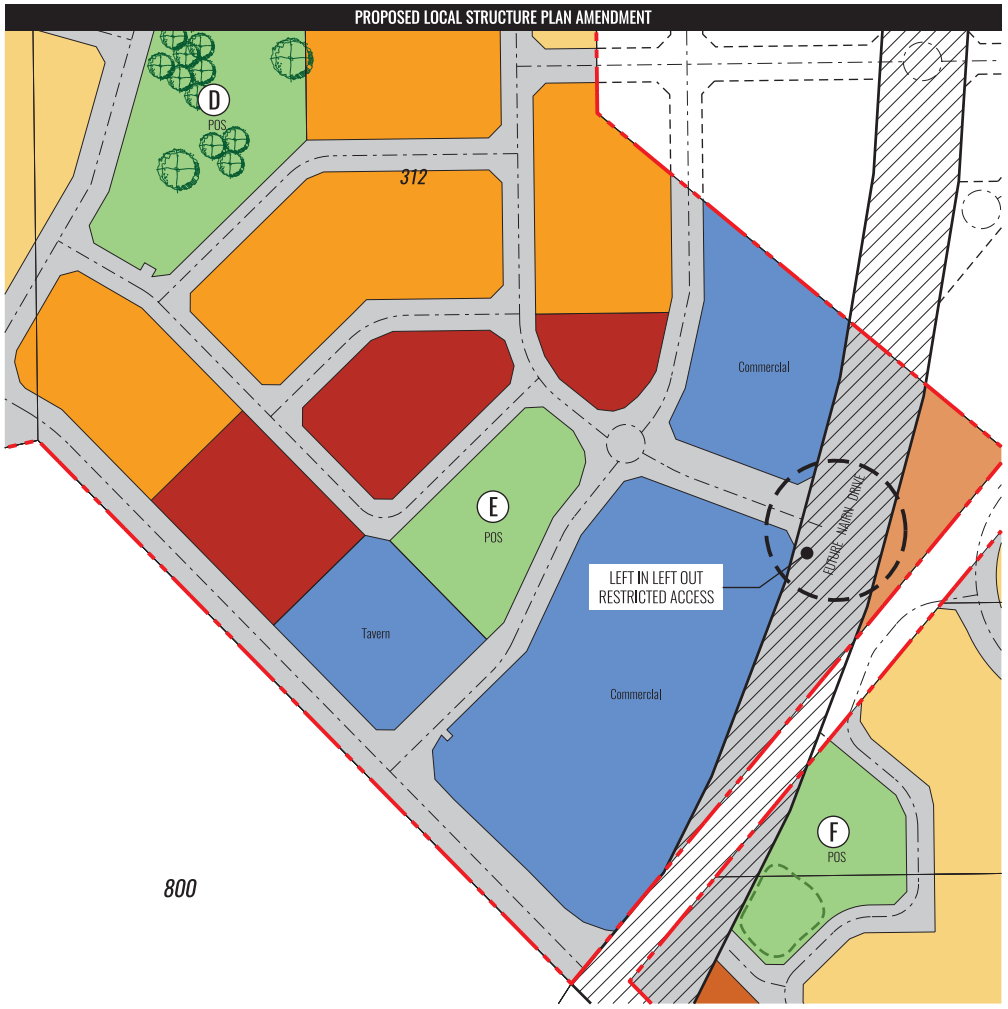
ATTACHMENT 1 –

- **CDP DRAWING COMPARING THE AREAS**
- **MARKED UP CATCHMENT PLAN ILLUSTRATING THE CHANGES PROPOSED**

APPROVED LOCAL STRUCTURE PLAN



PROPOSED LOCAL STRUCTURE PLAN AMENDMENT



LEGEND

SPIRES ESTATE LOCAL STRUCTURE PLAN BOUNDARY

ZONES

- R25 RESIDENTIAL
- R30 RESIDENTIAL
- R40 RESIDENTIAL
- R60 RESIDENTIAL
- R100 RESIDENTIAL
- COMMERCIAL

RESERVES

- PUBLIC OPEN SPACE
- ROAD RESERVE

ELEMENTS WHICH INFORM THE STRUCTURE PLAN

- PRIORITY CONTROLLED INTERSECTIONS
- 100m POULTRY FARM BUFFER
- GAS PIPELINE CORRIDOR
- TREES TO BE RETAINED (SUBJECT TO SURVEY)
- REMNANT VEGETATION TO BE RETAINED SUBJECT TO ENGINEERING AND DETAILED DESIGN

NOTE: Lots within 100m of classified vegetation identified by Bushfire Management Plan (BMP), require a detailed BAL assessment at Building License stage.

LOCAL STRUCTURE PLAN COMPARISON

Spires Estate, BALDIVIS

A Spatial Property Group Project

NORTH

Scale: 1:2500 @ A3

0 25 50 75m

PLAN: SPGBD-5-037 REVISION:
DATE: 10/12/2020 DRAWN: JP
PROJECTION: MGA 50 PLANNER: TV
DATUM: AHD CHECK: TV

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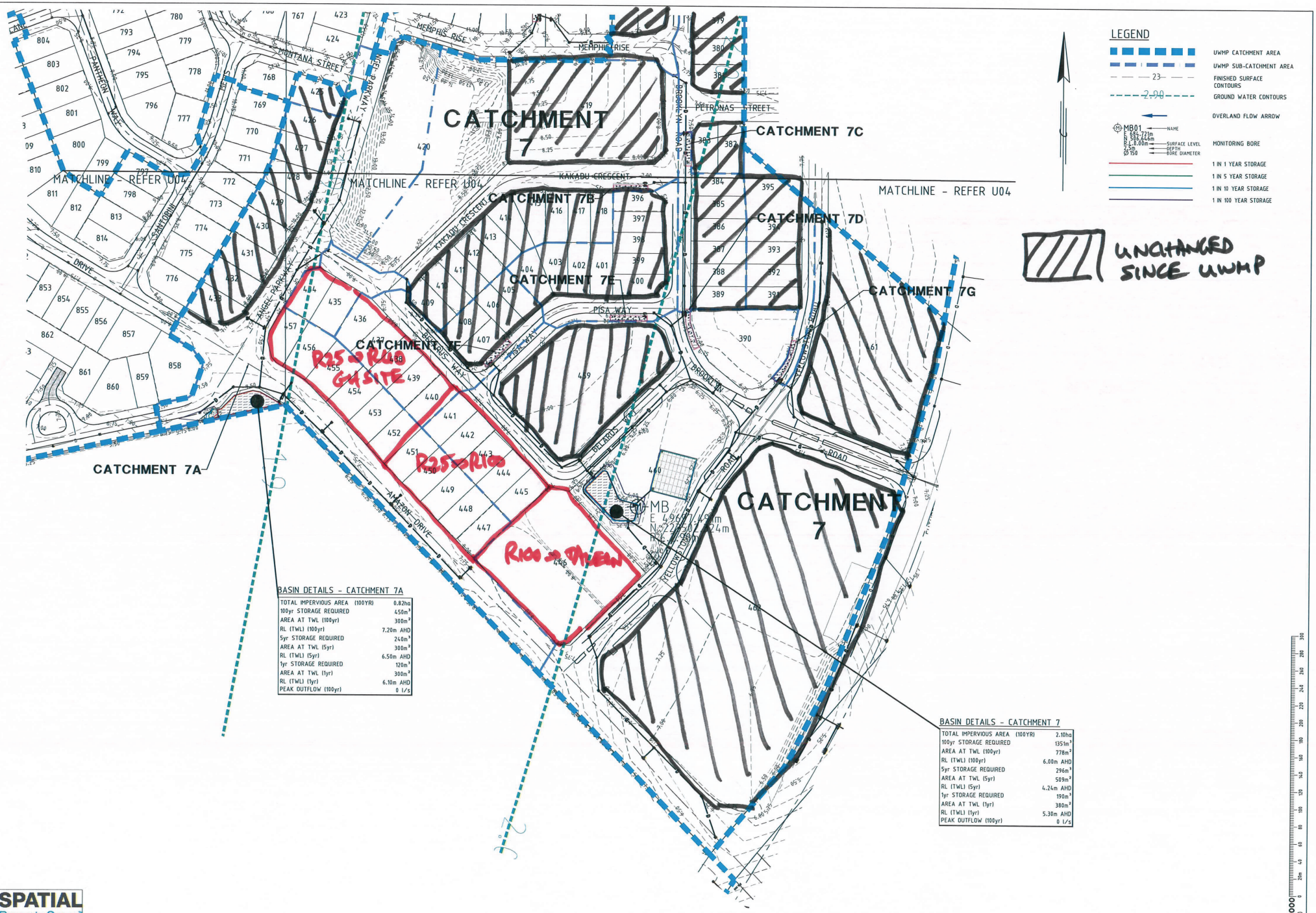

SPATIAL Property Group

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No.	DATE	BY	REVISION	
D	28/9/16	JEG	DRAINAGE REVISED	SRA
C	2/8/16	JEG	CATCHMENT NUMBERS AMENDED	SRA
B	6/5/16	JEG	PRECAL AND CATCHMENT REVISIONS	SRA
A	20/8/15	JEG	INITIAL ISSUE	SRA

CLIENT: CARCIONE NOMINEES PTY LTD

DEVELOPMENT ENGINEERING CONSULTANTS
SUITE 3, 123A COLIN ST, WEST PERTH, 6005 WESTERN AUSTRALIA
Ph: (08) 9481 1900
Fax: (08) 9481 1700

PROJECT: LOTS 312, 313 FIFTY RD & LOTS 2 ,4, 7 & 8 EIGHTY RD BALDIVIS STAGE 8
W.A.P.C. No. - 147921

DRAWING: POST DEVELOPMENT CATCHMENT PLAN AND GROUNDWATER LEVELS SHEET 2 OF 2
CAD DRAWING DO NOT MANUALLY ALTER

SCALE	DRAWN	CHECK	REV No.
1:1000	JEG	SRA	D
DATE	DESIGNED	APPROVED	
27/08/14	JEG	SRA	

PROJECT NUMBER: BDVCAN13 U05
DRAWING NUMBER
S:\CAN\BDVCAN13\Drawings\BDVCAN13 U05.dwg 30/09/2016

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ATTACHMENT 2 – "AT LOT" CALCULATIONS FROM THE UWMP

Development Engineering Consultants - At-Lot Drainage Spreadsheet

Project: The Spires - Stage 8/9/10, Baldivis

Client: Carcione Nominees Pty Ltd

Location: At-Lot Detention Calculations to Establish Run-off Coefficient

Designer: JPF

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Lots Unconnected > 300m^2 in Area - 430m^2 Ave

Data to be Input

Rainfall ARI (Years)	100
1 in 1 Year Impervious Catchment(Ha)	0.024
Required Storage(1 in 1Yr 1 Hr)(m^3)	3.742

Catchment Details	Paved Area	Unpaved area	Total
Lot Area (SQM)			**450.00**
Proportion Paved	**60%**	**40%**	**100%**
Area Paved (Ha)	**0.027**	**0.018**	**0.045**
Run-Off Co-efficient(C10)	0.90	0.00	
ARI Multiplier	1.00	1.20	
Run-Off Co-efficient(Cy)	0.90	0.00	
Impervious Area(Ha)	**0.024**	**0.000**	**0.024**

0.54 **Effective C**

ARI	Effective C	Multiplier
1	0	#DIV/0!
2	0	#DIV/0!
5	0	#DIV/0!
10	0	#DIV/0!
20	0	#DIV/0!
50	0.04	#DIV/0!
100	0.11	#DIV/0!

Volume and Dimensions of Available Storage

Area above Ground inundated to 0.03m			
Deep (Back Yard and Front Yard)	40.00	0.03	1.20
Storage provided manholes and pipe	-		
Number of Soakwells	2.00		
Diameter of Soakwells	1.50		
Depth of Each Soakwell	1.20		
Storage required Soakwells	**4.24**		
Strorage Provided	5.44		
Soakage Rate (l/s/m2)	0.02		

NOTE: All water is retained in Soakwells to 1 in 20 Year ARI without surcharge. For Greater ARI storms water will surcharge and soak over an area of 40 Square metres to a maximum depth of 30mm

Data From A,R & R Volume 2
Location **Baldivis WA**

Development Engineering Consultants - At-Lot Drainage Spreadsheet

Project: The Spires - Stage 8/9/10, Baldivis

Client: Carcione Nominees Pty Ltd

Location: At-Lot Detention Calculations to Establish Run-off Coefficient

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Map 1	$^{2}I_{1}$	20.6
Map 2	$^{2}I_{12}$	4.5
Map 3	$^{2}I_{72}$	1.3
Map 4	$^{50}I_{1}$	35.5
Map 5	$^{50}I_{12}$	7
Map 6	$^{50}I_{72}$	2.1
Map 7	G	0.68
Map 8	F2	4.82
Map 9	F50	17

Tc(mins)	Tc(hrs)	I(mm/hr)	Q(l/s)	Total V in	Q out (Soakage)(l/s)	V out	Net Storage	Vout (Required)	Q out(l/s)	Effective Run-off C
10	0.167	149.68	10.10	6.061899744	1.06	0.636922553	5.424977191	-	0.00	0.00
20	0.333	98.74	6.66	7.997763729	1.06	1.273845106	6.723918623	1.28	1.07	0.09
30	0.500	75.22	5.08	9.138757889	1.06	1.910767659	7.22799023	1.79	0.99	0.11
60	1.000	45.44	3.07	11.04132235	1.06	3.821535318	7.219787033	1.78	0.49	0.09
120	2.000	28.82	1.95	14.0064085	1.06	7.643070637	6.363337859	0.92	0.13	0.04
240	4.000	18.07	1.22	17.56313543	1.06	15.28614127	2.276994153	-	0.00	0.00
480	8.000	11.32	0.76	22.01552347	1.06	30.57228255	-8.556759073	-	0.00	0.00
960	16.000	7.21	0.49	28.0355931	1.06	61.14456509	-33.10897199	-	0.00	0.00
1440	24.000	5.58	0.38	32.56960149	1.06	91.71684764	-59.14724615	-	0.00	0.00
2880	48.000	3.53	0.24	41.14292467	1.06	183.4336953	-142.2907706	-	0.00	0.00
4320	72.000	2.62	0.18	45.91387034	1.06	275.1505429	-229.2366726	-	0.00	0.00

Development Engineering Consultants - At-lot Drainage Spreadsheet

Project: The Spires - Stage 8/9/10, Baldivis

Client: Carcione Nominees Pty Ltd

Location: At-Lot Detention Calculations to Establish Runoff Coefficient

Designer: JPF

DEVELOPMENT ENGINEERING CONSULTANTS

Commercial Lots - Storage applied on 'per hectare' basis

Data to be Input

Rainfall ARI (Years)	100
1 in 1 Year Impervious Catchment(Ha)	0.810
Required Storage(1 in 1Yr 1 Hr)(m^3)	124.740

Catchment Details	Paved Area	area	Total
Lot Area (SQM)			**10000.00**
Proportion Paved	**90%**	**10%**	**100%**
Area Paved (Ha)	**0.900**	**0.100**	**1.000**
Run-Off Co-efficient(C10)	0.90	0.00	
ARI Multiplier	1.00	1.20	
Run-Off Co-efficient(Cy)	0.90	0.00	
Impervious Area(Ha)	**0.810**	**0.000**	**0.810**

0.81 **Effective C**

ARI	Effective C	Multiplier
1	0	0.00
2	0	0.00
5	0	0.00
10	0.01	1.00
20	0.01	1.00
50	0.01	1.00
100	0.1	10.00

Volume and Dimensions of Available Storage

Area above Ground inundated to 0.03m Deep (Back Yard and Front Yard)	-	0.03
Storage provided manholes and pipe	-	
Number of Soakwells	50.50	
Diameter of Soakwells	1.80	
Depth of Each Soakwell	2.40	
Storage required Soakwells	**308.42**	
Strorage Provided	308.42	
Total Storage Required Per Unit Area ($1m^2$ per	**32.42**	**)Sqm**
Soakage Rate (l/s/m2)	0.02	

- **NOTE: All water is retained in Soakwells to 1 in 20 Year ARI without surcharge. For Greater ARI storms water will surcharge and enter the road drainage system, restricted to the residential runoff coefficients.**

Development Engineering Consultants - At-lot Drainage Spreadsheet

Project: **The Spires - Stage 8/9/10, Baldivis**

Client: **Carcione Nominees Pty Ltd**

DEVELOPMENT ENGINEERING

Data From A,R & R Volume 2

Location		**Baldivis WA**
Map 1	$^{2}I_{1}$	20.6
Map 2	$^{2}I_{12}$	4.5
Map 3	$^{2}I_{72}$	1.3
Map 4	$^{50}I_{1}$	35.5
Map 5	$^{50}I_{12}$	7
Map 6	$^{50}I_{72}$	2.1
Map 7	G	0.68
Map 8	F2	4.82
Map 9	F50	17

Tc(mins)	Tc(hrs)	I(mm/hr)	Q(l/s)	Total V in	Q out (Soakage)(l/s)	V out	Net Storage	Vout (Required)	Q out(l/s)	Effective Run-off C
10	0.167	149.68	336.77	202.0633248	13.76	8.25497452	193.8083503	-	0.00	0.00
20	0.333	98.74	222.16	266.5921243	13.76	16.50994904	250.0821753	-	0.00	0.00
30	0.500	75.22	169.24	304.625263	13.76	24.76492356	279.8603394	-	0.00	0.00
60	1.000	45.44	102.23	368.0440784	13.76	49.52984712	318.5142313	10.10	2.81	0.02
120	2.000	28.82	64.84	466.8802832	13.76	99.05969424	367.820589	59.40	8.25	0.10
240	4.000	18.07	40.66	585.4378475	13.76	198.1193885	387.318459	78.90	5.48	0.11
480	8.000	11.32	25.48	733.8507824	13.76	396.238777	337.6120055	29.20	1.01	0.03
960	16.000	7.21	16.22	934.51977	13.76	792.4775539	142.0422161	-	0.00	0.00
1440	24.000	5.58	12.57	1085.653383	13.76	1188.716331	-103.0629478	-	0.00	0.00
2880	48.000	3.53	7.94	1371.430822	13.76	2377.432662	-1006.00184	-	0.00	0.00
4320	72.000	2.62	5.90	1530.462345	13.76	3566.148993	-2035.686648	-	0.00	0.00

DEVELOPMENT
ENGINEERING
CONSULTANTS

ATTACHMENT 3 – CORRESPONDENCE FROM THE CITY DATED 9TH APRIL 2021

Our Ref: LUP/1633-15 – D21/54992

Enquiries to: Mr Robert Casella – 9528 0426

city of Rockingham

where the coast comes to life

9th April 2021

Ms Tamara Vreeken
CDP Town Planning & Urban Design
PO Box 8002
CLOISTERS SQUARE WA 6850

Dear Ms Vreeken

Re: Proposed Amendment to Spires Estate Structure Plan – Lots 312 & 313 Fifty Road, Lots 2, 4, 7 & 8 Eighty Road and Lot 5 Baldivis Road, Baldivis

I refer to your email dated 12th March 2021 seeking to amend the Spires Estate Structure Plan.

Following a review of the documentation, the City has determined, in accordance with the requirements of clause 17(1)(a)(ii) of the *Planning and Development (Local Planning Schemes) Regulations 2015* (Regulations), that further information is required before the proposed Structure Plan can be accepted for assessment and advertising.

In this regard, the City has identified the following information that needs to be provided in accordance with Clause 16(1)(a) of the Regulations, prior to the Structure Plan being accepted for assessment it is requested the following information be provided to enable an assessment of the Structure Plan Amendment:

Urban Water Management Plan – Addendum

Please update the Urban Water Management Plan Addendum to address the flood management criteria provided under Section 1.3 in the *Better Urban Water Management Guidelines* as follows:

1. Include runoff calculations for lots coded R40 and R100 densities.

2. Increase the percentage of impervious area attributed to all lot typologies to account for the additional site coverage allowable under the City's RMD Coding (i.e. Lots ranging >300m² to 450m² average would have an impervious area percentage of 85%).

3. Confirm whether the results of the lot runoff calculates will result in a >10% runoff in major storm events.

With respect to the matters raised above, the City requires information to determine whether stormwater runoff produced from residential lots proposed within the amendment will contribute significantly to local flood storage requirements.

To ensure the increase in residential density proposed as part of the Spires Estate Structure Plan Amendment does not impact flood storage within public open space, the modelling assumptions must be outlined for assessment.

Should you have any enquiries with respect to this advice, please do not hesitate to contact Mr Robert Casella on 9528 0426.

Yours faithfully

B D ASHBY
MANAGER, STRATEGIC
PLANNING & ENVIRONMENT

To:	**Tamara Vreeken**	tamarav@cdpaus.com.au	
Cc:	**Bruce Young**	Bruce@spatialproperty.com.au	
From:	**Greg Davis**	g.davis@taktics4.com.au	
Date	**3 February 2021**	Pages	**4**
Subject	**Sustainability / Needs Assessment – Tavern, Baldivis North**		

Purpose/ Intent

This paper provides a statement that effectively updates the Retail Sustainability Assessment for the Baldivis North Neighbourhood Centre Structure Plan prepared in accordance with SPP4.2 to account for proposed changes to incorporate a tavern in the Centre.

The statement outlines the key considerations and arguments which support the change to Baldivis North Neighbourhood Centre Structure Plan to accommodate a tavern on the site, including issues in relation to:

- State and local policy compliance.
- Market and commercial demand

Location

The Baldivis North Neighbourhood Centre is located on Nairn Drive 2km north of the Baldivis District Centre on Safety Bay Road, Baldivis in the City of Rockingham. The Baldivis North Neighbourhood Centre is planned to be located central to a significant and rapidly developing residential catchment.

Proposed changes to the Baldivis North Neighbourhood Centre Structure Plan add a site adjacent to the initially planned centre dedicated specifically for a tavern to complement the retail and community offer planned for Baldivis North community.

State Planning Policy 4.2 – Activity Centres for Perth and Peel (2010)

State Planning Policy 4.2 – Activity Centres Perth and Peel guides the preparation and review of local planning strategies, schemes, structure plans and development control as they pertain to the orderly planning and delivery of activity centres.

Although there is no specific reference in SPP4.2to the role that Taverns play in centre hierarchies, the inclusion of a tavern in a planned allocated Neighbourhood Centre is implicit across the broad principles and objectives outlined in SPP4.2.

Specific relevant references that support and promote the inclusion of a Tavern within an allocated Neighbourhood Centre include but may not be limited to:

- Land uses that generate activity outside normal business hours (eg. hospitality and entertainment, community facilities, gymnasiums) should be in activity centres to generate additional evening and weekend activity and to take advantage of shared use of facilities such as car parking and public transport.

- Activity centres should have an appropriate mix of uses to encourage vibrant, diverse, interactive, and safe activity centres that are lively during the day and night and reduce the overall need to travel.

  - the integration of activity centres with public transport, ensuring they contain a range of activities to promote community benefits through infrastructure efficiency and economic benefits of business clusters, and lower transport energy use and associated carbon emissions.

- Diversifying complementary land use in conventional retail-dominated and specialised (typically single use) centres is part of the challenge for integrating activity centres into the broader (sub)urban environment.

  - Plan activity centres to support a wide range of retail and commercial premises and promote a competitive retail and commercial market.

  - Increase the range of employment in activity centres and contribute to the achievement of sub-regional employment self-sufficiency targets.

  - Ensure activity centres provide sufficient development intensity and land use mix to support *high-frequency* public transport.

  - Maximise access to activity centres by walking, cycling and public transport while reducing private car trips.

  - Concentrate activities, particularly those that generate high numbers of trips, within activity centres.

  - The resulting centre boundary must contain sufficient land to deliver an appropriate degree of land use diversity for the relevant type and scale of centre.

Taverns are considered high trip generating land use, as reflected by the following statement and table - Restaurant, tavern, night club, reception area etc. >1,000 persons (seats) or > 2,000sqm gross floor area

These statements and references in SPP4.2 clearly confirm the expectation and intention for taverns to be included within Neighbourhood Centres.

City of Rockingham Local Planning Strategy (2015)

North Baldivis remains the only Neighbourhood Centre listed, delineated, and formally identified in the City of Rockingham Local Planning Strategy.

As per SPP4.2, the Local Planning Strategy does not specifically refer to a tavern's role within the centre hierarchy throughout the policy, but generally references the activity in the following statements:

  - Encourage the provision of ancillary convenience uses co-located at suburban shopping centres, retailing and other, that are operated independently and separately of the core retailing within the shopping centres and frequently operate extended trading hours. Such uses include fast food outlets, restaurants, video rental, chemist shops within medical centres, convenience shops attached to service stations and the like.

  - Table 1.1 on Page 4 of this report, taken from the *Metropolitan Centres Policy (2000),* identifies ancillary uses (to the core shop/retail PLUC 5 floor area) appropriate at each level of the shopping centre hierarchy. The policy envisages larger offices, commercial, recreation and entertainment (cinemas etc.), administrative and community functions being concentrated at the larger centres. Ancillary uses would also include taverns, restaurants, medical centres, and fast-food outlets.

- Shopping Floorspace in the (Guidelines on Shopping floorspace Provision) table is as defined in Category 5 of the Planning and Land Use Codes (SHOP) but excludes Hotels, taverns, and night clubs, which fall within the Entertainment PLUC.

PLUC	ACTIVITY/LAND USE	WASLUC code
ENT	DRINKING PLACES (ALCOHOLIC BEVERAGES)	582
ENT	DRINKING PLACES (ALCOHOLIC BEVERAGES) HOTELS	5821
ENT	DRINKING PLACES (ALCOHOLIC BEVERAGES) TAVERNS	5822

As such the agreed retail floor space allocation listed for activity centres does not / should not include floor space for the tavern – although it may include the retail space (not including the driveway) associated with the display and sale of packaged purchase of liquor as part of any adjoining drive through liquor store.

The inclusion of a tavern in a Neighbourhood Centre is one of the few activities or land uses that would satisfy the objectives and principles outlined above. In addition, a tavern's exclusion from shop/retail floor space allocations specifically defines taverns as an ancillary use and therefore confirms its role as a diverse activity to the retail sector.

Existing Taverns in Neighbourhood Centres

There are already many examples of taverns located in Neighbourhood Centres across the Perth Metropolitan Region establishing a clear existing commercial precedent. The table below highlights an extensive range of allocated Neighbourhood Centres which have relatively recently incorporated a tavern in accordance with state and local policy.

Tavern/Bar	Activity Centre	LGA
Subject site	Baldivis North NC	Rockingham
The Well Bar and Bistro	Wellard NC	Kwinana
The Quarie Bar and Brasserie	Success NC	Cockburn
Berrigan Bar and Bistro	South Lake	Cockburn
The Vale Bar and Brasserie	Yangebup	Cockburn
Port Kennedy Tavern	Palm Meadows	Rockingham
The Duke Bar and Bistro	Carramar	Wanneroo
The Ashby Bar and Bistro	Ashby	Wanneroo
The Greenwood Tavern	Greenwood	Joondalup
The Carine Glades Tavern	Carine	Joondalup

Commercial Demand

Traditional pubs have faced significant pressure over the past five years, due to changing consumer preferences. Pubs with larger floor space are increasingly making way for smaller bars and family-oriented taverns. Small bars are enjoying strong growth as new establishments continue to open initially in inner-city areas and more recently in urban and suburban environments.

They also benefit from the proximity to other cafes and restaurants and reciprocal car parking typically found in Neighbourhood centres. Neighbourhood Centre are also typically orientated on primary or arterial road networks – assisting with traffic and access to a broader community. Taverns typically have a catchment requirement consistent with supermarket and neighborhood center retail outlets, and a larger catchment than that offered by a smaller local centre retail offer.

There are subsequently limited opportunities for a tavern to be suitably located elsewhere in the North Baldivis District. Baldivis North Neighbourhood Centre is the only centre located centrally to the entire North Baldivis community with ready access to communities in each direction. The analysis of other taverns near higher order centres shows that a tavern in North Baldivis Neighbourhood Centre will be able to operate independently and with no detriment to bars/bistros located and planned in higher order centres elsewhere in Baldivis.

As the only Neighbourhood Centre located centrally to the entire North Baldivis Catchment, it makes strong commercial sense to accommodate a tavern at Baldivis North Neighbourhood Centre.

As discussed above, there are many examples of taverns in Neighbourhood Centres throughout the Perth Metropolitan Region. These taverns listed below are in neighbourhood centres which have a similar distance / spatial relationship to taverns at higher order centres that Baldivis North Neighbourhood Centres has with Baldivis District centre. There is no need for Baldivis North Neighbourhood Centre to set a precedent regarding provision for a tavern within its boundaries.

Tavern/Bar	Activity Centre	Proximity to nearest DC/tavern
Subject site	BNNC	2km from Baldivis DC
The Well Bar and Bistro	Wellard NC	2km from Kwinana DC
The Quarie Bar and Brasserie	Success NC	3km from Cockburn RC
Berrigan Bar and Bistro	South Lake	2.5km from Cockburn RC
The Vale Bar and Brasserie	Yangebup	3km from Spearwood DC
Port Kennedy Tavern	Port Kennedy/ Palm Meadows	2.2km from Warnbro DC
The Duke Bar and Bistro	Carramar	1km from Banksia Grove DC
The Ashby Bar and Bistro	Ashby	2km from Wanneroo DC
The Greenwood Tavern	Greenwood	1.3km from Warwick RC
The Carine Glades Tavern	Carine	2km from Warwick RC

Summary

This statement of key considerations highlights that:

- A tavern represents an appropriate and suitable use for the Baldivis North Neighbourhood Centre.
- There is an established commercial and market demand for a tavern at the Baldivis North Neighbourhood Centre.
- A tavern at the Baldivis North neighbourhood Centre will not unduly impact on the sustainability of existing or planned taverns within the planned activity centre network.
- A tavern represents a desired diversity of commercial activity and contributes to the night-time economy and overall employment and economic sustainability of the Baldivis North District.
- A tavern represents a high trip frequency activity which is supported and encouraged for Neighbourhood centres in accordance with the relevant state and local planning policy.
- There is clear policy, market, commercial and planning evidence to support the proposed amendment to include a tavern at the planned Baldivis North Neighbourhood Centre.

I trust that this information assists with deliberations. Please advise how you wish to proceed.

Regards
Taktics4

Greg Davis
Director
E g.davis@taktics4.com.au
M +61 439 959 762

ADDENDUM 4. AMENDMENT NO. 7: INCLUSIONS OF LOT 3 BALDIVIS ROAD, BALDIVIS, INTO THE STRUCTURE PLAN AREA

1. INTRODUCTION AND PURPOSE

Niche Planning Studio has prepared this amendment request to the Spires Estate Phase 2 LSP on behalf of Spatial Property Group for the purpose of including Lot 3 Baldivis Road, Baldivis into the LSP. Therefore, for the purposes of the Explanatory Section of the Structure Plan, this appendix (from herein) will primarily focus on the portion of the LSP subject to modification (herein referred to as the subject site), as defined on Figure 1.

The purpose of the LSP amendment is to facilitate the development of Lot 3 for residential development and public open space within the Spires Estate. The proposed LSP amendment has been considered in the context of the existing state and local planning frameworks and is intended to provide for urban development in accordance with the broad land use parameters of the approved Baldivis North District Structure Plan (DSP).

As part of this amendment, an extension to the expiry of the LSP is sought. The current LSP is valid until October 2025, and through this amendment

The proposed LSP amendment is supported by technical reports addressing Bush Management Plan, Environmental Assessment Report, Site Contamination, Water Management Strategy and Transport.

2. BACKGROUND

The LSP was adopted by the City of Rockingham on 17 June 2013, and approved by the Western Australian Planning Commission on 15 October 2014. Since then, there have been several amendments to the LSP, with this proposed amendment being the seventh.

The subject site is located within Precinct 1 of the North Baldivis District Structure Plan (DSP) area, which identifies the site as being subject to future urban and residential development. The North Baldivis DSP was formally adopted by the City of Rockingham Council in July 2000.

The structure plan area has been progressively subdivided since 2014 with approximately 80% of the LSP area either constructed or under construction.

The previous hatchery land use of the site has now been discontinued thereby removing any existing odour buffers to the surrounding sites.

3. SITE DESCRIPTION

3.1 LOCATION

Lot 3 Baldivis Road (the subject site) is located with the City of Rockingham approximately 40km south of the Perth Central Business District (Figure 1 refers). The subject site has an area of 4.046 hectares and is located between Everest Way to the west and Baldivis Road to the east, with existing access from Everest Way.

The subject site is located south of Lot 2 Eighty Road and north of Lot 4 Eighty Road. In addition to demonstrating the subject site in the context of the existing LSP, the Local Context Plan illustrates how the future development of the subject site will provide for infill residential development within the Spires Estate resulting in the coordinated and continued urban development of the area.

Figure 1: Location Plan

3.2 LEGAL DESCRIPTION, OWNERSHIP & CURRENT LAND USE

Table 1 below provides a summary of the land details pertaining to the subject site. A copy of the Certificate of Title listed above is included in Appendix 12A.

Table 1: Lot 3 Details

Lot / Address	Lot No.	Plan	Volume	Folio	Area / Ha
Lot 3 Baldivis Road, Baldivis	3	29589	382	138A	4.046ha

The site has previously been used a hatchery however, operations have ceased.

4. STATUTORY PLANNING FRAMEWORK

4.1 ZONES AND RESERVATIONS

4.1.1 METROPOLITAN REGION SCHEME

The subject site is zoned 'Urban' under the *Metropolitan Region Scheme* (MRS) (Figure 2 refers).

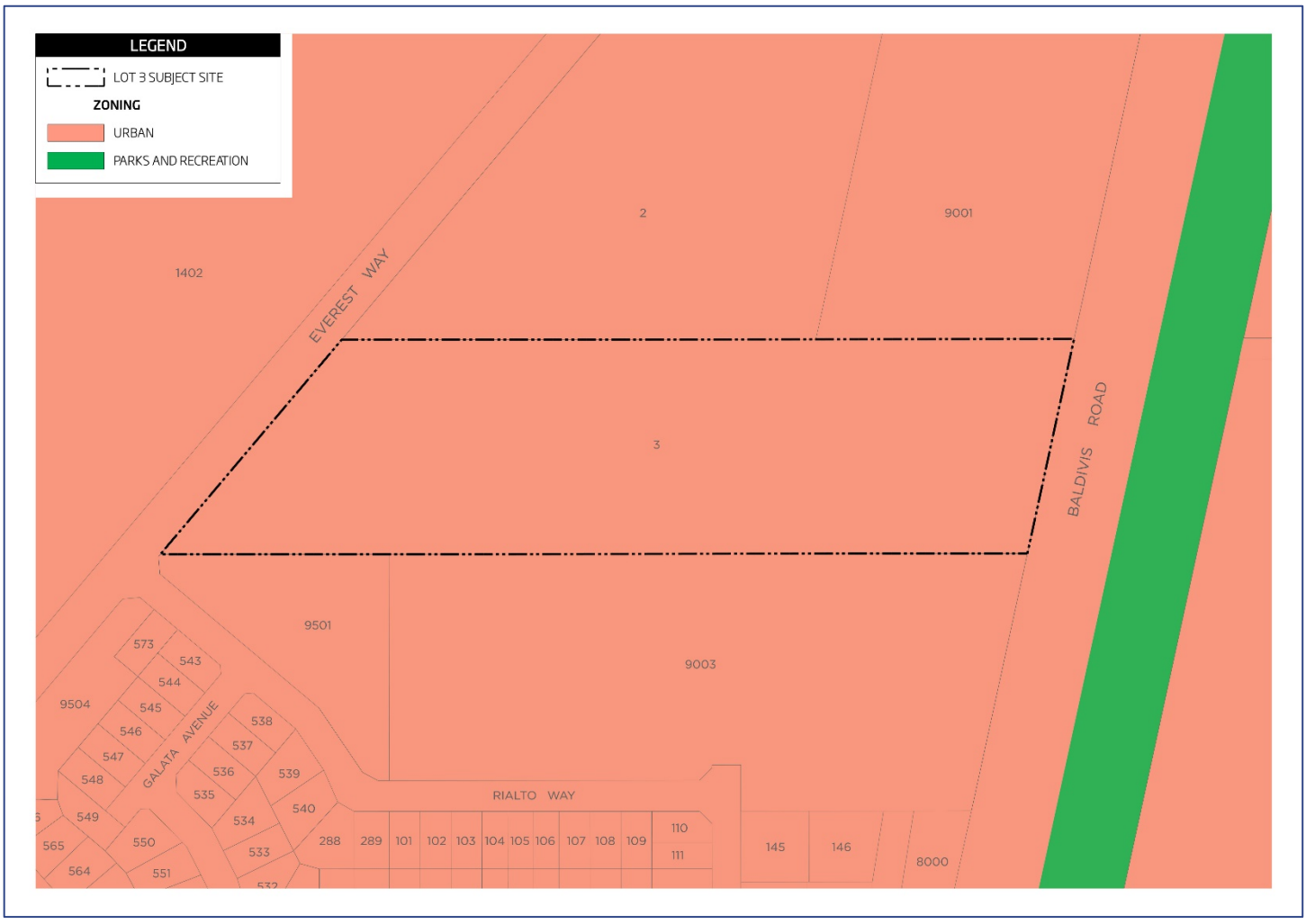


Figure 2: Metropolitan Region Scheme

4.1.2 CITY OF ROCKINGHAM TOWN PLANNING SCHEME No. 2

The subject site is zoned 'Development' under the City of Rockingham *Town Planning Scheme No.2* (TPS2). In accordance with Clause 4.2.2 of TPS2, the primary objectives of the 'Development' zone are to:

a) To identify areas requiring comprehensive planning prior to subdivision and development.

b) To coordinate subdivision, land use and development in areas requiring comprehensive planning.

The subject site is within 'Development Area 22' as indicated by Schedule No. 8 of TPS2. As per this schedule, an approved Structure Plan is required to provide guidance for the subsequent subdivision and development of this area (Figure 3 refers).

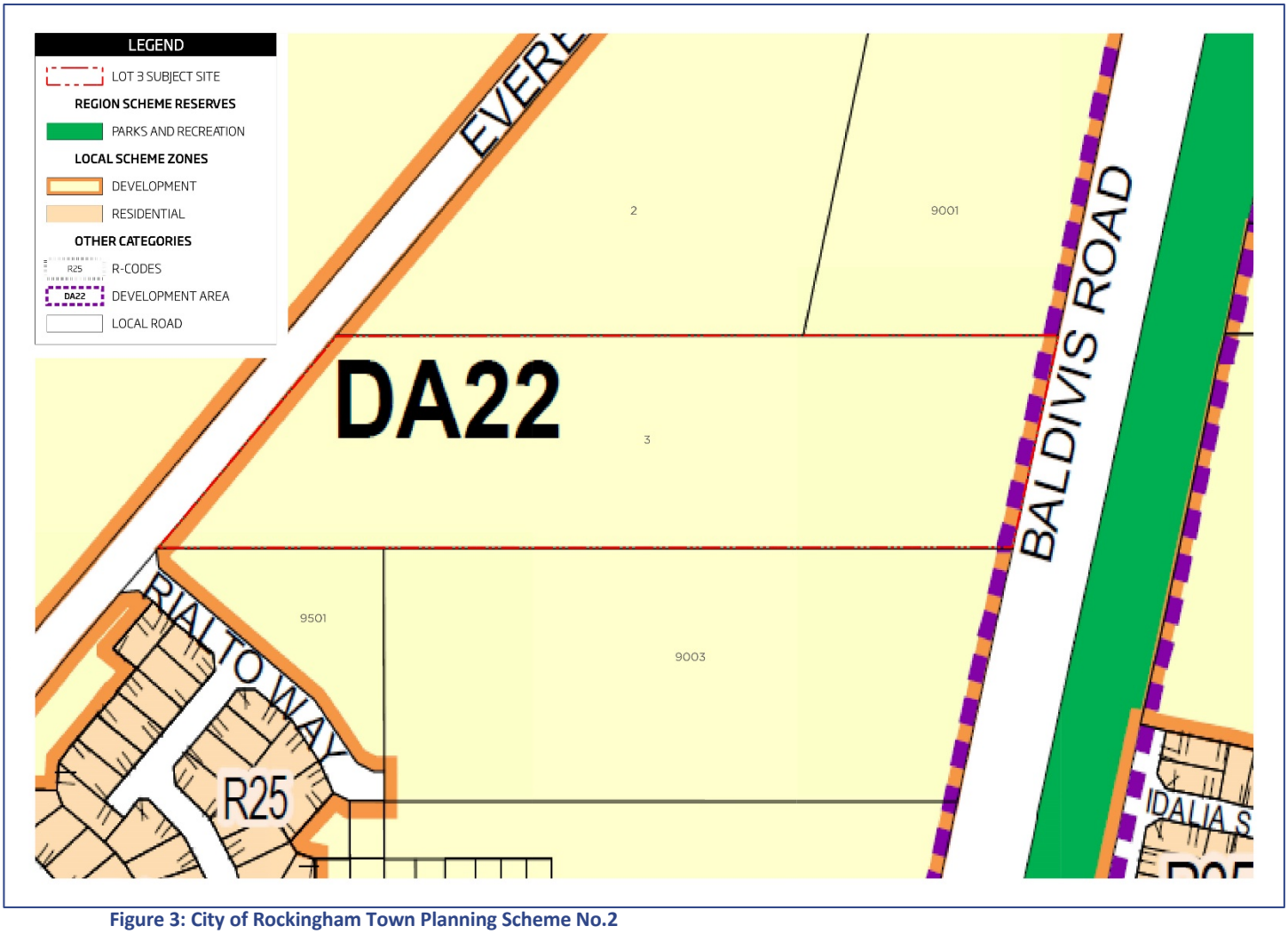


Figure 3: City of Rockingham Town Planning Scheme No.2

5. SITE CONDITIONS AND CONSTRAINTS

5.1 ENVIRONMENTAL ASSESSMENT

An Environmental Assessment Report (EAR) was originally prepared in 2014 by Coterra Environmental, an addendum (Appendix 13B) to that report has been prepared to support this LSP Amendment to:

- detail the subject site's environmental context and identify potential impacts associated with the site's inclusion within the LSP; and
- discuss the environmental design / management response to address these potential impacts.

The EAR suggests development of the site as proposed has not been identified to result in any unacceptable environmental impacts. Any potential direct or indirect impacts associated with its implementation can be appropriately managed and mitigated, as development progresses.

In summary:

- The site is predominately cleared, with only isolated native and non-native planted trees remaining, none of which are considered to be conservation significant. Implementation of the proposed development is considered to be consistent with the objectives of the North Baldivis DSP.
- Post development nutrient export levels are anticipated to be greatly reduced when compared to those associated with the site's historic land uses. Additional management actions proposed within a dedicated LWMS will ensure that the objectives of the Peel Harvey EPP will be met.
- Potential direct and indirect impacts to flora and vegetation will be mitigated through the retention of significant trees in POS and streetscaping, and the implementation of dust minimisation measures as required. Detailed landscaping design is anticipated to provide an avenue for the expansion and enhancement of flora and vegetation values within the site, predominately through the planting of native species.
- The retention of significance trees and planting of native species throughout the development area will also mitigate potential impacts to native fauna, particularly black cockatoos. Additional clearing controls will be implemented during the construction phases of development to further mitigate potential impacts to native fauna, during this time.

5.2 TRAFFIC ASSESSMENT

A Transport Assessment to support this LSP Amendment has been prepared by Transcore (Appendix 13C). In summary, the Traffic Assessment suggests the inclusion of Lot 3 in the LSP will increase the traffic generation of the LSP area by approximately 560vpd. However, the increase in traffic generation has already been taken into consideration in traffic modelling of future development of the area. Therefore, the proposed Amendment does not have any effect upon future total traffic volumes on the road network in this area.

Accordingly, the proposed Amendment does not require any changes to current planning for the road network and intersections in this area.

5.3 LOCAL WATER MANANGEMENT STRATEGY

Development Engineering Consultants (DEC) has prepared an addendum to the "Lots 312 and 313 and lots 2, 4, 5, 7 and 8 Eighty Road, Baldivis – Local Water Management Strategy", May 2013 prepared by Coterra Environmental (Appendix 13D). The DEC report concludes that:

- The UWMP provided criteria for storage requirements for higher density sites which resulted in the same outflow from standard residential lots.
- The impact of the proposed changes will mean that the increase in paved area will be countered by the increased storage provided on the higher density allotments.

As a result, provided the criteria is applied as outlined in the UWMP, no change to the UWMP is required.

5.4 BUSHFIRE MANAGEMENT PLAN

A Bushfire Management Plan has been prepared by JBS&G in support of the LSP amendment (Appendix 13E). Based on the information contained in this BMP, JBS&G considers the bushfire hazards within and adjacent to the project area and the associated bushfire risks to the proposed development are readily manageable through adoption of standard acceptable solution management responses outlined in the Guidelines.

JBS&G considers that the project area can be developed with a manageable level of bushfire risk whilst maintaining full compliance with SPP3.7 and the Guidelines, which will be demonstrated through future BMPs/addendums prepared to accompany future subdivision/development applications.

5.5 SITE CONTAMINATION

A detailed site contamination report has been prepared by Western Environmental (Appendix 13F), whereby environmental field monitoring and/or testing was conducted. In summary the results of the laboratory data from the current investigation confirmed that:

- The contaminant concentrations identified in soil and groundwater do not pose an unacceptable risk to human receptors either currently or under the proposed future residential development.
- A concrete sump on-site contains a minor amount of sediment with Zn present above the EIL-A. It does not pose an exposure risk but the excavation and disposal of the sump and material contained within should be managed during future site works.
- The contaminant concentrations of BaP in soil had the potential to pose a theoretical risk to on-site and off-site ecological receptors.
- The contaminant concentrations of nutrients and Zn in groundwater had the potential to pose a theoretical risk to aquatic receptors.

The report notes that the soil on the site is not environmentally sensitive or supportive of significant ecosystem functions/values, and that the clearing for development is likely to further reduce its habitat value for native fauna. There are no on-site aquatic receptors at risk from groundwater contamination, with the only potential receptors being located some distance from the site.

A qualitative risk assessment was completed with consideration of the likelihood of the source-pathway-receptor-linkages being complete along with the consequences if it were to be complete. The potential linkage for all potential linkages was assigned an overall risk classification of 'Very low' with a consequence of 'Negligible' or 'Minor' and a likelihood of 'Rare'. On this basis it is considered that there is no unacceptable risk to the environment, and no further actions are needed to reduce the risk.

Based on the data obtained during the current investigation and the outcome of the risk assessment, it can be reasonably concluded that the site does not meet the legal definition of contamination based on the data and risk assessment and is suitable for the proposed residential development.

5.6 SERVICING

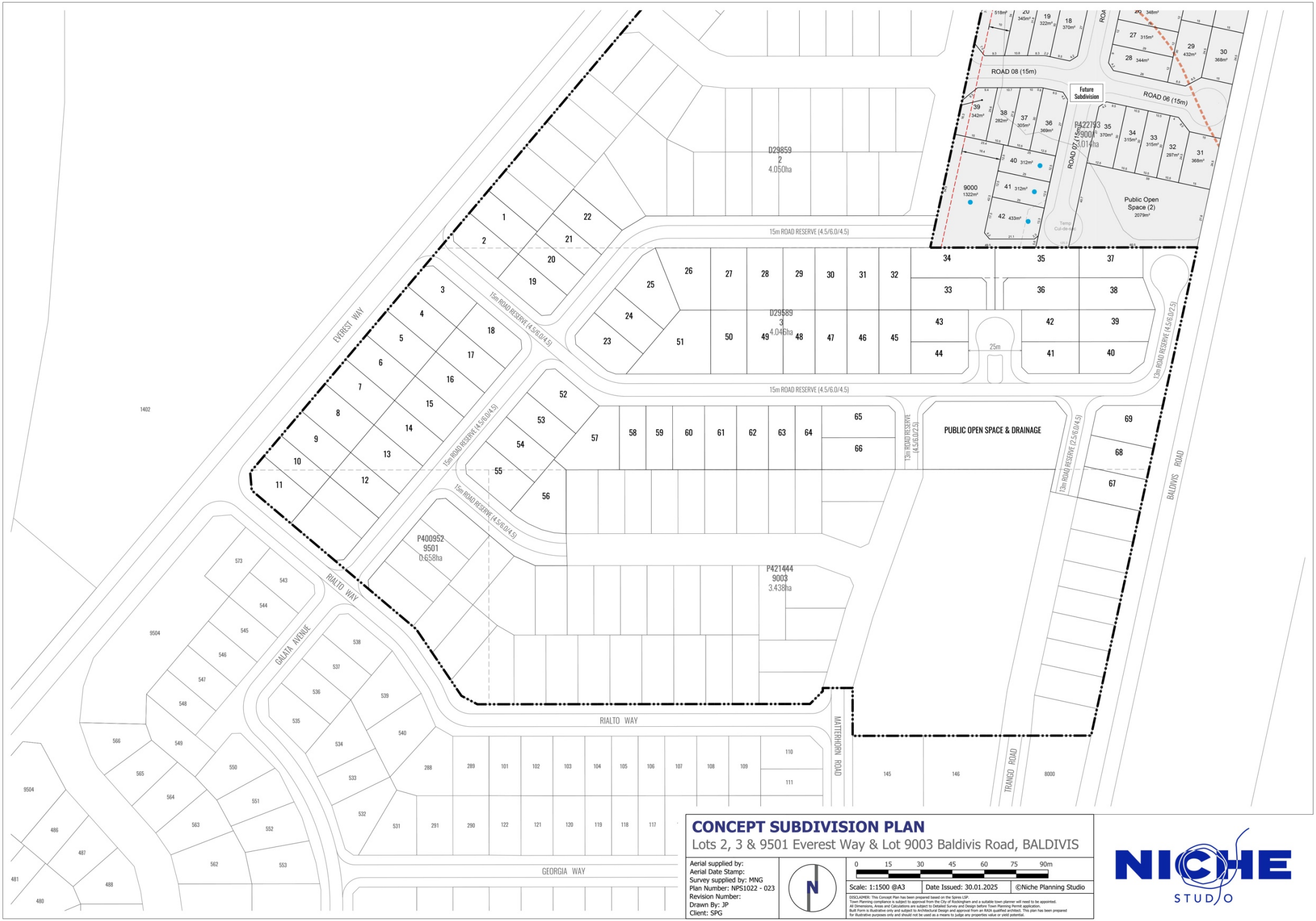
DEC has prepared an Engineering Servicing Report (Appendix 13G), which details that the inclusion of Lot 3 into the LSP area, can be connected to all services, either by extension and upgrading from existing infrastructure, or by provision of new infrastructure as set out below. Power, telephone, gas, sewer and water services already pass along the site frontage.

6. PROPOSED AMENDMENT TO LSP

The proposed concept plan for Lot 3 seeks to integrate with the approved development to the north and south as shown on the LSP. The concept plan demonstrates that Lot 3 can provide a seamless transition to adjoining lots integrating the local road network, public open space and complementary residential densities.

There is no vehicular access to Baldivis Road proposed from Lot 3. Access to Lot 3 will be taken from Eighty Road and will integrate with the established road network to adjoining lots as shown in the LSP.

The LSP as amended to include Lot 3 is shown in Figure 4..



CONCEPT SUBDIVISION PLAN

Lots 2, 3 & 9501 Everest Way & Lot 9003 Baldivis Road, BALDIVIS

Aerial supplied by:
Aerial Date Stamp:
Survey supplied by: MNG
Plan Number: NPS1022 - 023
Revision Number:
Drawn By: JP
Client: SPG

0 15 30 45 60 75 90m

Scale: 1:1500 @A3 | Date Issued: 30.01.2025 | ©Niche Planning Studio

DISCLAIMER: This Concept Plan has been prepared based on the Spires LSP.
Town Planning compliance is subject to approval from the City of Rockingham and a suitable town planner will need to be appointed.
All Dimensions, Areas and Calculations are subject to Detailed Survey and Design before Town Planning Permit application.
Built Form is illustrative only and subject to Architectural Design and approval from an RAIA qualified architect. This plan has been prepared for illustrative purposes only and should not be used as a means to judge any properties value or yield potential.

NICHE STUDIO

6.1 RESIDENTIAL

6.1.1 DENSITY

The proposed density aligns with the LSP. The inclusion of Lot 3 within the LSP will increase the total dwelling yield by approximately 60 to 70 residential lots when it is subdivided, in addition to the 900+ dwellings approved LSP area.

Based on the Liveable Neighbourhoods 'Site Hectare' definition, the overall density for the Structure Plan equates to ~28 dwellings per site hectare; therefore, exceeding the 22 dwellings per site hectare target of this document.

6.2 PUBLIC OPEN SPACE

The provision of public open space (POS) across the subject site has been considered in accordance with the approved LSP area and with regard to the requirements of Liveable Neighbourhoods. The proposed Structure Plan Amendment provides for approximately 0.2ha of POS, and including the existing areas of POS, the LSP provides for a total of approximately 6ha and meeting the minimum 10% requirement as demonstrated below in Tables 2 and 3.

Table 2: POS Summary

LAND BUDGET - SPIRES ESTATE PHASE 2		
		Area (ha)
Structure Plan Area		58.62
Deductions	Drainage 1:1	0.65
	Commercial Uses	3.30
	Nairn Drive	1.01
	Gas Pipeline	0.00
	Road Widening	0.15
Total Deductions:		4.96
Developable Area		53.66
POS Requirement		5.37
	Maximum Restricted Open Space (20%):	1.07
	Minimum Unrestricted Open Space (80%):	4.29

Table 2: POS Calculations

Drainage Provisions and Creditable Open Space - Stage 2 Subdivision Spires Estate					
POS Area LSP Ref (Sub Ref)	Land Area (ha)	Non Credit	Restricted	Unrestricted	Total Credit Open Space
		1:1 Year Event	>1:1 – 1:5 Year	Above 1:5	Combined
All figures in hectares (ha)					
AREAS OF POS					
A	0.4573	0	0	0.4573	0.4573
B	0.4871	0.0759	0.0181	0.3931	0.4112
C	0.1212	0.0168	0.0398	0.0646	0
D	0.879	0	0	0.879	0.879
E	0.4926	0.038	0.0129	0.4417	0.4546
F	0.4883	0.0413	0.1717	0.2753	0.447
G	0.395	0.082	0.025	0.288	0.313
G (Lot 3 portion)	0.2057	0	0	0	0.2057
H	0.8509	0.0791	0.026	0.7458	0.7718
I	0.3211	0.0842	0.0268	0.2101	0.2369
J	0.8264	0.1084	0.03	0.688	0.718
J (Gas Pipeline)	0.5015	0	0	0	0.5015
		Subtotal:	**0.3503**	**4.4429**	**5.396**
	10% POS REQUIRED:				**5.37**
	TOTAL CREDITBALE POS:		**0.3503**	**4.4429**	**5.396**
			POS Surplus		**0.030**

7. CONCLUSION

Progression of this amendment to the Spires Estate Phase 2 Local Structure Plan will facilitate subdivision and development of Lot 3, remove the current poultry farm use and allow for the completion of development within the area.

APPENDIX 1: CERTIFICATE OF TITLE

WESTERN AUSTRALIA

TITLE NUMBER	
Volume	Folio
382	**138A**

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

BGRoberts

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 3 ON DIAGRAM 29589

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

AMAZON VIEW PTY LTD OF 11 FIRST AVENUE APPLECROSS WA 6153

(T P337597) REGISTERED 31/10/2022

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. P337598 MORTGAGE TO COMMONWEALTH BANK OF AUSTRALIA REGISTERED 31/10/2022.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required. Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

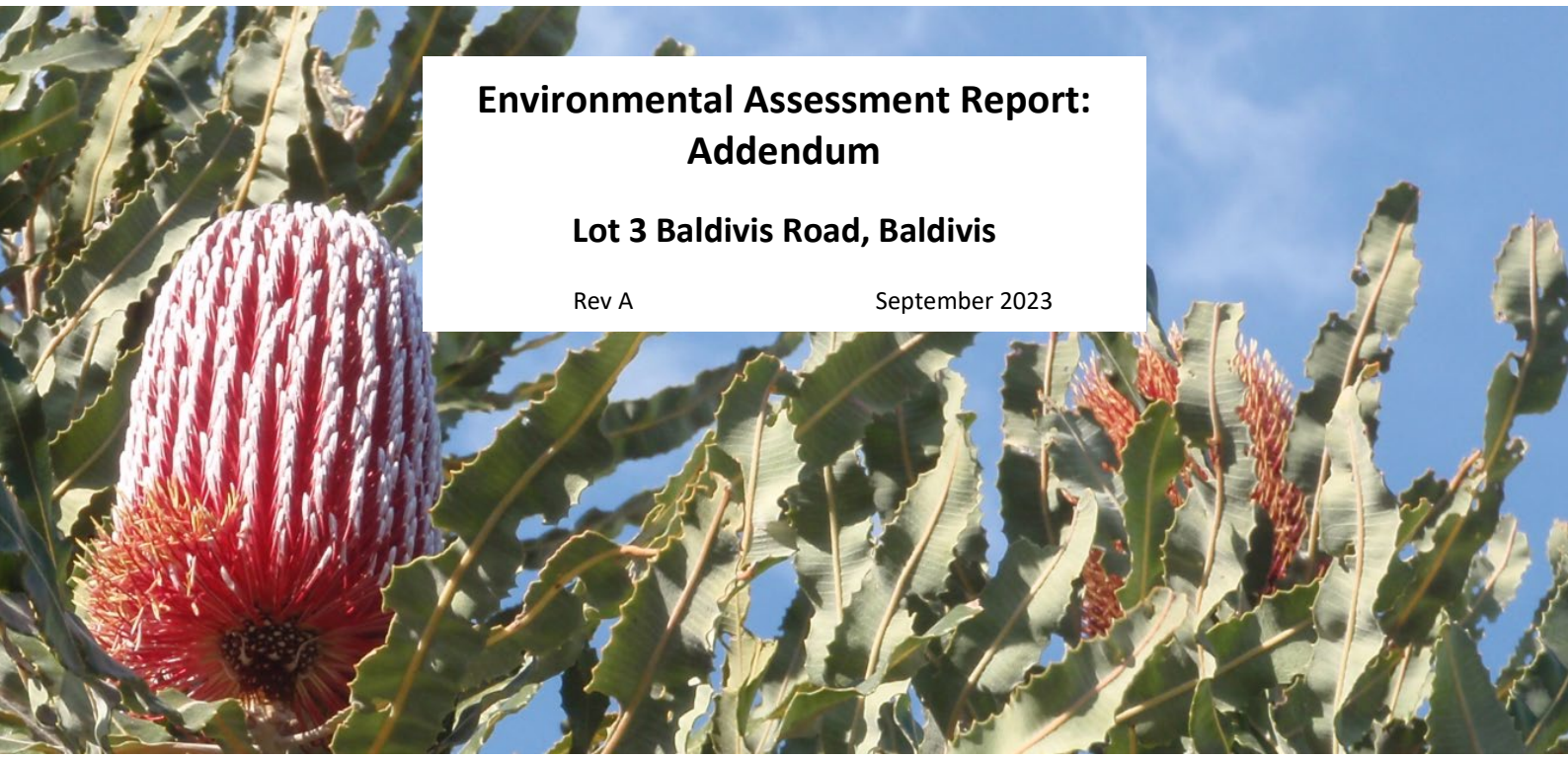
SKETCH OF LAND:	382-138A (3/D29589)
PREVIOUS TITLE:	1282-474
PROPERTY STREET ADDRESS:	392 BALDIVIS RD, BALDIVIS.
LOCAL GOVERNMENT AUTHORITY:	CITY OF ROCKINGHAM

LANDGATE COPY OF ORIGINAL NOT TO SCALE 23/10/2023 02:34 PM Request number: 65759421

Landgate
www.landgate.wa.gov.au

APPENDIX 2: ENVIRONMENTAL ASSESSMENT REPORT

COTERRA ENVIRONMENT



Environmental Assessment Report: Addendum

Lot 3 Baldivis Road, Baldivis

Rev A September 2023

CALIBRE | COMMITMENT | COLLABORATION

This report was prepared by: Coterra Pty Ltd trading as COTERRA ENVIRONMENT
ABN: ABN: 92 143 411 456
Our Ref: SPABAL16
Author(s): W. Oversby
Reviewer: K. Watts
Report Version: Rev A
Date: September 2023

This report was prepared for:

Spatial Property Group
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Appendix 1 Database Search Results

Appendix 2 Harewood, G. (2023). Black Cockatoo habitat assessment.

1 Introduction

1.1 Background

Spatial Property Group are proposing the residential development of Lot 3 Baldivis Road, Baldivis (the site; Figure 1). The site is approximately 4 hectares (ha) in size and is located between Everest Way and Baldivis Road in the City of Rockingham, approximately 40 km south of the Perth central business district.

The site is currently zoned as Urban under the Perth Metropolitan Region Scheme (MRS), and as Development under the City of Rockingham Local Planning Scheme (LPS) No. 2.

The site is located within Precinct 1 of the North Baldivis District Structure Plan (DSP) area, which identifies the site as being subject to future urban and residential development. The North Baldivis DSP was formally adopted by the City of Rockingham Council in July 2000.

1.2 Approvals context

In accordance with the objectives of the DSP, Spatial Property Group developed a Local Structure Plan (LSP) for a number of lots to the north, south and west of the site, covering a total area of 54.57 ha. This LSP, termed the Spires Phase 2 LSP, provides a greater level of detail in respect to the development design for the applicable landholdings. Spatial Property Group are now seeking to amend the Spires Phase 2 LSP, so as to also detail the future urban residential development of the site.

1.3 Purpose of this Report

To inform and support the Spires Phase 2 LSP, an Environmental Assessment Report (EAR) was prepared, which describes the suite of environmental factors relevant to the area and outlines management measures to effectively mitigate potential environmental impacts resulting from implementation of the proposed development (Coterra Environment 2014).

As an addendum to the Spires Phase 2 LSP EAR, this report has been prepared to detail the site's environmental context, identify potential impacts associated with the site's inclusion within the LSP, and discuss the environmental design / management response to address these potential impacts. This addendum should be read in conjunction with the Coterra Environment (2014) EAR.

1.4 Relevant Guidance and Policies

1.4.1 Environmental Protection (Peel Inlet – Harvey Estuary) Policy 1992

The site is located within the Swan Coastal Plain Catchment of the Peel Inlet – Harvey Estuary, which has a history of poor water quality. The objective of the *Environmental Protection (Peel Inlet – Harvey Estuary) Policy 1992* (Peel Harvey EPP) is to reduce the input of nutrients, particularly phosphorous, into the Peel Inlet – Harvey Estuary through a number of means, which include appropriate land management by landowners in the policy area.

The Peel-Harvey EPP requires any future development within the policy area to be designed to meet the water quality objectives.

To inform the Spires Phase 2 LSP, a Local Water Management Strategy (LWMS) was developed by Coterra Environment (2012). The LWMS was developed in accordance with the Better Urban Water Management Guidelines (DoW 2008) and identifies a suite of management actions to ensure that the quality of stormwater and groundwater is either maintained or improved following development. These include the planting of native vegetation in drainage basins, community education and engagement, appropriate groundwater separation distances, and a commitment to ongoing monitoring.

For the site specifically, a dedicated LWMS has been developed by Development Engineering Consultants (DEC 2023). The LWMS holistically addresses water management for the future urban residential development of Lots 2, 3, 9001, 9003 and 9501. Water quality management actions developed as part of the original Spires Phase 2 LWMS, and which have successfully been implemented across the broader LSP area, are proposed to be implemented for this LWMS also, to ensure that the objectives of the Peel Harvey EPP can be met. Further information on water quality management is provided in Section 3.1

1.4.2 State Planning Policy 3.7 – Planning in Bushfire Prone Areas

State Planning Policy 3.7 – Planning in Bushfire Prone Areas (SPP 3.7) and the associated Guidelines for Planning in Bushfire Prone Areas have been developed to implement effective risk-based land use planning and development to preserve life and reduce the impact of bushfire on property and infrastructure.

SPP 3.7 applies to all strategic planning, subdivision and development applications in bushfire prone areas, and aims to support development through an assessment of bushfire hazard. The aims of SPP 3.7 are to:

- Avoid increases in the threat of bushfire to people, property and infrastructure
- Reduce vulnerability to bushfire through identification and consideration of bushfire risks
- Ensure higher order strategic planning documents, proposals, subdivision and development applications take into account bushfire protection requirements
- Achieve an appropriate balance between bushfire risk management measures, biodiversity conservation values, environmental protection and biodiversity management and landscape amenity, with consideration to climate change.

The Guidelines for Planning in Bushfire Prone Areas (WAPC 2021) provides guidance on the implementation of SPP 3.7 and assists in:

- Determining appropriate land use planning in relation to bushfire prone areas across Western Australia
- Specifying the requirements to be met at each stage of the planning process
- Ensuring the necessary bushfire protection measures are incorporated into development

1.4.3 City of Rockingham Information Sheet: Preparation of Environmental Assessment Reports to Inform Structure Plan Applications

To address a lack of guidance material available to inform the preparation of EARs, the City has developed an information sheet to outline the City's expectations of information that is to be provided in such reports, to inform Structure Plan applications.

The information sheet summarises the matters that are to be addressed in an EAR, including a description of a site's environmental attributes and context, impacts, and proposed management. This EAR addendum has been developed in accordance with this information sheet.

Due regard has also been given to the *City of Rockingham Planning Procedure 1.23: Environmental Assessment* in the development of this report, which provides guidance on how the City undertakes environmental assessments of planning applications.

2 Existing Environment

2.1 Context and Setting

Historic aerial imagery indicates that the site was entirely cleared of vegetation between 1970 and 1974, after which the site was used for intensive horticultural activities. Use of the site appears to have transitioned to a rural lifestyle property in the late 1980's, before its eventual conversion for use as a poultry farm. While the farm was in operation at the time of the DSP's development, it has since ceased operations and the associated structures have been demolished (see section 2.7).

Urban residential development is currently progressing to the north and south of the site in accordance with the approved LSP. Remnant native vegetation is located to the west of the site opposite Everest Way, however this area has also been identified for future development under a dedicated LSP (Lot 311 Fifty Road Baldivis LSP). Further remnant native vegetation is located to the east of the site, opposite Baldivis Road. This area has been designated as a reserve (Baldivis Reserve) under the MRS.

2.2 Topography, Landforms and Soils

Topography at the site ranges from approximately 12 metres Australian Height Datum (m AHD) in the west of the site, to approximately 6 mAHD in the east (Figure 2).

Soils within the site were mapped by Gozzard (1983) as being of the S8 type, which is described as SAND – very light grey at the surface, yellow at depth, fine to medium-grained, sub rounded quartz, moderately well sorted, of eolian origin as relatively thin veneer over C2, M4 and Mc2.

The site is mapped as having a moderate to low risk (Risk Class II) of Acid Sulfate Soils (ASS) occurring within the soil profile (Landgate 2023).

2.3 Hydrology

Regional groundwater mapping obtained from the Department of Water and Environmental Regulation (DWER) (Landgate 2023) indicates that groundwater occurs at a depth of approximately 2m AHD across the site. Based on the mapped surface topography, this equates to an estimated depth to groundwater of between 10m and 4m. Regional groundwater information indicates that groundwater flow is generally in a westerly direction (Landgate 2023).

The site is not mapped as being in a priority drinking water source area (Landgate 2023).

There are no geomorphic wetlands present within or adjacent to the site, as mapped by the Department of Biodiversity Conservation and Attractions (DBCA) (Landgate 2023). There are no other natural or artificial surface water features within the site (Landgate 2023).

2.4 Vegetation and Flora

Regional vegetation mapping undertaken by Heddle et al. (1980) identifies the site as originally forming part of the Karrakatta Complex Central and South, which is described as predominately an open forest of *Eucalyptus gomphocephala* (Tuart) – *Eucalyptus marginata* (Jarrah) – *Corymbia calophylla* (Marri) and woodland of *Eucalyptus marginata* – Banksia spp. There is approximately 23.49 % of this complex remaining within Western Australia, and approximately 12.4% remaining within the Perth Metropolitan Region (GoWA 2019).

The EPA uses vegetation complexes as the basis for regional representation of biodiversity and has an overall objective to seek retention of at least 10% of the pre-clearing extent of each ecological community within constrained areas such as the Perth Metropolitan and Bunbury Regions (EPA 2015). Being located within the Perth Metropolitan Region, the site is considered to be in a constrained area and as such, the remaining

extents for each vegetation complex and vegetation system associated are above the nominated 10% threshold.

Historic aerial imagery indicates that the site was entirely cleared of native vegetation between 1970 and 1974, at which point the site was used for intensive agricultural activities. Minor plantings occurred in the late 1980's, 1990's, and mid 2000's, with the most recent plantings taking place after 2010. No conservation covenant or similar is known to be in place for the site. Therefore, vegetation on-site is considered to not meet the definition of native vegetation as defined in the *Environmental Protection Act 1986,* nor the associated *Environmental Protection (Clearing of Native Vegetation) Regulations 2004.*

Vegetation in the broader LSP area was assessed as part of a Level 1 Flora and Vegetation Survey undertaken by Bennett Environmental Consulting Pty Ltd in 2011. Lots adjacent to the site, and which share a similar history of use were mapped as comprising open woodlands of Marri or Jarrah over dense tall grass dominated by **Erharta calycina*, in a degraded to completely degraded condition (Bennett Environmental Consulting 2011).

A site inspection was undertaken by Coterra Environment personnel on 29 June 2023 to confirm the findings of the desktop investigation. While a number of native and non-native tree species were observed (which were likely planted in the 1980's and 1990's), the understory was comprised almost exclusively of introduced grasses and other weeds (Plate 2-5; Plate 2-6). Tree species were later confirmed as part of a targeted black cockatoo habitat assessment (Harewood 2023; section 2.5.1).

Plate 2-1: Example of planted non-native tree species observed on-site

Plate 2-2: Example of planted native tree species over an understory of introduced grasses.

It should be noted that isolated Tuart trees were identified during the site inspection and as part of a black cockatoo habitat assessment (Greg Harewood 2023). For the Tuart Woodlands and Forests of the Swan Coastal Plain Threatened Ecological Community to be present within the site, a minimum of four native understory species must be present in a quadrat of 10 m^2 as per the approved conservation advice (DoEE 2019). No such species were identified in the course of either the site inspection nor the black cockatoo habitat assessment. Further, patches of the TEC must be at least 2 ha in size to qualify, however the small number of identified Tuarts and their isolation within the site (Figure 3) indicates that no patch would meet this minimum threshold. On this basis, it was concluded that the Tuart Woodlands and Forests of the Swan Coastal Plain TEC is not present.

2.5 Fauna and Habitat

A desktop assessment was undertaken to determine the potential for conservation significant fauna and fauna habitat to occur within the site. Based on a search of the DBCA's Naturemap database and the Commonwealth's Protected Matters Search Tool, 12 threatened, 17 specially protected (including migratory and conservation dependant) and 11 priority fauna species were identified as potentially occurring within 10 km of the site boundary (Appendix 1). Based on an assessment of habitat requirements, the following conservation significant species were considered to potentially occur within the site:

- *Zanda baudinii* (Baudin's Black Cockatoo) – listed as Endangered under State and Commonwealth legislation
- *Zanda latirostris* (Carnaby's Black Cockatoo) – listed as Endangered under State and Commonwealth legislation
- *Calyptorhynchus banksia naso* (Forest Red-tailed Black Cockatoo) – listed as Vulnerable under State and Commonwealth legislation

No evidence of kangaroo presence was observed as part of the site inspection undertaken by Coterra Environment on 29 June 2023.

2.5.1 Black Cockatoos

To assess the value of the site as habitat for black cockatoos, a dedicated assessment was undertaken by Greg Harewood (2023; Appendix 1). The assessment involved targeted searching for habitat trees (trees with a Diameter at Breast Height of greater than 50cm), existing and potential nest hollows from ground level, foraging habitat and roosting habitat. Evidence for the presence or likely presence conservation significant fauna, including black cockatoos, was searched for as part of the assessment's methodology.

In terms of foraging habitat, the majority of species observed were considered to only make up a small proportion of any species' diet, relative to more favoured plant species. No evidence of foraging was observed during the assessment. Vegetation within the site was given a foraging score of 1/10 for each black cockatoo species, on this basis (Appendix 1).

A total of 39 potential habitat trees were identified in the course of the assessment, of which none were observed to have hollows potentially suitable for breeding. Of the 39 trees identified, the vast majority (29) were confirmed to be non-endemic Eucalypts, and one was identified as a stag (unknown species).

No confirmed or unconfirmed roosting sites have been identified within or in proximity to the site. No evidence of black cockatoos roosting within the site was observed during the survey period.

2.6 Bushfire Risk

The site is located in a bushfire prone area, as mapped by the Department of Fire and Emergency Services (DFES) (Landgate 2023). These areas are defined as being subject to, or likely to be subject to, bushfire attack, and are identified by the presence of and proximity to bush fire prone vegetation and includes both the area containing the bush fire prone vegetation and a 100 m buffer zone immediately surrounding it.

To address the risk of bushfire to the development proposal, a dedicated Bushfire Management Plan has been prepared for the site (JBS&G 2023). This BMP is being submitted in support of an amendment to the LSP, and should be read in conjunction with this Environmental Assessment Report addendum.

2.7 Contamination

Based on a review of historical land uses of the site, two potentially contaminating activities are known to have occurred as per DWER's *Guideline: Assessment and Management of Contaminated Sites* (2021), these being market gardening and poultry farming. A Preliminary Site Investigation (PSI) and associated Sampling

and Analysis Quality Plan (SAQP) were therefore undertaken by Western Environmental (2022a; 2022b) to determine how the presence and extent of potential contamination at the site would be determined, as part of a subsequent Detailed Site Investigation (DSI). While works associated with the DSI are ongoing, preliminary results indicate that there is no risk of soil or groundwater contamination, no risk of asbestos, and the site is suitable for urban residential development.

2.8 Heritage

A search of the Aboriginal Cultural Heritage Inquiry System was undertaken to determine the presence of aboriginal cultural heritage within the site. No registered sites or sites or other sites were identified within the site. The closest known aboriginal cultural heritage site is Gas Pipeline 82, which is of an Artefacts / Scatter type, located approximately 1.2 km to the south west.

No non-indigenous heritage places are located within the boundary of the site. The nearest non-indigenous heritage place is 'Natural Bush Reserve, Rear of Baldivis School' (Place No. 3158), which is located north of the site, opposite Fifty Road.

3 Environmental Impacts and Proposed Management

3.1 Inland Waters

3.1.1 Potential Impacts

The site is located within the Swan Coastal Plain Catchment of the Peel Inlet – Harvey Estuary, which has a history of poor water quality. When compared to the site's historical land uses, future residential development is anticipated to result in substantially reduced nutrient export levels, consistent with the objectives of the Peel Harvey EPP.

3.1.2 Proposed Management

The site's prolonged historical use as a market garden and poultry farm (> 30 years) has led to significantly elevated nutrient export levels from the site, as evidenced by testing undertaken as part of the site's Preliminary Site Investigation (Western Environmental 2022a). Noting that future residential development of the site will include a reticulated sewer system, it is anticipated that the potential for nutrient export to the receiving environment will be greatly reduced, consistent with the objectives of the Peel Harvey EPP.

To further address both nutrient and broader water management at the site, a dedicated LWMS has been developed (DEC 2023). The LWMS builds upon the existing Spires Phase 2 LWMS, and holistically addresses water management for the future urban residential development of Lots 2, 3, 9001, 9003 and 9501. Water quality management actions developed as part of the Spires Phase 2 LWMS, and which have been successfully implemented across the broader LSP area, have been proposed as a part of this LWMS also. These include:

- The planting of native vegetation in drainage basins to prevent erosion, maintain soil infiltration as well as to remove particulate and soluble pollutants, particularly nitrogen.
- Implementation of non-structural controls, including public awareness, community education, and the establishment of operational and maintenance activities
- Infiltration of stormwater as close to source as possible to mimic pre-development infiltration conditions
- Minimum separation distances of drainage basins to groundwater levels
- An absence of sub-soil drainage systems to minimise soil disturbance and maximise groundwater separation distances.

3.2 Vegetation and Flora

3.2.1 Potential Impacts

Implementation of the proposed development will necessitate the removal of planted native and non-native trees from the site. Construction activities have the potential to cause indirect impacts to adjacent, retained vegetation and priority flora, via dust emissions only.

3.2.2 Proposed Management

No conservation significant flora or vegetation will be cleared to facilitate the proposed development. Clearing boundaries are currently demarcated by existing roads, which will ensure that proximal vegetation will not be incidentally cleared. Potential indirect impacts to proximal flora and vegetation during the course of construction will be minimised as far as practicable through the implementation of dust minimisation strategies, which may include water carts being available for use on-site, works being limited to times of lesser wind conditions, and the temporary installation of perimeter fencing. It should be noted however that vegetation to the west of the site has been identified for future urban residential development.

Opportunities for the retention of native trees in streetscaping and Public Open Space (POS) will be explored as part of detailed landscaping design undertaken to support future subdivision applications. Planting of native species, which will ultimately lead to an expansion and diversification of flora and vegetation within the site, will also be explored as part of this process.

There are not anticipated to be any significant impacts to flora and vegetation as a result of the proposed development, on this basis.

3.3 Fauna and Habitat

3.3.1 Potential Impacts

Implementation of the proposed development will necessitate the removal of up to 39 potential habitat trees for black cockatoos, the vast majority of which (29) are non-native, and none of which contain hollows suitable for breeding. No other faunal impacts are anticipated as a result of the proposed development.

3.3.2 Proposed Management

Based on the absence of roosting habitat and breeding hollows within the site, impacts to fauna are anticipated to be limited to the partial removal of very poor foraging habitat for black cockatoos, and some significant trees, only. Despite the majority of significant trees being non-native, opportunities for their retention in streetscaping and POS will be explored as part of detailed landscaping design.

To further minimise potential impacts to fauna during clearing and construction activities, the following management strategies are proposed:

- Prior to clearing, significant trees identified for retention will be clearly fenced to reduce the risk of incidental impact
- Loud noises (e.g. air horns) will be made just prior to commencement of clearing
- If any injured or distressed fauna are encountered during site works the site supervisor (or similar) will be instructed to immediately contact the DBCA Wildcare Helpline on 9474 9055

3.4 Other Matters

3.4.1 Acid Sulphate Soils

The DWER guideline *Identification and investigation of acid sulfate soils and acidic landscapes* (DER 2015) identifies a number of scenarios which would trigger the requirement for an ASS investigation. These are listed in Table 1, with comments provided relevant to proposed development of the site.

Table 1: ASS Investigation Trigger Criteria Assessment

Criteria	Comment
Acid sulfate soil disturbing subdivision or development that is subject to conditional approval requiring the investigation and management of acid sulfate soils	No approvals are in place at this time.
Soil or sediment disturbance of 100m^3 or more in an area depicted on an ASS risk map as Class I 'high to moderate risk of ASS occurring within 3m of natural soil surface' (e.g., construction of roads, foundations, installation of underground infrastructure, drainage works, land forming works, dams and aquaculture ponds or sand or gravel extraction)	The site is not located within a high to moderate (Class I) ASS risk area

Criteria	Comment
Soil or sediment disturbance of 100m^3 or more with excavation from below the natural water table in an area depicted on an ASS risk map as Class II 'moderate to low risk of ASS occurring within 3m of natural soil surface but high to moderate risk of ASS beyond 3m of natural soil surface'	To be assessed as a part of the subdivision design and construction planning phase.
Lowering of the water table, whether temporary or permanent (e.g., for groundwater abstraction, dewatering, installation of new drainage, modification to existing drainage), in areas depicted in an ASS risk map as Class I 'high to moderate risk of AASS or PASS occurrence' or Class II 'moderate to low risk of AASS or PASS occurrence within 3m of natural soil surface'	To be assessed as a part of the subdivision design and construction planning phase.
Any dredging operations	No dredging is proposed.
Extractive industry works (e.g., mineral sand mining) in any of the areas listed in Table 1	No extractive industries works are proposed.
Flood mitigation works, including construction of levees and flood gates, in any of the areas listed in Table 1	No flood mitigation works are proposed.

Based on the above, further assessment of the potential need for an ASS investigation will be undertaken at the subdivision design and construction planning stage of the project. This approach is consistent with DWER requirements and potential investigation triggers.

4 Conclusion

The site is predominately cleared, with only isolated native and non-native planted trees remaining, none of which are considered to be conservation significant. Implementation of the proposed development is considered to be consistent with the objectives of the North Baldivis DSP.

Post development nutrient export levels are anticipated to be greatly reduced when compared to those associated with the site's historic land uses. Additional management actions proposed within a dedicated LWMS will ensure that the objectives of the Peel Harvey EPP will be met.

Potential direct and indirect impacts to flora and vegetation will be mitigated through the retention of significant trees in POS and streetscaping, and the implementation of dust minimisation measures as required. Detailed landscaping design is anticipated to provide an avenue for the expansion and enhancement of flora and vegetation values within the site, predominately through the planting of native species.

The retention of significance trees and planting of native species throughout the development area will also mitigate potential impacts to native fauna, particularly black cockatoos. Additional clearing controls will be implemented during the construction phases of development to further mitigate potential impacts to native fauna, during this time.

In summary, development of the site as propsed has not been identified to result in any unacceptable environmental impacts. Any potential direct or indirect impacts associated with its implementation can be appropriately managed and mitigated, as development progresses.

5 References

Coterra Environment (2012). *The Spires Phase 2: Local Water Management Strategy.* Prepared for Spatial Property Group.

Department of the Environment and Energy (DoEE) (2019). *Approved Conservation Advice (incorporating listing advice) for the Tuart* (Eucalyptus gomphocephala) *woodlands and forests of the Swan Coastal Plain ecological community*. Canberra

Department of Water (DoW) (2008). *Better Urban Water Management.* Western Australian Planning Commission.

Development Engineering Consultants (DEC) (2023). Lot 3 Baldivis Road, Baldivis: *Local Water Management Strategy*. Report prepared for Spatial Property Group.

Environmental Protection Authority (EPA) (2015). *Perth and Peel @ 3.5 Million: Environmental impacts, risks and remedies*, Perth, Western Australia

Government of Western Australia. (GoWA) 2019b. *2018 South West Vegetation Complex Statistics*. Current as of 30 April 2019. WA Department of Biodiversity, Conservation and Attractions, Perth, Western Australia. https://catalogue.data.wa.gov.au/dataset/dbca

Gozzard, J.R. 1986. *Rockingham Part Sheets 2033 III and 2033 II.* Perth Metropolitan Region Environmental Geology Series, Geological Survey of Western Australia.

Harewood, G. (2023). *Black Cockatoo Habitat Assessment: Lot 3 (#392) Baldivis Road, Baldivis.* Report prepared for Coterra Environment

JBS&G (2023). *Lot 3 Baldivis Road, Baldivis: Bushfire Management Plan.* Report prepared for Spatial Property Group

Landgate (2023). *Shared Land Information Platform (SLIP) – Locate V5.* Available via https://maps.slip.wa.gov.au/landgate/locate/. Government of Western Australia, Perth Western Australia.

Western Environmental (2022a). *Lot 3 Baldivis Road, Baldivis: Preliminary Site Investigation.* Report prepared for Spatial Property Group.

Western Environmental (2022b). *Lot 3 Baldivis Road, Baldivis: Sampling Analysis and Quality Plan.* Report prepared for Spatial Property Group.

Figures

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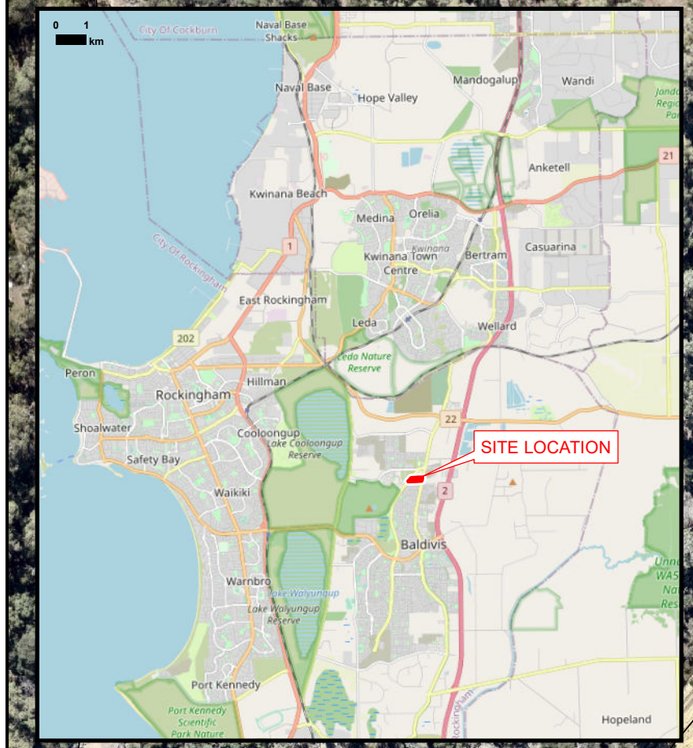

LEGEND

Site Boundary

Cadastre

N

0 5 10 20 30 40 m

Scale: 1:1,500 @ A3

GDA 1994 MGA Zone 50

Everest Wy

Baldivis Rd

Rialto Wy

Galata Av

Nairn Dr

Source: Cadastre - Landgate
Orthophoto - Nearmaps, 29.04.23

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Spatial Property Group
ENVIRONMENTAL ASSESSMENT REPORT
LOT 3 BALDIVIS ROAD, BALDIVIS

REGIONAL LOCATION

Figure 1

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LEGEND

- Site Boundary
- Cadastre
- Contour (mAHD)

Geology

- LS1: LIMESTONE - pale yellowish brown, fine to coarse-grained, sub-angular to well rounded, quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin.
- M4: SILT - very pale brown silt, soft when moist, firm when dry, low clay content, of alluvial origin.
- S8: SAND - very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted, of eolian origin as relatively thin veneer over C2, M4 and Mc2.

N

0 10 20 40 60 80 m

Scale: 1:1,500 @ A3
GDA 1994 MGA Zone 50

Source: Contours - DWER
Cadastre - Landgate, 2023
Orthophoto - Nearmaps, 29.04.23
Geology - DoIR: Geological Survey of W.A., 1999

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Spatial Property Group
ENVIRONMENTAL ASSESSMENT REPORT
LOT 3 BALDIVIS ROAD, BALDIVIS

TOPOGRAPHY AND SOILS

Figure 2

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LEGEND

Site Boundary

Cadastre

Acid Sulfate Soil Risk

Moderate to Low Risk

N

0 12.5 25 50 75 100 m

Scale: 1:2,000 @ A3

GDA 1994 MGA Zone 50

Everest Wy

Baldivis Rd

Cobu

Japoon Vsta

Rialto Wy

Paparone Rd

Nairn Dr

Edmonton

Galata Av

Georgia Wy

Rd

Maryland Wy

Idalia St

Source: ASS - DWER
Cadastre - Landgate, 2023
Orthophoto - Nearmaps, 29.04.23

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ENVIRONMENTAL ASSESSMENT REPORT
LOT 3 BALDIVIS ROAD, BALDIVIS

ACID SULFATE SOILS

Figure 3

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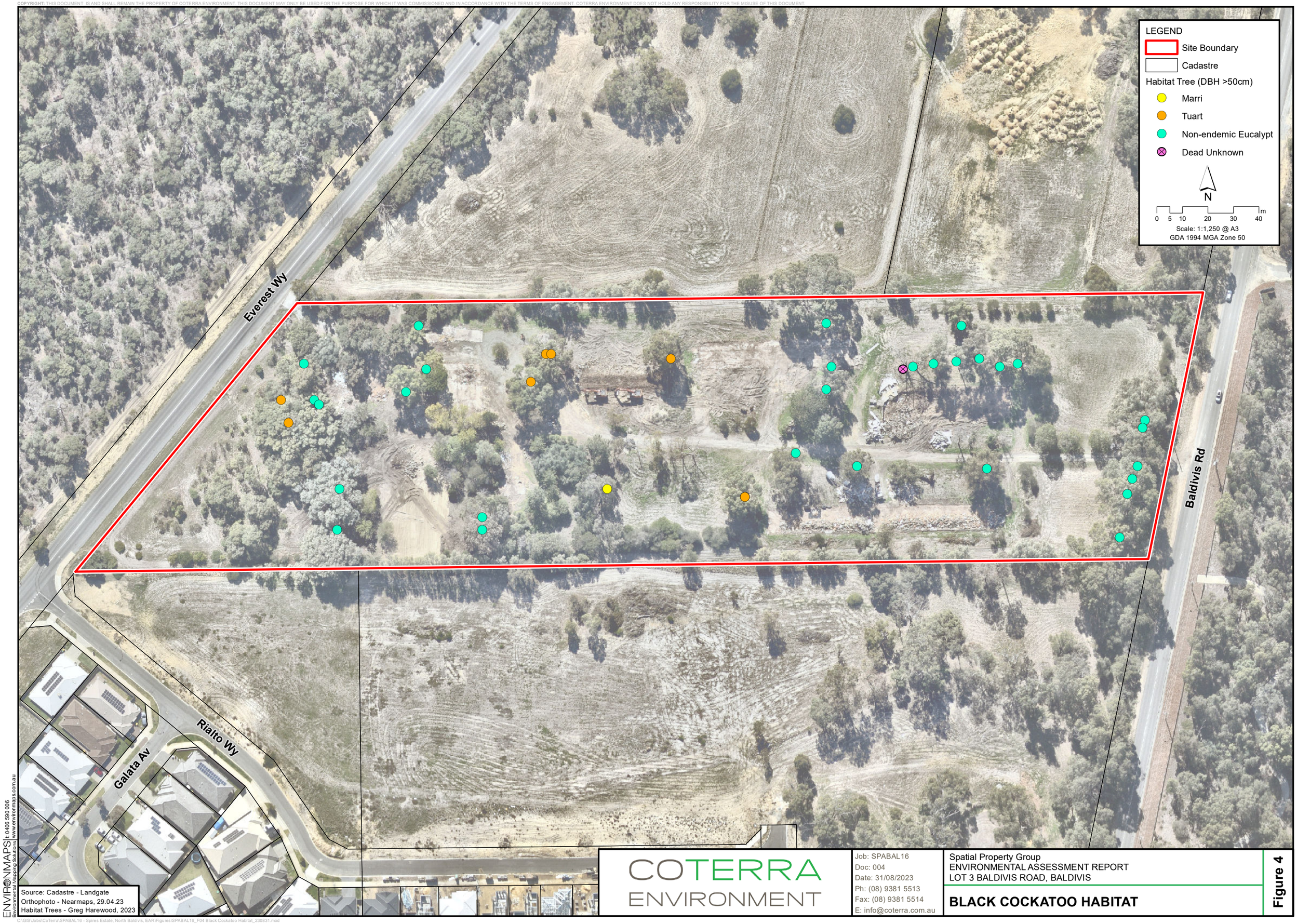

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ENVIRONMENTAL ASSESSMENT REPORT
LOT 3 BALDIVIS ROAD, BALDIVIS

BLACK COCKATOO HABITAT

Figure 4

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Appendix 1 Database Search Results

DBCA Naturemap database and Protected Matters Search Tool search results (August 2023). CD: Conservation Dependant. CR: Critically Endangered. EN: Endangered. OS: Other Specially Protected. V: Vulnerable. P: Priority

Taxon	Common Name	Class	WA status	EPBC status
Tringa nebularia	Common greenshank	BIRD	MI	MI
Actitis hypoleucos	Common Sandpiper	BIRD	MI	MI
Oxyura australis	Blue-billed duck	BIRD	P4	
Hydroprogne caspia	Caspian Tern	BIRD	MI	MI
Plegadis falcinellus	Glossy ibis	BIRD	MI	MI
Calidris acuminata	Sharp-tailed sandpiper	BIRD	MI	MI
Calidris ferruginea	Curlew Sandpiper	BIRD	CR	MI
Calidris subminuta	Long-toed Stint	BIRD	MI	MI
Tringa stagnatilis	Marsh sandpiper	BIRD	MI	MI
Tringa glareola	Wood sandpiper	BIRD	MI	MI
Thalasseus bergii	Crested tern	BIRD	MI	MI
Calidris ruficollis	Red-necked stint	BIRD	MI	MI
Calyptorhynchus latirostris	Carnaby's cockatoo	BIRD	EN	EN
Arenaria interpres	Ruddy turnstone	BIRD	MI	MI
Falco peregrinus	Peregrine falcon	BIRD	OS	
Apus pacificus	Fork-tailed swift	BIRD	MI	MI
Limosa lapponica	Bar-tailed godwit	BIRD	MI	MI
Calidris tenuirostris	Great knot	BIRD	CR	MI
Calidris alba	sanderling	BIRD	MI	MI
Phascogale tapoatafa wambenger	South-western brush-tailed phascogale, wambenger	MAMMAL	CD	
Isoodon fusciventer	Quenda, southwestern brown bandicoot	MAMMAL	P4	
Synemon gratiosa	Graceful sunmoth	INVERTEBRATE	P4	
Westralunio carteri	Carter's freshwater mussel	INVERTEBRATE	VU	VU
Calyptorhynchus banksii naso	Forest red-tailed black cockatoo	BIRD	VU	VU
Lerista lineata	Perth slider, lined skink	REPTILE	P3	
Neelaps calonotos	Black-striped snake, black-striped burrowing snake	REPTILE	P3	
Dasyurus geoffroii	chuditch, western quoll	MAMMAL	VU	VU
Thinornis rubricollis	hooded plover, hooded dotterel	BIRD	P4	
Notamacropus irma	western brush wallaby	MAMMAL	P4	
Numenius madagascariensis	eastern curlew	BIRD	CR	CR & MI
Ixobrychus dubius	Australian little bittern	BIRD	P4	
Calyptorhynchus baudinii	Baudin's cockatoo	BIRD	EN	EN
Carcharodon carcharias	great white shark	FISH	VU	VU & MI

Taxon	Common Name	Class	WA status	EPBC status
Macronectes halli	northern giant petrel	BIRD	MI	VU & MI
Hydromys chrysogaster	water-rat, rakali	MAMMAL	P4	
Ctenotus gemmula (Swan Coastal Plain population)	jewelled southwest Ctenotus (Swan Coastal Plain population)	REPTILE	P3	
Calyptorhynchus sp. 'white-tailed black cockatoo'	white-tailed black cockatoo	BIRD	EN	
Chelonia mydas	green turtle	REPTILE	VU	VU & MI
Caretta caretta	loggerhead turtle	REPTILE	EN	EN & MI
Idiosoma sigillatum	Swan Coastal Plain shield-backed trapdoor spider	INVERTEBRATE	P3	

Appendix 2 Harewood, G. (2023). Black Cockatoo habitat assessment.

Black Cockatoo Habitat Assessment

Lot 3 (#392) Baldivis Road

Baldivis

August 2023

V1

On behalf of:
Coterra Environment
Level 3, 25 Prowse Street
WEST PERTH WA 6005

Prepared by:
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SUMMARY

This report details the results of a black cockatoo habitat assessment over Lot 3 (#392) Baldivis Road, Baldivis (the survey area). The survey area covers about 4 hectares and is mostly comprised of grassland/bare sand with scattered/groves of planted non-endemic/exotic/native trees and shrubs (Figure 1).

The proponent is proposing to subdivide the existing lots into a number of smaller lots and therefore the removal/modification of habitats potentially in use by native fauna will possibly be required. The potential loss/modification of existing black cockatoo habitat has been identified as one possible issue.

The assessment reported on here has primarily been carried out to provide information that will be used to determine the scale of any impacts that may occur to black cockatoo habitat when the proposed works are undertaken.

The fauna assessment was carried out on 15 July 2023 by Greg Harewood (Zoologist).

Key Findings

- The entire survey area has been subject to considerable historical disturbance with the Lot now consisting of a mosaic of scattered/small groves of trees and shrubs with considerable expanses of totally cleared grassland/sand areas. The vegetation remaining is dominated by planted non-endemic/exotic trees and shrubs with a small number of planted native trees and shrubs. A number of buildings previously present in the survey area have recently been demolished and removed.

- Given the complex mosaic nature of the vegetation present the survey area has, for the purpose of this assessment, been place into one broad habitat type – Cleared with scattered/groves of planted trees/shrubs over grassland.

- The assessment identified a total of 39 trees within the survey area with a DBH of >50cm. None of the trees within the survey area appear to contain hollows, a consequence of their relatively young age with most having been planted less than 50 or 60 years ago.

- The survey area has been assessed as being of low foraging value to all three species of black cockatoo (total score of 1 out of 10). The low foraging value score can be attributed to the limited extent of intact native vegetation and the paucity/absence of preferred foraging species.

- No evidence of black cockatoos roosting within trees located within the survey area was observed during the survey period.

- No evidence of any fauna species of conservation significance utilising the survey area was recorded. The highly degraded nature of the habitats present suggests that it is unlikely that any fauna species of conservation significance would be present and/or rely on the site to a degree that development of the survey area, at any scale, would result in significant impact on their overall status.

1. INTRODUCTION

This report details the results of a black cockatoo habitat assessment over Lot 3 (#392) Baldivis Road, Baldivis (the survey area - Figure 1). The survey area has a total extent of about 4.0 hectares (ha).

The proponent is proposing to subdivide the existing lot into a number of smaller lots and therefore the removal/modification of habitats potentially in use by native fauna will possibly be required. The potential loss/modification of existing black cockatoo habitat has been identified as one possible issue.

The assessment reported on here has primarily been carried out to provide information that will be used to determine the scale of any impacts that may occur to black cockatoo habitat when the proposed works are undertaken.

2. SCOPE OF WORKS

The scope of works was to conduct a targeted survey for black cockatoo habitat. An assessment of the potential for other fauna species of conservation significance to be present was also required. The assessment has therefore involved:

1. Targeted searches for black cockatoo habitat/site use (habitat trees, existing and potential nest hollows, foraging and roosting habitat);

2. Evidence of the presence or likely presence of other fauna species of conservation significance (or suitable habitat) was also searched for and recorded concurrent with the primary site survey.

3. Report for summarising methods and results.

Note: For the purposes of this proposal the term black cockatoo is in reference to Baudin's cockatoo *Zanda baudinii (BBC)*, Carnaby's cockatoo *Zanda latirostris (CBC)* and the forest red-tailed black cockatoo *Calyptorhynchus banksii naso (FRTBC).*

3. METHODS

The field component of the fauna assessment was carried out on the 15 July 2023. All survey work and reporting has been carried out by Greg Harewood (Zoologist).

3.1 FAUNA HABITAT ASSESSMENT

Vegetation units, landforms and soils observed during the site reconnaissance survey have been used to define broad fauna habitat types across the survey area.

The main objective of the assessment was to determine if it were likely that species of conservation significance would utilise the habitats identified as occurring within the survey area based on their documented habitat preference and current known distribution.

3.2 BLACK COCKATOO HABITAT ASSESSMENT

The following methods were employed to comply with the defined scope of works and are based on Commonwealth of Australia (2012 and 2022) guidelines which state that surveys for Carnaby's, Baudin's and forest red-tailed black cockatoo habitat should:

- be done by a suitably qualified person with experience in vegetation or cockatoo surveys, depending on the type of survey being undertaken;
- maximise the chance of detecting the species' habitat and/or signs of use;
- determine the context of the site within the broader landscape—for example, the amount and quality of habitat nearby and in the local region (for example, within 10 km);
- account for uncertainty and error (false presence and absences); and
- include collation of existing data on known locations of breeding and feeding birds and night roost locations.

The Commonwealth of Australia (2012) places habitats used by black cockatoos into the following three categories:

- Breeding Habitat;
- Foraging Habitat; and
- Night Roosting Habitat.

3.2.1 Breeding Habitat Assessment

The black cockatoo breeding habitat assessment identified all suitable breeding tree species within the survey area that have a diameter at breast height (DBH) equal to or greater than 50cm. The DBH of each tree was estimated using a pre-made "caliper".

Target tree species included marri, jarrah, tuart and flooded gum and any other *Corymbia/Eucalyptus* species of a suitable size that was present. Peppermints, *Banksia*, sheoak and *Melaleuca* tree species (for example) were not assessed as they typically do not develop hollows used by black cockatoos.

The location of each tree identified as being over the threshold DBH will be recorded with a GPS and details on tree species, number and size of hollows (if any) noted. Trees observed to contain hollows (of any size/type) will be marked with "H" using spray paint.

Hollow/potential hollows were placed into one of four categories, based on the size of the apparent hollow entrance, these being:

- Small = ~<5cm diameter (i.e. entrance too small for a black cockatoo);
- Medium = ~5cm-10cm diameter (i.e. entrance too small for a black cockatoo);
- Large = ~>10cm diameter (entrance large enough for a black cockatoo but hollow appears unsuitable for nesting i.e. wrong orientation, appears too small, too low or too shallow); or
- Large (cockatoo) = ~>10cm diameter (entrance and apparent hollow appears big enough and suitably sized/orientated for a black cockatoo to use for nesting).

Based on this assessment, trees present within the survey area were placed into one of four categories:

- Tree <50cm DBH or an unsuitable species (these were not assessed/recorded);
- Tree ≥50cm DBH, no hollows seen;
- Tree ≥50cm DBH, one or more hollows seen, none of which were considered suitable for black cockatoos to use for nesting; or
- Tree ≥50cm DBH, one or more hollows seen, with at least one considered suitable for black cockatoos to use for nesting.

For the purposes of this assessment, a tree containing a potential black cockatoo nest hollow was defined as:

Generally, any tree which is alive or dead that contains one or more visible hollows (cavities within the trunk or branches) or possible hollows potentially suitable for occupation by black cockatoo for the purpose of nesting/breeding. Hollows or possible hollows that had an entrance greater than about 10cm in diameter and would allow the entry of a black cockatoo into a suitably orientated and sized branch/trunk, were recorded as a "potential nest hollow".

Identified hollows, if observed, were to be examined using binoculars for evidence of actual use by black cockatoos (e.g. chewing around hollow entrance, scarring and scratch marks on trunks and branches). Details recorded included hollow size, height, type, orientation, comments on suitability and any evidence of use.

3.2.2 Foraging Habitat Assessment

Foraging habitat is represented by plant species that are known to provide a food source for black cockatoos. This can be in the form of seeds, flowers and also boring grubs that are extracted from some plant species.

In addition to the vegetation/habitat mapping, the specific plant species present that represent potential foraging habitat have been documented. The location and nature of black cockatoo foraging activity (e.g. chewed fruits around base of trees) observed during the field survey was also recorded.

Based on these observations (and other relevant information) the black cockatoo foraging value of each of the identified vegetation units present has been assessed for each of the three black cockatoo species. This information has then been used to calculate a foraging score as outlined in Appendix A.

The system used here to determine a score for foraging values for each species of black cockatoo was developed by Bamford Consulting Ecologists (BCE) to provide an objective scoring system that is practical and can be used by trained field zoologists with experience in the environments frequented by the species. The system seeks to provide data applicable to the offset assessment guide (offsets guide) developed by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for assessing black cockatoo foraging habitat which requires the calculation of a score out of 10.

The foraging value score used provides a numerical value that reflects the significance of vegetation as foraging habitat for black cockatoos. This numerical value is designed to provide information to assist in the assessment of impact significance and offset requirements by the relevant regulatory authorities. The foraging value of the vegetation depends upon the type, density and condition of trees and shrubs in an area and can be influenced by the context such as the availability of foraging habitat nearby. The BCE scoring system for value of foraging habitat has three components as detailed below. These three components are drawn from the DCCEEW offsets guide but the scoring approach was developed by BCE and includes a fourth (moderation) component (BCE 2020).

Calculating the total score (out of 10) requires the following steps:

- Site Condition: Determining a score out of six for the vegetation composition, condition and structure;
- Site Context: Determining a score out of three for the context of the site;
- Species Stocking Rate: Determining a score out of one for species density; and.
- Moderation: Determining the total score out of 10, which may require moderation for context and species density with respect to the site condition (vegetation) score.

Foraging value can thus be assigned a score out of six, based upon site vegetation characteristics, or a score out of 10 if context and species density are also considered. The score out of 10 is calculated only for vegetation of at least Low to Moderate foraging value (vegetation characteristics score of ≥3). Vegetation with No, Negligible or Low foraging value is effectively assigned context and species density scores of ‘0’ because the context and species density are of little relevance if the vegetation does not support regular foraging by the birds. Foraging value scores are calculated differently for the three black-cockatoo species depending upon the vegetation present (BCE 2020).

Calculation of scores and the moderation process are described in Appendix A.

3.2.3 Night Roosting Habitat Assessment

Direct and indirect evidence of black cockatoos roosting within trees on site was noted where observed (e.g. branch clippings, droppings or moulted feathers).

3.3 OTHER FAUNA SPECIES OF CONSERVATION SIGNIFICANCE

Evidence of the presence or likely presence of fauna species of conservation significance (or suitable habitat) was searched for and recorded concurrent with other site surveys. Opportunistic observations of all fauna species were made during all field survey work and recorded where positive species identifications were made.

This aspect of the assessment included but was not limited to:

- Undertaking a series of transects across the survey area.
- Searching for evidence (i.e. individuals, tracks, scats, calls) of potential conservation significant species under logs, rocks and leaf litter.
- Observing bird species with binoculars.

4. SURVEY LIMITATIONS

No seasonal sampling was carried out as part of this fauna assessment. The conclusions presented are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of the field assessments. It should be recognised that site conditions can change with time.

Lack of observational data on some species should also not necessarily be taken as an indication that a species is absent from the site or does not utilise it for some purpose at times.

During the survey, habitat trees with hollows were searched for. It should be noted that identifying hollows suitable for fauna species from ground level has limitations. Generally, the full characteristics of any hollow seen are not fully evident (e.g. internal dimensions). It is also difficult to locate all hollows within all trees as some are not observable from ground level.

The location of observations was recorded using a handheld GPS. The accuracy of the GPS cannot be guaranteed above a level of about 5 to 10 metres, though it should be noted that in some circumstance the accuracy can increase or decrease beyond this range.

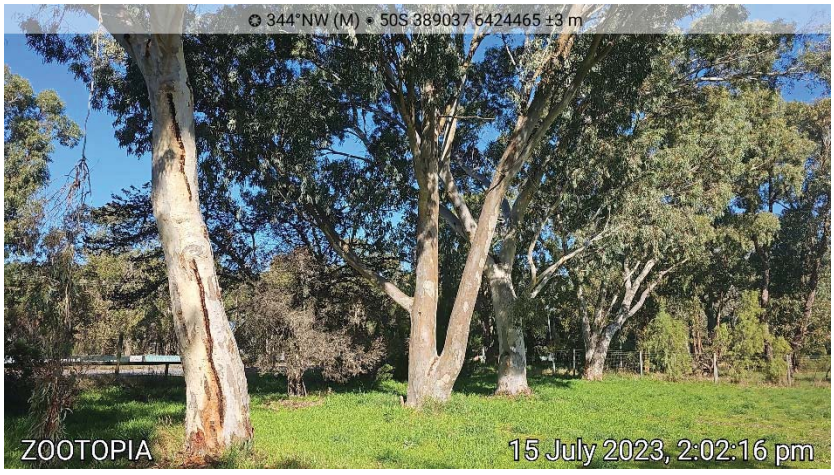
5. RESULTS

5.1 FAUNA HABITAT ASSESSMENT

The entire survey area has been subject to considerable historical disturbance with the Lot now consisting of a mosaic of scattered/small groves of trees and shrubs with considerable expanses of totally cleared grassland areas. The vegetation remaining is dominated by planted non-endemic/exotic trees and shrubs with a small number of planted native trees and shrubs. A number of buildings previously present in the survey area have recently been demolished and removed.

Given the complex mosaic nature of the vegetation present the survey area has, for the purpose of this assessment, been place into one broad habitat type – Cleared with scattered/groves of planted trees/shrubs over grassland. Example images of the various fauna habitats present are provided in Table 1.

Table 1: Example images of the fauna habitats within the survey area.

Fauna Habitat Description	Example Images
Planted non-endemic Eucalypts.	
Planted non-endemic shrubs and exotic trees (*Pinus* spp.)	

Fauna Habitat Description	Example Images
Planted sheoak (*Allocasuarina* spp.) and non-endemic eucalypts.	
Planted tuart (*E.gomphocephala*) trees	

5.2 BLACK COCKATOO HABITAT ASSESSMENT

5.3 Breeding Habitat Assessment

Trees considered potentially suitable for black cockatoos to use as nesting habitat (subject to a suitable hollow being present and other factors) found within the survey area comprised the following species:

- Non-Endemic Eucalypts – *Eucalyptus* spp. (planted - several unidentified species);
- Marri – *Corymbia calophylla* (planted);
- Tuart – *Eucalyptus gomphocephala* (planted); and
- Dead Unknown – *Eucalyptus spp.*

A summary of the habitat trees observed is provided in Table 2. The locations of habitat trees are shown in Figure 2.

Table 2: Summary of potential habitat trees (DBH ≥50cm) recorded.

Total Number of Habitat Trees (DBH > 50cm)	Number of Habitat Trees with No Hollows Observed	Number of Habitat Trees with Possible Hollows considered Unsuitable for Black Cockatoos	Number of Habitat Trees with Possible Hollows considered Potentially suitable for Black Cockatoos	Tree Species			
				Non-endemic Eucalypt	Marri	Tuart	Dead Unknown
39	39	0	0	29	1	8	1

The assessment identified a total of 39 trees within the survey area with a DBH of >50cm.

None of the trees within the survey area appear to contain hollows, a consequence of their relatively young age with most having been planted less than 50 or 60 years ago.

Additional details on each habitat tree observed can be found in Appendix B.

5.3.1 Foraging Habitat Assessment

The following flora species, known to be or potentially used as a direct food source (e.g. seeds, flowers, nectar, bark or grubs) by one or more species of black cockatoo were recorded within the survey area:

- Non-Endemic Eucalypts – *Eucalyptus* spp. (planted - several unidentified species);
- Marri – *Corymbia calophylla* (planted);
- Tuart – *Eucalyptus gomphocephala* (planted);
- Pine – *Pinus* spp. (planted);
- Sheoak - *Allocasuarina* spp. (planted); and
- Peppermint – *Agonis flexuosa* (planted).

It should be noted that most of the above-mentioned species (e.g. all small fruited eucalypts such a tuart, and several non-endemic eucalypt species in addition to peppermint) while foraged upon on occasions would make up only a small proportion of any one bird's diet relative to more favoured plant species (e.g. marri). Marri itself is only represented by a single specimen and therefore also does not contribute to the overall foraging resource to a significant degree.

No foraging debris/activity attributed to black cockatoos was located within the survey area during the survey period.

The foraging values of the single identified vegetation/habitat unit for each black cockatoo species is given in Table 3. The table shows foraging value based upon vegetation characteristics, with the total value including context and species density (as outlined in Appendix A).

Table 3: Foraging values of vegetation recorded for black cockatoos.

Habitat Description	Vegetation Characteristics			Site Context			Species Density			Total Score		
	CBC	BBC	FRTBC	CBC	BBC	FRTBC	CBC	BBC	FRTBC	CBC	BBC	FRTBC
Cleared with scattered/groves of planted trees/shrubs over grassland	1	1	1	0	0	0	0	0	0	**1**	**1**	**1**

Vegetation within the survey area has been assessed as being of low foraging value to all three species of black cockatoo (Total Score = 1). The low foraging value score can be attributed to the limited extent of intact native vegetation and the paucity/absence of preferred foraging species.

5.3.2 Night Roosting Habitat Assessment

No evidence of black cockatoos roosting within trees located within the survey area was observed during the survey period.

5.4 OTHER FAUNA SPECIES OF CONSERVATION SIGNIFICANCE

No evidence of any fauna species of conservation significance was recorded within the survey area during the survey period.

The highly degraded nature of the habitats present suggests that it is unlikely that any fauna species of conservation significance would be present and/or rely on the site to a degree that development of the survey area, at any scale, would result in significant impact on their overall status.

6. CONCLUSION

The fauna assessment within the survey area was primarily undertaken to document black cockatoo habitat and to determine the possible presence of other conservation significant fauna species and/or their habitat.

The entire survey area has been subject to considerable historical disturbance with the Lot now consisting of a mosaic of scattered/small groves of trees and shrubs with considerable expanses of totally cleared grassland areas. The vegetation remaining is dominated by planted non-endemic/exotic trees and shrubs with a small number of planted native trees and shrubs. Given the complex mosaic nature of the vegetation present the

survey area has, for the purpose of this assessment, been place into one broad habitat type – Cleared with scattered/groves of planted trees/shrubs over grassland.

Overall the survey area can be regarded as representing low quality black cockatoo habitat given an absence of any existing nest hollows, low value foraging habitat an a lack of any apparent roosting activity.

No evidence of any fauna species of conservation significance was recorded within the survey area during the survey period.

7. REFERENCES

Bamford Consulting Ecologists (BCE) (2020). Scoring system for the assessment of foraging value of vegetation for black-cockatoos. Revised 5th June 2020.

Commonwealth of Australia (2012). *EPBC Act* Referral guidelines for three threatened Black Cockatoo species: Carnaby's cockatoo (endangered) *Calyptorhynchus latirostris*, Baudin's cockatoo (vulnerable) *Calyptorhynchus baudinii*, Forest Red-tailed Black Cockatoo (vulnerable) *Calyptorhynchus banksii naso*.

Commonwealth of Australia (2022). Referral guideline for 3 threatened WA threatened black cockatoo species: Carnaby's cockatoo (*Zanda latirostris*), Baudin's cockatoo (*Zanda baudinii*), Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*). Department of Agriculture, Water and the Environment, Canberra.

Department of Primary Industries and Regional Development (DPIRD) Geographic Information Services (2023). Native Vegetation Extent (DPIRD-005) (Western Australia) Shapefile - https://catalogue.data.wa.gov.au/dataset/native-vegetation-extent.

Peck, A., Barrett, G. & Williams, M. (2019). The 2019 Great Cocky Count: a community-based survey for Carnaby's Black-Cockatoo *(Calyptorhynchus latirostris),* Baudin's Black-Cockatoo *(Calyptorhynchus baudinii)* and Forest Red-tailed Black-Cockatoo *(Calyptorhynchus banksii naso)*. BirdLife Australia, Floreat, Western Australia.

FIGURES

Legend

Survey Area

0 20 40 60 80 100

Metres

Fauna Survey

Lot 3 (#392) Baldivis Road
Baldivis

Survey Area Aerial Photograph

Drawn: G Harewood	
Date: 13-Aug-23	
Scale: 1:1,600	
Projection/Coordinate System: UTM/MGA Zone 50	Figure: 1

Legend

- Survey Area
- Habitat Trees - No hollows observed

0 20 40 60 80 100

Metres

Fauna Survey

Lot 3 (#392) Baldivis Road
Baldivis

Habitat Trees (DBH >50cm)

Drawn: G Harewood	
Date: 13-Aug-23	
Scale: 1:1,600	
Projection/Coordinate System: UTM/MGA Zone 50	Figure: 2

APPENDIX A

SCORING SYSTEM FOR THE ASSESSMENT OF FORAGING VALUE OF VEGETATION FOR BLACK-COCKATOOS (BCE 2020)

Scoring system for the assessment of foraging value of vegetation for Black-Cockatoos. Revised 5th June 2020

Bamford Consulting Ecologists

Introduction

Application of the Offset Assessment Guide (offsets guide) developed by the federal environment department for assessing Black-Cockatoo foraging habitat requires the calculation of a score out of 10. The following system has been developed by Bamford Consulting Ecologists (BCE) with assistance from Quessentia Consulting to provide an objective scoring system that is practical and can be used by trained field zoologists with experience in the environments frequented by the species.

The foraging value score provides a numerical value that reflects the significance of vegetation as foraging habitat for Black-Cockatoos, and this numerical value is designed to provide the information needed by the Federal Department of Agriculture, Water and the Environment (DAWE) to assess impact significance and offset requirements. The foraging value of the vegetation depends upon the type, density and condition of trees and shrubs in an area and can be influenced by the context such as the availability of foraging habitat nearby. The BCE scoring system for value of foraging habitat has three components as detailed above. These three components are drawn from the DAWE offsets guide but the scoring approach was developed by BCE and includes a fourth (moderation) component.

Calculating the total score (out of 10) requires the following steps:

A Site condition. Determining a score out of six for the vegetation composition, condition and structure; plus

B Site context. Determining a score out of three for the context of the site; plus

C Species stocking rate. Determining a score out of one for species density.

D Determining the total score out of 10, which may require moderation for context and species density with respect to the site condition (vegetation) score. Moderation also includes consideration of pine plantations as a special case for foraging value.

Calculation of scores and the moderation process are described in detail below.

A. Site condition. Vegetation composition, condition and structure scoring

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
0	No foraging value. No Proteaceae, eucalypts or other potential sources of food. Examples: • Water bodies (e.g. salt lakes, dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits) or with vegetation of no food value, such as some suburban landscapes. • Mown grass	No foraging value. No eucalypts or other potential sources of food. Examples: • Water bodies (e.g. dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).	No foraging value. No eucalypts or other potential sources of food. Examples: • Water bodies (e.g. dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).
1	Negligible to low foraging value. Examples: • Scattered specimens of known food plants but projected foliage cover of these is < 2%. This could include urban areas with scattered foraging trees; • Paddocks that are lightly vegetated with melons or other known food-source weeds (e.g. *Erodium* spp.) that represent a short-term and/or seasonal food source; • Blue Gum plantations (foraging by Carnaby's Black-Cockatoos has been reported but appears to be unusual).	Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these < 1%. This could include urban areas with scattered foraging trees.	Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these < 1%. Could include urban areas with scattered foraging trees.

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
2	Low foraging value. Examples: • Shrubland in which species of foraging value, such as shrubby banksias, have < 10% projected foliage cover; • Woodland with tree banksias 2-5% projected foliage cover; • Open eucalypt woodland/mallee of small-fruited species; • Paddocks that are densely vegetated with melons or other known food-source weeds (e.g. *Erodium* spp.) that represent a short-term and/or seasonal food source.	Low foraging value. Examples: • Woodland with scattered specimens of known food plants (e.g. Marri and Jarrah) 1-5% projected foliage cover; • Urban areas with scattered foraging trees.	Low foraging value. Examples: • Woodland with scattered specimens of known food plants (e.g. Marri, Jarrah or Sheoak) 1-5% projected foliage cover; • Urban areas with scattered food plants such as Cape Lilac, *Eucalyptus caesia* and *E. erythrocorys*.
3	Low to Moderate foraging value. Examples: • Shrubland in which species of foraging value, such as shrubby banksias, have 10-20% projected foliage cover; • Woodland with tree banksias 5-20% projected foliage cover; • Eucalypt Woodland/Mallee of small-fruited species; • Eucalypt Woodland with Marri < 10% projected foliage cover.	Low to Moderate foraging value. Examples: • Eucalypt Woodland with known food plants (especially Marri) 5-20% projected foliage cover; • Parkland-cleared Eucalypt Woodland/Forest with known food plants 10-40% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability).	Low to Moderate foraging value. Examples: • Eucalypt Woodland with known food plants (especially Marri and Jarrah) 5-20% projected foliage cover; • Parkland-cleared Eucalypt Woodland/Forest with known food plants 10-40% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability).

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
4	Moderate foraging value. Examples: • Woodland/low forest with tree banksias (of key species *B. attenuata* and *B. menziesii*) 20-40% projected foliage cover; • Kwongan/ Shrubland in which species of foraging value, such as shrubby banksias, have 20-40% projected foliage cover; • Eucalypt Woodland/Forest with Marri 20-40% projected foliage cover.	Moderate foraging value. Examples: • Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover; • Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths. • Eucalypt Woodland/Forest with diverse, healthy understorey and known food trees (especially Marri) 10-20% projected foliage cover. • Orchards with highly desirable food sources (e.g. apples, pears, some stone fruits).	Moderate foraging value. Examples: • Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover; • Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Sheoak Forest with 40-60% projected foliage cover.
5	Moderate to High foraging value. Examples: • Banksia Low Forest (of key species *B. attenuata* and *B. menziesii*) with 40-60% projected foliage cover; • Banksia Low Forest (of key species *B. attenuata* and *B. menziesii*) with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Pine plantations with trees more than 10 years old (but see pine note below in moderation section).	Moderate to High foraging value. Examples: • Marri-Jarrah Forest with 40-60% projected foliage cover; • Marri-Jarrah Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths.	Moderate to High foraging value. Examples: • Marri-Jarrah Forest with 40-60% projected foliage cover; • Marri-Jarrah Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths. • Sheoak Forest with > 60% projected foliage cover.

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
6	High foraging value. Example: • Banksia Low Forest (of key species *B. attenuata* and *B. menziesii*) with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).	High foraging value. Example: • Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).	High foraging value. Example: • Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).

Vegetation structural class terminology follows Keighery (1994).

B. Site context.

Site Context is a function of site size, availability of nearby habitat and the availability of nearby breeding areas. Site context includes consideration of connectivity, although Black-Cockatoos are very mobile and will fly across paddocks to access foraging sites. Based on BCE observations, Carnaby's are unlikely to regularly go over open ground for a distance of more than a few kilometres and prefer to follow tree-lines.

The maximum score for site context is 3, and because it is effectively a function of presence/absence of nearby breeding and the distribution of foraging habitat across the landscape, the following table, developed by Bamford Consulting in conjunction with DEE, provides a *guide* to the assignation of site context scores. Note that 'local area' is defined as within a 15 km radius of the centre point of the study site. This is greater than the maximum distance of 12km known to be flown by Carnaby's Black-Cockatoo when feeding chicks in the nest.

Site Context Score	**Percentage of the existing native vegetation within the 'local' area that the study site represents.**	
	'Local' breeding known/likely	**'Local' breeding unlikely**
3	> 5%	> 10%
2	1 - 5%	5 - 10%
1	0.1 - 1%	1 - 5%
0	< 0.1%	< 1%

The table above provides weighting for where nearby breeding is known (or suspected) and for the proportion of foraging habitat within 15km represented by the site being assessed. Some adjustments may be needed based on the judgement of the assessor and in relation to the likely function of the site. For example, a small area of foraging habitat (eg 0.5% of such habitat within 15km) could be upgraded to a context of 2 if it formed part of a critical movement corridor. In contrast, the same sized area of habitat, of the same local proportion, could be downgraded if it were so isolated that birds could never access it.

C. Species density (stocking rate).

Species stocking rate is described as "the usage and/or density of a species at a particular site" in the offsets guide. The description also implies that a site supports a discrete population, which is unlikely in the case of very mobile black-cockatoos. Assignation of the species density score (0 or 1) is based upon the black-cockatoo species being either abundant or not abundant. A score of 1 is used where the species is seen or reported regularly and/or there is abundant foraging evidence. Regularly is when the species is seen at intervals of every few days or weeks for at least several months of the year. A score of 0 is used when the species is recorded or reported very infrequently and there is little or no foraging evidence. Where information on actual presence of birds is lacking, a species density score can be assigned by interpreting the landscape and the site context. For example, a site with a moderate condition score that is part of a network of such habitat where a black-cockatoo species is

known would get a species density score of 1 even without clear presence data, while a species density score of 0 can be assigned to a site where the level of usage can confidently be predicted to be low.

D. Moderation of scores for the calculation of a value out of 10.

The calculation out of 10 requires the vegetation characteristics (out of 6) to be combined with the scores given for context and species density. It is considered that the context and density scores are not independent of vegetation characteristics; otherwise habitat of absolutely no value for black-cockatoo foraging (such as concrete or a wetland) could get a foraging score out of 10 as high as 4 if it occurred in an area where the species breed (context score of 3) and are abundant (species density score of 1). Similarly, vegetation of negligible or low characteristics which could not support black-cockatoos could be assigned a score as high as 6 out of 10. In that case, the score of 6 would be more a reflection of nearby vegetation of high characteristics than of the foraging value of the negligible to low scoring vegetation. The Black-Cockatoos would only be present because of vegetation of high characteristics, so applying the context and species density scores to vegetation of low characteristics would not give a true reflection of their foraging value.

For this reason, the context and species density scores need to be moderated for the vegetation characteristic score to prevent vegetation of little or no foraging value receiving an excessive score out of 10. A simple approach is to assign a context and species density score of zero to sites with a Condition score of low (2), negligible (1) or none (0), on the basis that birds will not use such areas unless they are adjacent to at least low-moderate quality foraging habitat ($\geq$3). The approach to calculating a score out of 10 can be summarised as follows:

vegetation composition, condition and structure score (out of 6)	context score	Species density score
3-6 (low/moderate to high value)	Assessed as per B above	Assessed as per C above
0-2 (no to low value)	0	0

Note that this moderation approach may require interpretation depending on the context. For example, vegetation with a condition score of 2 could be given a context score of 1 under special circumstances. Such as when very close to a major breeding area or if strategically located along a movement corridor.

Pine plantations

Pine plantations are an important foraging resource for Carnaby's Black-Cockatoo (only) but are not directly comparable with native vegetation. In comparing native vegetation with pine plantations for the purpose of calculating offsets, the following should be noted:

- Pine plantations are a commercial crop established with the intention of being harvested and thus have short-term availability (30-50 years), whereas native vegetation is available indefinitely if protected. Due to the temporary nature of pines as a food source, site condition and context differs between pines and native vegetation.
- Although pines provide a high abundance of food in the form of seeds, they are a limited food resource compared with native vegetation which provides seeds, insect larvae, flowers and nectar. The value of insect larvae in the diet of Carnaby's Black-Cockatoo has not been quantified, but in the vicinity of Perth, the birds forage very heavily on insect larvae in young cones of *Banksia attenuata* in winter, ignoring the seeds in these cones and seeds in older cones on the same trees (Scott and Black 1981; M. Bamford pers. obs.). This suggests that insect larvae are of high nutritional importance immediately prior to the breeding season.
- Pine plantations have very little biodiversity value other than their importance as a food source for Carnaby's Black-Cockatoos. They inhibit growth of other flora. While this is not a factor for direct consideration with respect to Carnaby's Black-Cockatoo, it is a factor in regional conservation planning of which offsets for the cockatoos are a part.

Taking the above points into consideration, it is possible to assign pine plantations a foraging value as follows:

- Site condition. The actual foraging value of pines is high. Stock *et al.* (2013) report that it takes nearly twice as many seeds of *Pinus pinaster* to meet the daily energy requirements for Carnaby's Black-Cockatoo compared with Marri, and three times as many *P. pinaster* seeds compared with Slender Banksia. However, pines are planted at a high density so the food supply per hectare can be high. Taking account of the lack of variety of food from pines, this suggests a site condition score of 4 or 5 out of 6 (5 is used in Section A above). As a source of food, pines are thus comparable to the best banksia woodland. This site condition score then needs to be adjusted to take account of the short-term nature of the food supply (for pine plantations to be harvested. Where pines are 'ornamental, such as in some urban contexts, they can be treated as with other trees in urban landscapes). The foraging value of a site after pines are harvested will effectively be 0, or possibly 1 if there is some retention. It is proposed that this should approximately halve the site condition score; young pine plantations could be redacted slightly less than old plantations on the basis that a young plantation provides a slightly longer term food supply. If a maximum site condition score of 5 is given, then a young plantation (>10 but <30 years old) could be assigned a score of 3, and an old plantation (>30 years old) could be assigned a score of 2. Plantations <10 years old and thus not producing large quantities of cones could also get a score of 2, but recognising they may increase in value.
- Site context. Although a temporary food source, pines can be very important for Carnaby's Black-Cockatoo in some contexts; they could be said to carry populations in areas where there

is little native vegetation. The system for assigning a context score as outlined above (Section B) also applies to pines. Thus, a context score of 3 can be given where pines are a significant proportion of foraging habitat (>5% if breeding occurs; >10% if no breeding), but where pines are a small part of the foraging landscape they will receive a context score of less than this.

- Species density. As outlined above (Section C), pines will receive a species density score of 1 where Carnaby's Black-Cockatoo are regular visitors. This is irrespective of an old plantation having a moderated condition score of 2.

Based on the above, pine plantations that represent a substantial part of the foraging landscape, such as in the region immediately north of Perth, would receive a total score (out of 10) of 6; young plantations in this area would receive a score of 7. In contrast, isolated and small plantations in rural landscapes could receive a score of just 2 if they are only a small proportion of foraging habitat and Carnaby's Black-Cockatoos are not regularly present.

Keighery (1994).

Scott, J. K. and Black, R. (1981). Selective Predation by White-Tailed Black Cockatoos on Fruit of *Banksia attenuata* Containing the Seed-Eating Weevil *Alphitopis nivea*. *Australian Wildlife Research* **8(2)**, 421-430.

Stock, W.D., Finn, H., Parker, J. and Dods, K. (2013). Pine as Fast Food. Foraging Ecology of an Endangered Cockatoo in a Forestry Landscape. PlosOne 8: issue 4.

APPENDIX B
HABITAT TREE DETAILS

Habitat Trees (DBH >50cm)

Waypoint Number	Zone	mE	mN	Tree Species	DBH (cm)	Tree Height (m)	Number of Hollows	Potential Cockatoo Nest Hollow
wpt001	50H	389045	6424476	Non-endemic Eucalypt	>50	20+	0	No
wpt002	50H	389044	6424473	Non-endemic Eucalypt	>50	20+	0	No
wpt003	50H	389042	6424458	Non-endemic Eucalypt	>50	20+	0	No
wpt004	50H	389040	6424453	Non-endemic Eucalypt	>50	20+	0	No
wpt005	50H	389038	6424447	Non-endemic Eucalypt	>50	20+	0	No
wpt006	50H	389035	6424430	Non-endemic Eucalypt	>50	20+	0	No
wpt007	50H	388983	6424457	Non-endemic Eucalypt	>50	15-20	0	No
wpt008	50H	388932	6424458	Non-endemic Eucalypt	>50	15-20	0	No
wpt009	50H	388908	6424463	Non-endemic Eucalypt	>50	15-20	0	No
wpt010	50H	388888	6424446	Tuart	>50	15-20	0	No
wpt011	50H	388888	6424446	Tuart	>50	15-20	0	No
wpt012	50H	388834	6424449	Marri	>50	15-20	0	No
wpt013	50H	388785	6424438	Non-endemic Eucalypt	>50	20+	0	No
wpt014	50H	388785	6424433	Non-endemic Eucalypt	>50	15-20	0	No
wpt015	50H	388728	6424433	Non-endemic Eucalypt	>50	20+	0	No
wpt016	50H	388729	6424449	Non-endemic Eucalypt	>50	20+	0	No
wpt017	50H	388709	6424475	Tuart	>50	15-20	0	No
wpt018	50H	388706	6424484	Tuart	>50	15-20	0	No
wpt019	50H	388719	6424484	Non-endemic Eucalypt	>50	20+	0	No
wpt020	50H	388721	6424482	Non-endemic Eucalypt	>50	15-20	0	No
wpt021	50H	388715	6424498	Non-endemic Eucalypt	>50	20+	0	No
wpt022	50H	388755	6424487	Non-endemic Eucalypt	>50	15-20	0	No
wpt023	50H	388763	6424496	Non-endemic Eucalypt	>50	15-20	0	No
wpt024	50H	388760	6424513	Non-endemic Eucalypt	>50	15-20	0	No
wpt025	50H	388810	6424502	Tuart	>50	15-20	0	No
wpt026	50H	388812	6424502	Tuart	>50	15-20	0	No
wpt027	50H	388804	6424491	Tuart	>50	15-20	0	No
wpt028	50H	388859	6424500	Tuart	>50	15-20	0	No
wpt029	50H	388920	6424514	Non-endemic Eucalypt	>50	20+	0	No
wpt030	50H	388922	6424497	Non-endemic Eucalypt	>50	15-20	0	No
wpt031	50H	388920	6424488	Non-endemic Eucalypt	>50	20+	0	No
wpt032	50H	388950	6424496	Dead Unknown	>50	15-20	0	No
wpt033	50H	388954	6424497	Non-endemic Eucalypt	>50	20+	0	No
wpt034	50H	388962	6424498	Non-endemic Eucalypt	>50	20+	0	No
wpt035	50H	388971	6424499	Non-endemic Eucalypt	>50	20+	0	No
wpt036	50H	388973	6424513	Non-endemic Eucalypt	>50	15-20	0	No
wpt037	50H	388980	6424500	Non-endemic Eucalypt	>50	20+	0	No
wpt038	50H	388988	6424497	Non-endemic Eucalypt	>50	20+	0	No
wpt039	50H	388995	6424498	Non-endemic Eucalypt	>50	20+	0	No

DISCLAIMER

This fauna assessment report ("the report") has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Greg Harewood ("the Author"). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints. In accordance with the scope of services, the Author has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

The conclusions are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. Also it should be recognised that site conditions, can change with time.

Within the limitations imposed by the scope of services, the field assessment and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

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The Author will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

APPENDIX 3: TRAFFIC ASSESSMENT

Technical Note: No. 1 **Date:** 21/08/2023
Project No: t23.078
Project: Spires LSP Amendment, Baldivis
Subject: Addendum to Transport Assessment (LSP Amendment)

1 Introduction

This Technical Note has been prepared as an Addendum to the Transport Assessment report dated April 2014 for The Spires Local Structure Plan (LSP) in Baldivis, in relation to a proposed Amendment to the approved LSP.

The proposed Amendment will include an additional property (Lot 3 Baldivis Road) into this LSP area. That property is anticipated to yield approximately 60 to 70 residential lots when it is subdivided, in addition to the 900 dwellings previously modelled in the approved LSP area.

2 Background

Transcore prepared a Transport Assessment report in June 2012 and a revised version in April 2014 for the Spires Estate Local Structure Plan (LSP) in the City of Rockingham. The LSP area includes various lots east and west of Everest Way (formerly Eighty Road) in Baldivis, south of Fifty Road and west of Baldivis Road, as shown in **Figure 1**.

There have been several amendments to the LSP since 2014 and a technical note was prepared by Transcore in December 2016 (our ref: t12.089-mr-tn01) to address the traffic impacts of an amendment that up-coded three residential cells from R60 to R100 within the LSP area, increasing the overall dwelling yield from 800 to 900 dwelling units.

The LSP area also includes a neighbourhood activity centre located on the western side of Nairn Drive, north of Amazon Drive.

Another technical note prepared by Transcore in November 2021 (our ref: t15185-rw-tn02a) related to another LSP Amendment that resulted in a Special Use zoning to accommodate a future tavern and bottle shop as an expansion of the neighbourhood activity centre site northwest along Amazon Drive. Upcoding of adjacent residential zoned land to higher density meant no net change in dwelling yield as a result of that previous Amendment.

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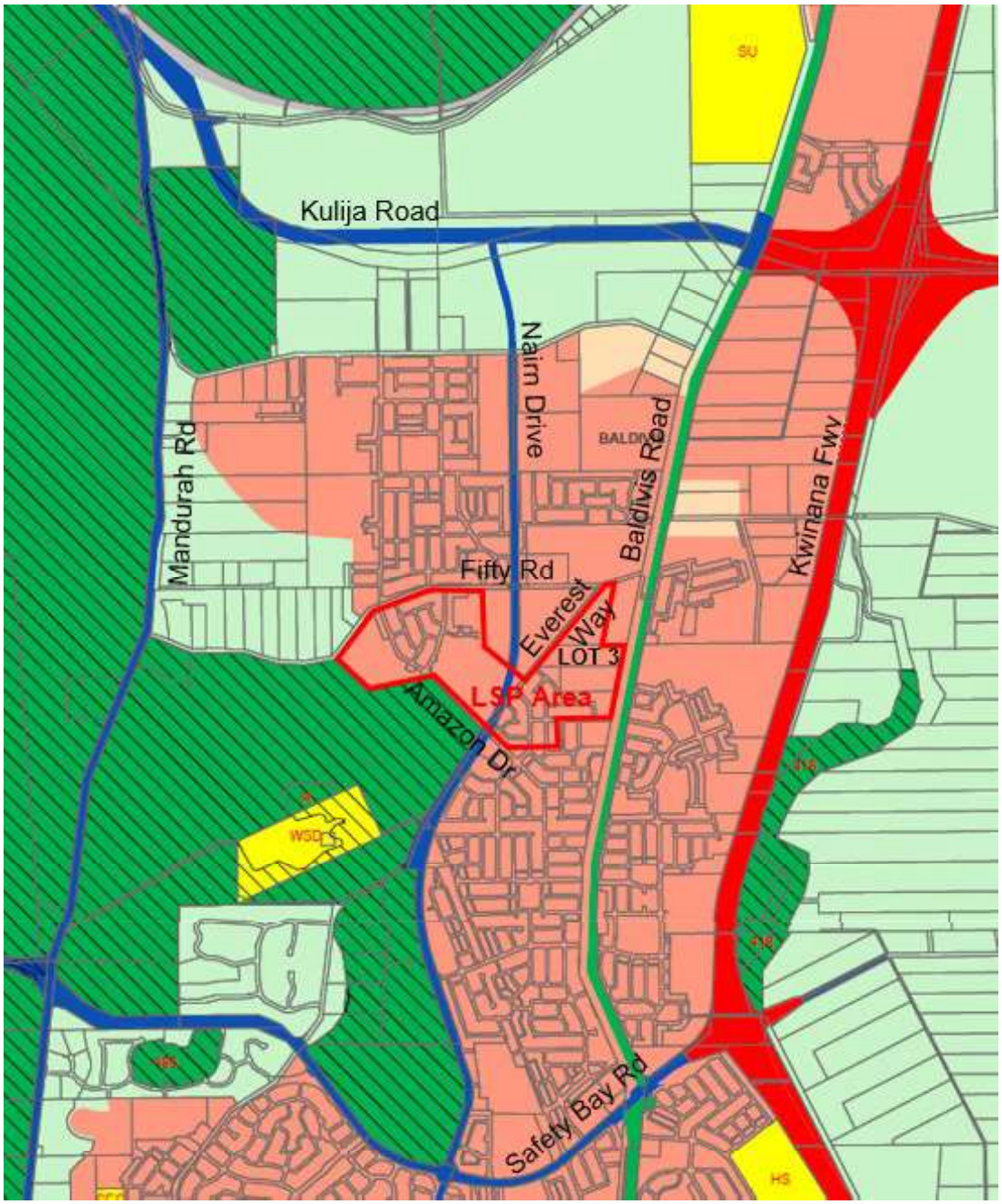


Figure 1: Proposed Amended LSP area on MRS map

3 Proposed LSP Amendment

The proposed Amendment will include an additional property (Lot 3 Baldivis Road) into this LSP area. That property is anticipated to yield approximately 60 to 70 residential lots when it is subdivided, in addition to the 900 dwellings previously modelled in the approved LSP area.

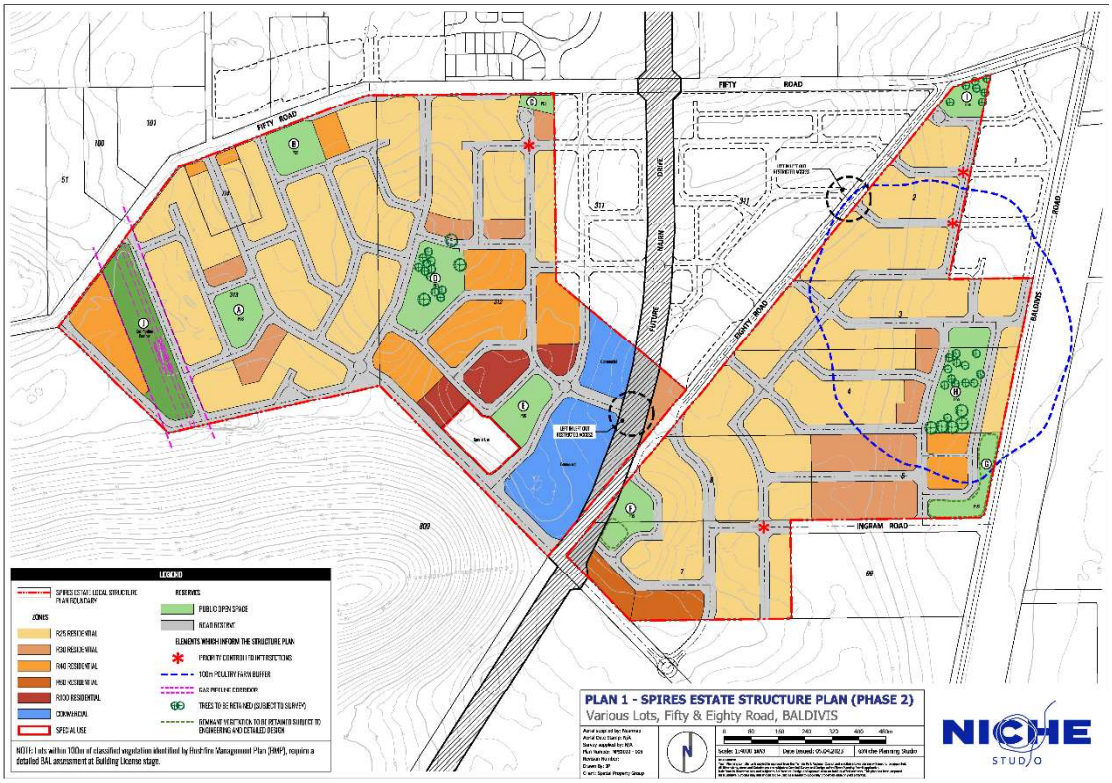


Figure 2: Spires LSP with Proposed Amendment

4 Traffic Model

Transcore has progressively developed a subregional traffic model of weekday traffic flows for future development of the Mandurah-Rockingham area using the EMME transport modelling software package. This model has been developed in more detail for various projects in the Baldivis area including this proposed LSP. The future traffic scenario modelled in this area reflects full development of the Baldivis area.

5 Traffic Generation

The daily traffic generation rate used in the LSP area and surrounding residential areas for this traffic analysis is 8 vehicle trips per day (vpd) per dwelling (i.e. 4 in / 4 out), which corresponds to AM and PM peak hour trip generation rates of 0.8vph per dwelling as recommended in the Western Australian Planning Commission (WAPC) *Transport Impact Assessment Guidelines* (2016).

The anticipated total of up to 970 dwellings in the Amended LSP area will therefore generate approximately 7,760vpd.

The abovementioned November 2021 Technical Note documented the anticipated traffic generation of the neighbourhood shopping centre in the Spires LSP as approximately 7,500 vpd (daily), with approximately 750vph in the weekday PM peak and approximately 190vph in the weekday AM peak period. The future tavern and bottle shop were estimated at approximately 1,430 vpd (daily), with approximately 174vph in the weekday PM peak (not open during the AM peak period).

6 Future Daily Traffic Volumes

The modelled future daily traffic flows in and around the LSP area are shown in **Figure 3**. This figure shows future daily traffic flows to and from the Amended LSP area and also (in brackets) the total daily traffic flows on this part of the modelled road network.

The total daily traffic flows in **Figure 3** are the same as reported in the November 2021 Technical Note because future residential development of Lot 3 was already included in the traffic model as future development outside of the LSP area. The only change is in the LSP area traffic generation because Lot 3 will now be included in the LSP area.

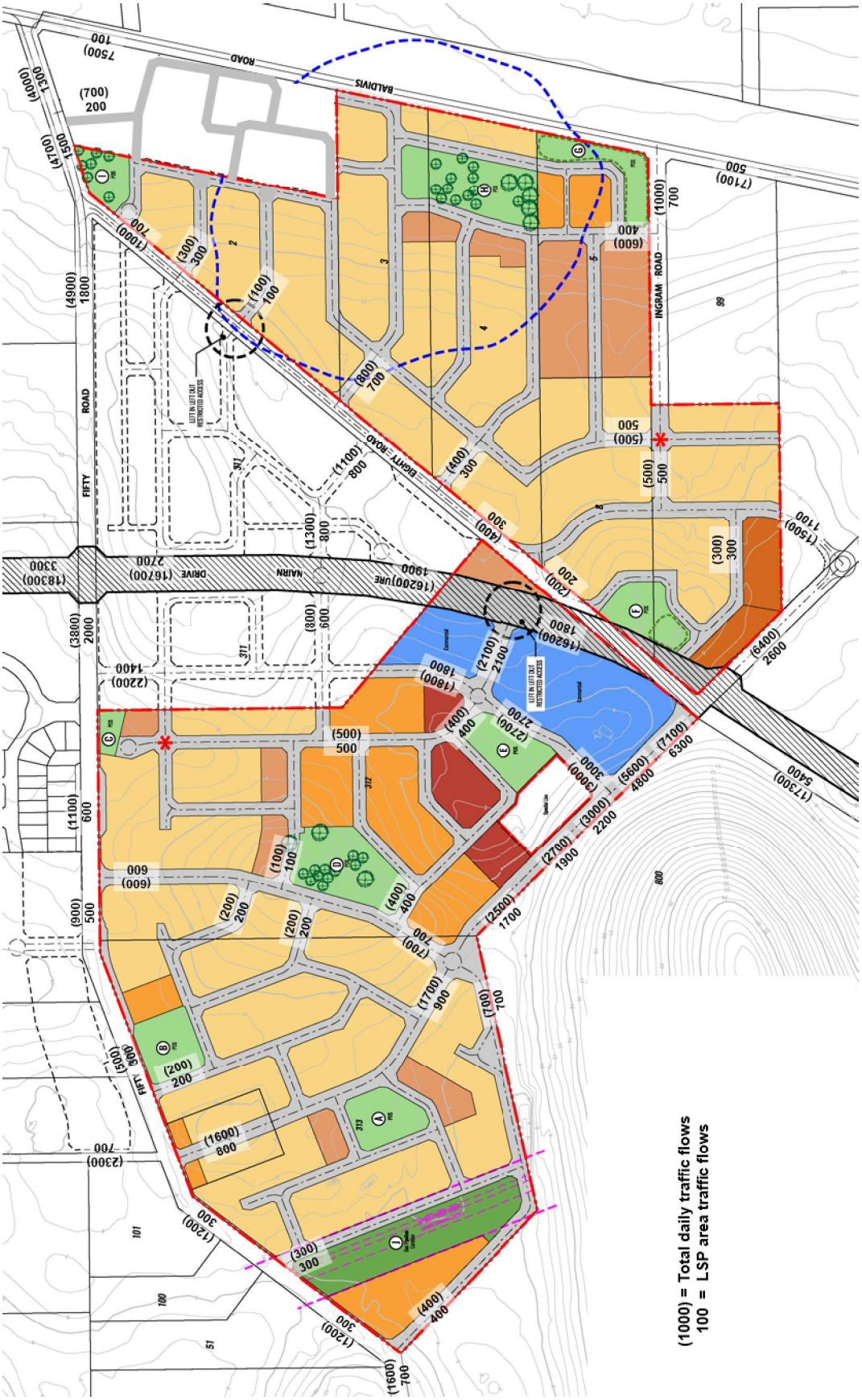


Figure 3: Future Daily Traffic Volumes with Proposed LSP Amendment

7 Roads and Intersections

All of the roads within Lot 3 are anticipated to carry future daily traffic flows of less than 1,000vpd and would be classified as Access Street D in the road hierarchy of the WAPC *Liveable Neighbourhoods* Policy.

Lot 3 will include one Access Street connection to Everest Way on the western side of this property, which will be constructed as T-intersection with Give Way sign control on that side road approach. This section of Everest Way will also carry daily traffic flows of less than 1,000vpd after the future construction of Nairn Drive through to Fifty Road, so a simple T-intersection will easily accommodate those future traffic flows.

There would be one more four-way intersection created on low-volume access streets within Lot 3, similar to other four-way intersections within the LSP area. It would be treated the same way as those other four-way access street intersections. As recommended in the 2014 LSP Transport Assessment report, "These are recommended to be constructed as priority-controlled intersections with give way signs on the minor road approaches as suggested in Liveable Neighbourhoods (LN Element 2 pages 31-33). Appropriate entry treatments will be provided on the side roads to help to alert drivers to the presence of the intersection and that traffic on the major road has priority. Existing threshold treatments on side roads crossing Amazon Drive west of Baldivis Road are a suitable example of the type of treatment that could be implemented at these 4-way intersections."

The proposed LSP Amendment does not result in any changes to the future traffic flows on the surrounding road network, so no further traffic analysis is considered to be warranted in this Technical Note.

8 Conclusions

The information presented in this Transport Assessment Addendum documents the anticipated future traffic flows generated by The Spires Local Structure Plan (LSP) in Baldivis following a proposed Amendment to the approved LSP to include an additional property (Lot 3 Baldivis Road) into this LSP area.

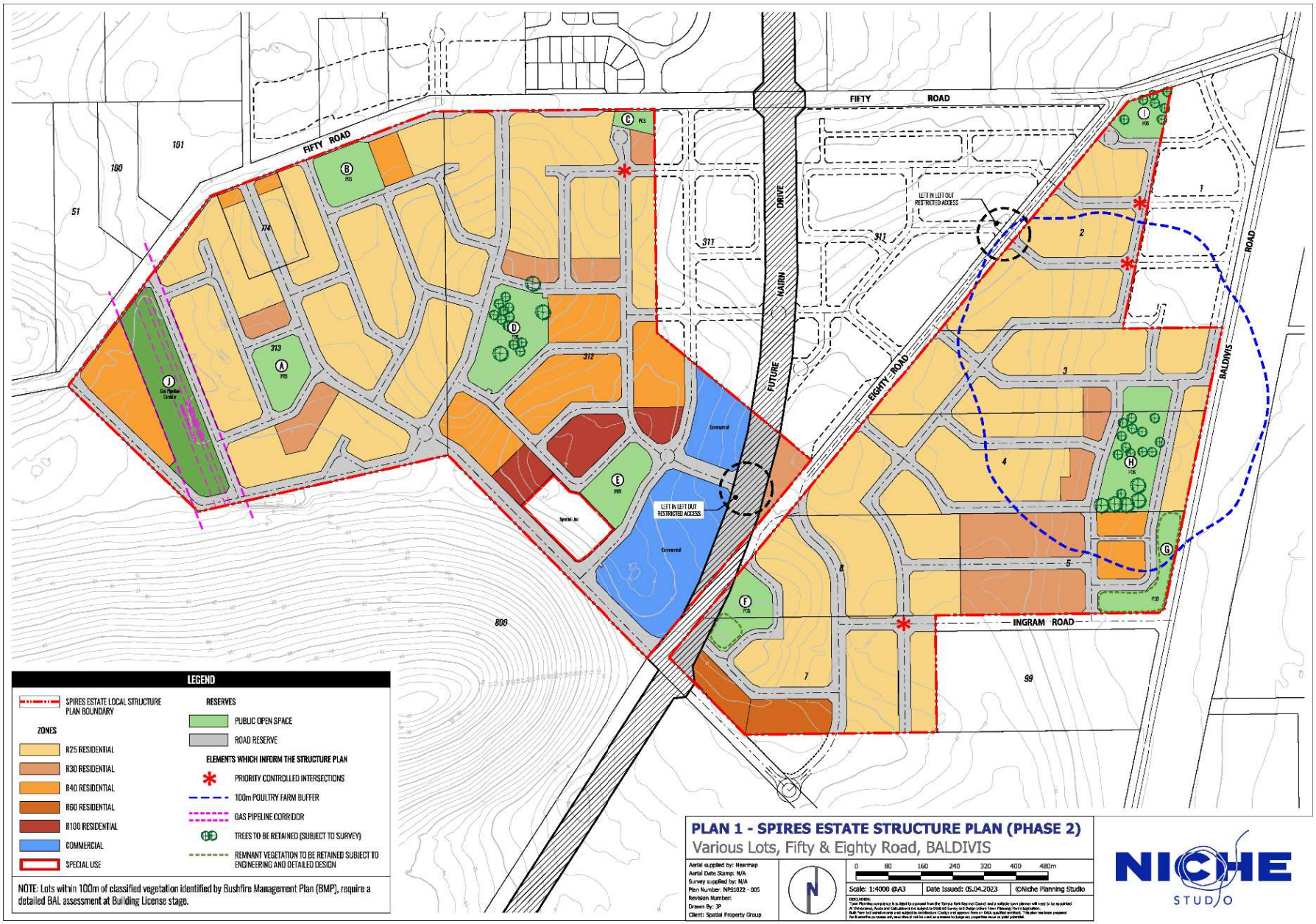
That property is anticipated to yield approximately 60 to 70 residential lots when it is subdivided, in addition to the 900 dwellings previously modelled in the approved LSP area.

This Amendment will increase the traffic generation of the LSP area by approximately 560vpd but that traffic generation was already taken into consideration in traffic modelling of future development of this area, so the proposed Amendment does not have any effect upon future total traffic volumes on the road network in this area.

Accordingly, the proposed Amendment does not require any changes to current planning for the road network and intersections in this area.

APPENDIX A

Proposed Amended LSP Plan


FIFTY ROAD
FIFTY ROAD
FUTURE NAIRN DRIVE
EIGHTY ROAD
BALDIVIS ROAD
INGRAM ROAD
LEFT IN LEFT OUT RESTRICTED ACCESS
LEFT IN LEFT OUT RESTRICTED ACCESS
Commercial
Commercial
Special Use
Gas Pipeline Corridor
LEGEND
SPIRES ESTATE LOCAL STRUCTURE PLAN BOUNDARY
ZONES
R25 RESIDENTIAL
R30 RESIDENTIAL
R40 RESIDENTIAL
R60 RESIDENTIAL
R100 RESIDENTIAL
COMMERCIAL
SPECIAL USE
RESERVES
PUBLIC OPEN SPACE
ROAD RESERVE
ELEMENTS WHICH INFORM THE STRUCTURE PLAN
PRIORITY CONTROLLED INTERSECTIONS
100m POULTRY FARM BUFFER
GAS PIPELINE CORRIDOR
TREES TO BE RETAINED (SUBJECT TO SURVEY)
REMNANT VEGETATION TO BE RETAINED SUBJECT TO ENGINEERING AND DETAILED DESIGN
NOTE: Lots within 100m of classified vegetation identified by Bushfire Management Plan (BMP), require a detailed BAL assessment at Building License stage.
PLAN 1 - SPIRES ESTATE STRUCTURE PLAN (PHASE 2)
Various Lots, Fifty & Eighty Road, BALDIVIS
Aerial supplied by: Nearmap
Aerial Date Stamp: N/A
Survey supplied by: N/A
Plan Number: NPS1022 - 005
Revision Number:
Drawn By: JP
Client: Spatial Property Group
0 80 160 240 320 400 480m
Scale: 1:4000 @A3
Date Issued: 05.04.2023
©Niche Planning Studio
NICHE STUDIO

APPENDIX 4: LOCAL WATER MANAGEMENT STRATEGY ADDENDUM

REPORT

CARCIONE NOMINEES PTY LTD
SPIRES ESTATE STRUCTURE PLAN
(PHASE 2) LOTS 9003, 9501, 3 AND 4
BALDIVIS ROAD/EVEREST WAY, BALDIVIS

LOCAL WATER MANAGEMENT STRATEGY

DECEMBER 2024

DEVELOPMENT
ENGINEERING
CONSULTANTS

Revision History:

Revision	Description	Checked	Approved	Date
0	Issued to COR and DWER for Approval	SRA	SRA	06/10/2023
1	Updated to incorporate DWER Comments	SRA	SRA	23/01/2024
2	Updated to reflect COR Comments in response to structure Plan Submission	SRA	SRA	05/08/2024
3	Updated to reflect COR Comments in response to structure plan	SRA	SRA	18/11/2024
4	Updated to reflect additional COR Comments in response to structure plan	SRA	SRA	12/12/2024
5	Updated to reflect additional COR Comments in response to structure plan	SRA	SRA	19/12/2024

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Access Street Scale 5
Allotment Scale 5
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Executive Summary

Estate Scale

- Drainage basins will be constructed in the public open spaces (POS) in the northern corner and in the southern central POS. The basins will be designed to ensure all events up to and including the 1% annual exceedance probability (AEP) storm are infiltrated on-site.
- Bio-retention of a minimum 2% connected impervious area will be installed to the bases of the basins. The 63.2% AEP event will be limited to a maximum depth of 0.5m above this base. The 20% AEP event will be retained within a lower tier basin to minimise the drainage impact on the POS.
- The 1% AEP storm will be contained within the wider POS areas additional to the lower tier of the basin.
- Maximum Groundwater levels (MGL's) have been established to be a minimum of 2.4m beneath proposed site levels, based on site measurements and long term bore records.

Access Street Scale

- All piped drainage systems will be designed to accommodate the 20% AEP event.

Allotment Scale

- All lot owners will be encouraged to install rainwater tanks plumbed into their homes for household use to assist in containing minor events on-site in lieu of soakwells.
- Information packages will be provided as part of sales documentation to all lot purchasers to: (a) fully inform residential lot owners of the requirement to provide soakage facilities to dispose of on-site drainage equivalent of 2 by 1.5m by 1.2m soakwells being some 4.24m^3 (5% AEP storm without outflow); (b) encourage the use of plumbed rainwater tanks for household use in lieu of soakwells, and bores for irrigation purposes; (c) utilise water-efficient devices and appliances throughout their homes, and; (d) maximise use of water- and nutrient-wise plants, and minimise use of lawns.

Public Open Space Areas

- The basin constructed within the POS area will be designed to fully infiltrate all runoff up to and including the 1% AEP event.

1 Introduction

This LWMS report has been prepared as a stand-alone document to support the local structure plan (LSP) for Lots 9003, 9501, 3 and 4 Baldivis Road/Everest Way.

In effect this is an addendum to "Lots 312 and 313 and lots 2, 4, 5, 7 and 8 Eighty Road Baldivis – Local Water Management Strategy", prepared by Coterra Environment in May 2013. The structure plan has been altered to reflect the amended planning for Lot 1 and the inclusion of Lot 3 which was not included in the original structure planning.

The location of the site is shown in Appendix A, together with an aerial photograph of the existing site.

The site is located between Everest Way and Baldivis Road in Baldivis, extending north from Rialto Way to Fifty Road.

1.1 Previous LWMS over this area

As part of the structure planning for "North Baldivis" an LWMS was prepared by Coterra Environment entitled "Lots 312 and 313 and Lots 2, 4, 5, 7 and 8 Eighty Road Baldivis – Local Water Management Strategy" which was approved by the Department of Water in May 2013 and the City of Rockingham (CoR) in June 2013.

The catchment plan for this site was incorporated within "Catchments 2, 3 and 4" of the LWMS. A copy of the original catchment plan is included in Appendix A of this report. The structure plan was prepared on the basis that Lots 3 and 1 were in a separate ownership arrangements, hence the catchments more or less aligned with the original cadastral boundaries. While Lot 1 is still in separate ownership and has its own drainage system, the balance of the land is controlled by the same owners hence presents opportunity for consolidation of the drainage areas. The original planning allowed for three basins being basins 2, 3 and 4 – one for each catchment.

As shown, the measured groundwater levels did not specifically cover Lot 1 but bore SP1 was immediately west of the boundary of Lot 1.

As part of the previous LWMS work, the following stormwater management measures were proposed:

Stormwater management:

- Each catchment has a dedicated infiltration basin designed to contain and infiltrate up to the 100 year ARI (1% AEP) rainfall event.
- There will be no lot drainage connections to the road drainage network. Lots will infiltrate roof runoff via on-site soakwells.
- All stormwater from the road network for up to a 20% AEP event will be conveyed via the pipe network into the basins.
- Stormwater from events greater than 20% AEP event will be conveyed into the basins as overland flow within the road reserves.
- Appropriate vegetation will be planted in all the basins to provide additional water quality treatment during infiltration.

Groundwater management:

- The minimum levels will be around RL6.30mAD and maximum recorded groundwater levels will be 4.6m AHD and no subsoils are proposed.
- Post development catchment and basin infiltration areas are in similar proximity to areas where predevelopment infiltration would have occurred.
- All proposed basin inverts are significantly greater than the 0.3m separation distance requirement from groundwater

1.2 Drainage/Water Management Principles and Design Objectives

The following water sensitive design criteria, principles and objectives are to be pursued and/or implemented as part of the proposed development:

- *Water conservation and water efficiency*

  Objective: To maximise the reuse of stormwater and minimise the use of scheme water outside of the home, and to use water as efficiently as possible both within and outside of the home.

  Deliverable: All lot purchasers will be encouraged to install rain water tanks plumbed into their homes, to use water-efficient devices and appliances throughout their homes and to plant water- and nutrient-wise gardens.

- *Water quantity management and protection of property*

  Objective: To maintain the total water cycle balance within development areas relative to the predevelopment conditions.

  Deliverable: All post development runoff will be fully infiltrated on-site, mimicking the natural predevelopment conditions.

  Objective: To protect the built environment from flooding or water logging.

  Deliverable: All finished floor levels of lots to be a minimum 0.3m above the 1% AEP flood level.

  Deliverable: All finished floor levels of lots to be a minimum 1.2m above the maximum groundwater level (MGL).

  Deliverable: Detention basin to be provided to ensure that 1% AEP storm is disposed of on-site via infiltration without outflow.

- *Water quality management*

  Objective: To maintain and if possible improve the overall surface water and groundwater quality of the water leaving the development.

  Deliverable: Surface water will be routed to the basin and infiltrated on-site.

  The first 15mm rainfall event will be treated within the bioretention area in the POS basin.

1.3 Planning Background

The subject land is currently zoned “Urban” under the Local Town Planning Scheme.

The proposed structure plan is detailed in Appendix A.

2 Proposed Development

2.1 Key Elements of the Local Structure Plan (LSP)

The site is located between Everest Way and Baldivis Road in Baldivis, extending north from Rialto Way to Fifty Road within the CoR. It covers an area of approximately 11.7ha of future residential land.

The development proposal consists of approximately 160 single residential allotments and two POS areas of 10,711m^2 and 3,168 m^2.

2.2 Previous Land Use

The land is currently undeveloped and is partially cleared. The land has been previously used for a hatchery in the case of Lot 3 and agriculture in the case of the other lots. The land was largely cleared in the 1960's and 1970's and some regrowth has occurred particularly for Lot 3.

2.3 Finished Lot Levels

Finished lot floor levels will be set a minimum of 0.5m above the 1% AEP top water level (TWL) of the drainage basin and 0.3m above the 1% AEP hydraulic grade line (HGL) in the road system. This will ensure that major storms flood down roadways into POS in lieu of flooding lots.

A further criterion is that lots are to be a minimum of 1.2m above MGL.

3 Design Criteria

The drainage requirements for developments within this area are controlled by the requirements of the CoR and the Department of Water and Environmental Regulation (DWER), which are outlined below:

Item	Description	Requirement	Source/Comment
1	Water quality	63.2% AEP – 1 hr storm to be treated within the bio retention area in the POS basin	DWER requirement
		Bio-retention of 2% connected impervious area when within 5m of groundwater	CoR requirement
2	ARI for pipe design	20% AEP	CoR requirement
3	ARI for compensating basin design	1% AEP without outflow from site	CoR requirement – No predevelopment flows currently exit the site.
4	Min. lot freeboard	0.5m above basin 1% AEP flood level	CoR requirement
		0.3m above 1% AEP HGL in road system	

Item	Description	Requirement	Source/Comment
5	Basin criteria		
	Side slopes	Max. 1 in 6	CoR requirement
	Retain existing trees in POS	POS layout to consider location & level of existing trees	CoR requirement
	Bio-retention area	Soil PRI > 10	CoR requirement
6	Runoff coefficients		
	Road reserve	0.7	Based on 90% runoff from paved area in road reserve
	Lots	$C_{1\%}$ – 0.11	As per calculations in Appendix C
	Residential	$C_{<2\%}$ – 0 IL 13.60mm CL 9.71mm/hr	
	POS	0	
	Drainage Basin	1	

4 Predevelopment Environment

4.1 Topography and Landform

The site generally falls from south to north and west to east. Everest Way ranges from RL9.00mAHD near Fifty Road, rising to RL11mAHD around a third of the length from Fifty, then generally around RL9.5-10mAHD before rising on the southern boundary to around RL11m AHD. The site rises up to RL12 close to the southern boundary around a third of the way across the site, then falls east to around RL7.00mAHD on Baldivis Road. Baldvis Road is generally flat but the western boundary of the land generally falls to around RL6.00m AHD on the northern boundary.

4.2 Soil Characteristics

The Perth Environmental Geology mapping[1] indicates that the site area consists of Bassendean Sand, very light grey at surface, yellow at depth, fine- to medium-grained, sub-rounded quartz, moderately well sorted, of eolian origin. It is noted as compatible with urbanisation, being well drained and a good groundwater recharge area.

The various areas of the site as classified in the geology mapping have been superimposed on Drawing L03 in Appendix B.

Acid Sulphate Soil (ASS) mapping by DWER[2] indicates that the whole site has moderate to low risk of ASS occurring within 3m of natural soil surface, but high to moderate risk of ASS beyond 3m of natural soil surface. Earthworks and excavations on-site are not proposed beyond 3m depth so ASS is not likely to be encountered.

4.3 Geotechnical

At this stage no geotechnical investigation has been undertaken across the site. Significant work has been undertaken in the areas to the south, the west and the north and this has indicated that the soils are relatively homogeneous and indicate free draining sand overlying some areas of limestone.

Extensive testing has been undertaken across the site in 2015 by Emission Assessments which supported the soil conditions being deep sand. The bore logs and locations are shown in Appendix F.

A geotechnical report has been commissioned to confirm soil conditions and will be included in the UWMP for the development.

4.4 Groundwater Aspects

4.4.1 General

Groundwater levels (GWLs) and flow directions are well documented from detailed investigations surrounding the site. Interpolation between UWMPs for the Spires North[3], Lot 5 Baldivis Road[4], Baldivis Parks[5] and Greenlea[6] indicates MGLs of RL4.0mAHD on the eastern boundary of site to RL2.1mAHD on the western boundary.

The results indicate that Baldivis Road is more or less a groundwater catchment boundary where the clayey substrate of the area east of Baldivis Road results in perching of infiltrated surface water. This is controlled by subsoil drainage within the adjoining Greenlea Park and Baldivis Parks developments and directed to the main drain to the east of Baldivis Road. The area west of Baldivis Road consists of an unconfined groundwater aquifer within the sandy soils which falls steeply beyond the influence of the impervious soil base, which results in a mound beneath Baldivis Road.

The MGLs are plotted on Drawings L03 and L04 in Appendix B.

4.4.2 Predevelopment Groundwater Monitoring

1) Background Information on Data and Summary of Information Received

In addition to the tests on Lot 1 itself, there are several bores that have been used to establish the likely groundwater contours beneath Lot 1. As shown in Drawing L-03 in Appendix B, existing bores SP1 and SP2 (Spires), ZZ3 and BH3 (Greenlea) and MW28 (Baldivis Parks) are in close proximity to Lot 1.

The soil conditions east and west of Baldivis Road are different. While the subject site and the land west of Baldivis Road consists of an unconfined aquifer within a deep sand formation, the area east of Baldivis Road is a clay base with water controlled by a Water Corporation controlled Main Drain. Consequently, the area east of Baldivis Road is a perched aquifer controlled by drainage. The contours to the east of Baldivis Road were derived from the controlled groundwater levels proposed from the proposed drainage systems in those abutting systems and information pertaining to the bores which is shown in Figure 3 from the Greenlea Park UWMP which is included in Appendix E.

2) Groundwater Level Information

The collated bore information on measured groundwater levels is outlined below in Table 4.1.

Table 4.1 – Groundwater Depth Results

Bore	SP1	SP2	SP7	MW28	MB1	MB4	MB5
RL Surface (mAHD)	**7.00**	**11.461**	**7.153**				
All levels outlined herein are measured in mAHD							

Bore	SP1	SP2	SP7	MW28	MB1	MB4	MB5
RL Surface (mAHD)	7.00	11.461	7.153				
19/03/2015	-	1.928	2.161				
October 2016	2.03	2.662					
Nov 2009	-	2.227					
28/09/2005				4.31			
06/10/2005				4.36			
01/12/2005				4.39			
15/12/2005				3.91			
01/01/2006				3.65			
17/02/2006				3.59			
22/03/2006				3.41			
21/04/2006				3.31			
10/05/2006				3.21			
14/06/2006				3.19			
19/07/2006				3.17			
01/08/2006				3.53			
28/09/2006				3.71			
01/10/2006				3.58			
26/11/2006				3.40			
01/12/2006				3.34			
01/02/2007				3.23			
20/11/2018					3.18	3.03	3.87

As outlined in Table 4.1 monitoring relates to both internal and external bores.

The measured levels to the west in the unconfined aquifer were correlated with long term records of DWER bores to ensure that the 95 percentile groundwater contours could be established with reasonable certainty.

The regional data from the 2004[7] and particularly the 1997[8] Perth Groundwater Atlases is limited in the area. The Atlas contours helped establish the shape of the MGL contours derived from the more detailed surrounding data; however the Atlas levels were largely disregarded in establishing MGL levels.

Based on the bore records for the site and the surrounding bores, the MGL's grade from RL4.0mAHD at Baldivis Road to and 2.1mAHD at the on the western boundary of the site. The proposed base of basin in the southern portion of the site is around 2.6m above the MGL. The north western basin is around 1.60m above the MGL. Proposed

lot levels range from RL7.0mAHD on the eastern boundary of the site to RL12.0mAHD at the crest of the site meaning the groundwater is between 2.4 and 3.6m below proposed allotment levels.

With a minimum separation distance of 2.4m, MGLs are unlikely to pose any threat to the proposed lots; therefore no further investigation will be required in this regard.

Further groundwater level checks will be undertaken as part of the UWMP work and steps have been undertaken to start this in the near future.

3) Groundwater Quality Information

Chemical analysis has been undertaken within bores MB1 to MB 5 and the information for that and adjoining bores is outlined in table 4.2 below.

Table 4.2 – Groundwater Quality test results

Sample ID	Date	Trigger	Nutrients		
			Total P	Total N	NH_4-N
		LOR	0.01	0.1	0.01
		Refer Below	0.8-12[1]	5 [1]	0.04 [2]
		LIWG	NG	NG	NG
SP1	25/09/2013		<0.05	1.7	0.03
SP2	25/09/2013		<0.05	2.3	0.03
SP2	15/01/2015		<0.05	2.1	0.01
MW28	06/10/2005		<0.1	<2.0	<1.0
MW28	01/02/2006		<0.1	<2.0	<1.0
MW28	22/03/2006		0.20	2.2	0.02
MW28	10/05/2006		<0.10	<2.0	<0.01
MW28	19/07/2006		N/A	10	0.32
MB1	20/11/2018		<0.01	0.4	0.05
MB4	20/11/2018		0.02	90.2	0.22
MB5	20/11/2018		<0.01	0.5	0.26

1. Irrigation Guidelines ANZECC/ARMCANZ 2000, Chapter 9
2. Values for Wetland environments - Table 3.3.6 ANZECC/ARMCANZ 2000 Freshwater and Marine WQ Guidelines Chapter 3

In looking at the measured nutrient levels it is evident that all nitrogen and phosphorous levels although outside the allowable ANZECC limits are generally quite low, despite this, the measured total Nitrogen at MB4 is significantly higher than other records.

We believe that the reason for this is that MB4 is located very close to the hatchery that was located on Lot 3 which would have a significant impact on the nitrogen levels in the groundwater in the immediate vicinity of the hatchery. The general flow of groundwater is east to west; hence it is only the bore that is really close to the buildings that would measure the high levels. It is expected that this will decrease now that the hatchery has been decommissioned.

In terms of post development measurements, given that the northern basin is well away from the influence of the hatchery but it is probably best to measure on the western side of the POS in that area and a proposed new bore is shown on Drawing L-04 in Appendix B. The southern basin is located in Lot 3 which was where the hatchery was located. It is suggested that the monitoring for this should be to the west of the basin and a new bore is also proposed in this area to provide for monitoring which is shown on Drawing L-04. It is expected that nitrogen levels will reduce given the source is now gone.

The location of existing monitoring bores is shown on Predevelopment Catchment Plan L03 in Appendix B and proposed new monitoring bores is shown in Drawing L-04 in Appendix B.

4.5 Surface Water Aspects

As shown in Drawing L03 Appendix B, the current site consists of a two catchments which are divided by the ridgeline through the site, effectively dividing the area into east and west of the ridge. The soil is permeable and in the rare event that runoff occurs, the catchment will drain north-east to the low area adjacent to the Fifty/Baldivis Road and west to the area abutting Baldivis Road and dissipate via infiltration.

4.6 Environmental Assets and Water-Dependent Ecosystems

According to the Geomorphic Wetlands Mapping[9], there are four conservation category wetlands in the area, the nearest being the Folly Pool Palusplain some 1.2km south-east of site. The Opwin and Spot Swamps are located some 1.5km to the west, and the Tamworth Hill Swamp is located some 1.9km south-west.

The Folly Pool Palusplain is upstream of site, and all downstream wetlands are at sufficient distance to not be affected by the proposed development. In any case, runoff is proposed to be treated by a bio-retention facility in the drainage basins prior to infiltrating to groundwater.

4.7 Existing Infrastructure and Design Constraints

Sufficient capacity is available in the existing network adjacent to site to service its development.

The entire site is proposed to be sewered into existing infrastructure to the east along Baldivis Road. The existing sewer level does not constrain site levels.

Baldivis Road does not form part of the catchment for the site, but will need to be drained as part of required upgrade works. The road has significant service infrastructure and trees in the western verge and cannot be used as part of the drainage strategy. Despite this, there is room on the eastern verge on Baldivis Road to install swales for drainage as shown on drawing L-04.

5 Water Sustainability Initiatives

5.1 General

The current state government requirement to increase the efficiency of water use in new developments to a target of less than 100kl per person per year is proposed to be implemented within the development.

This is proposed to be achieved by encouraging the use of:

- Water-wise appliances in the household through regulation and financial incentives to increase water efficiency.
- Rainwater tanks to supplement or replace scheme water for irrigation.
- Low water requirement plants and minimal turf in gardens and POS.

5.2 Individual Lot Owner Initiatives

Water conservation will be encouraged by the developer through the promotion of native, water-wise gardens and water-efficient household devices and appliances. All requirements for the purchaser will be outlined in their purchase contract and associated information handouts.

The information will also outline the case for all lot owners to use rainwater tanks plumbed into their homes to assist with the retention of the 63.2% AEP event.

5.3 Estate Public Open Space (POS) Initiatives

5.3.1 Aims

The drainage impacts of the POS will be managed to ensure that:

- The maximum depth of water within the drainage basin is limited to 0.5m and 1.2m during 63.2% AEP (1EY) and 1% AEP storms, respectively.
- The basin inlet will be directed to the bio-retention area in the lower tier of the basin, which will facilitate infiltration and treatment of the minor storms prior spreading to the wider POS area, and hence maximise POS usability.
- Flush kerbs may be constructed abutting POS with direct runoff for infiltration in lower areas or swales for infiltration/conveyance to the drainage basin.
- Vegetation retention where practically possible.

Any proposed landscaping development of the POS will address the following objectives:

- minimise irrigation and fertiliser demands via appropriate species selection
- manage fertiliser application to minimise impacts on water quality
- weed management
- fauna protection

5.3.2 General POS initiatives

The treatment of the POS will typically consist of grassed areas with designated areas of native planting and mulching. All areas will be designed to minimise irrigation requirements with predominantly native plantings incorporated into the landscape design and the use of low water requirement grasses such as kikuyu.

Full landscape plans will be prepared at the time of subdivision in accordance with agreed requirements with the CoR, which will address the objectives outlined in Section 5.3.1.

5.3.3 Irrigation

5.3.3.1 Water sources and re uired allocations

For the POS irrigation the overall water use is limited to a maximum of 7,500kL/Ha/yr in accord with DWER requirements. Approximately 1.39Ha of the development is to be irrigated, which will require a maximum annual bore yield of some 10,425kL/yr.

As outlined in Appendix E, the "water wa" website indicates that the site has allocation (License Number 151745) of some 181,650kl per annum which covers the greater Spires area both covered by this LWMS area and the balance of the Spires between Fifty Road end Everest Way (Area 2). Area 2 consists of some 4.3ha of POS requiring an allocation of 32,250kL/year in addition to the 10,425kL/year required for this area requiring a total of some 42,675kl/year. This indicates that the current allocation is more than sufficient for the requirements.

Standard conditions require irrigation usage to be metered monthly and submitted annually in accord with DWER requirements.

Trees planted in areas within POS and adjoining verges will be irrigated via ground sources for the establishment period. Trees in other verge areas will be irrigated via a method which will be discussed and approved to the City's satisfaction. This may include using hand watering or from an individuals internal irrigation system if there is insufficient allowance within the available allocation.

Hydrozoning and ecozoning to be assessed during landscape detailed design, including ultimate water schedules.

5.3.3.2 Programming and irrigation minimisation

In general, watering will be 10mm three times per day for initial establishment over a period of approximately 1 month, depending on the weather and the time of the year. This will be reduced to 10mm once per day for a period of approximately 2 months dependent on the time of year. The watering is then reduced to 10mm every two days.

Establishment irrigation for street trees and POS planting is expected to be used for a period of 3 to a maximum of 5 years after planting, and disconnected thereafter.

Irrigation will be programmed and maintained to minimise the water used across the site, through monitoring and adjustment, and a water-wise watering regime.

The system will be checked regularly to detect faults and ensure water is being used effectively and efficiently. In general the system will be checked at a frequency of:

- November to April – Once per fortnight.
- May to October – Once per month.

All sprinklers will be checked to fully pop-up and retract, as well as provide adequate coverage, and bubblers and nozzles will be checked to be free of blockages. Particular

attention will be paid to irrigation of transplanted mature trees and street trees to ensure they are receiving adequate water.

The watering regime for planted areas shall reflect the plants' needs appropriate to the plant type and natural rainfall, in accordance with the Water Corporation of WA "Waterwise" guidelines. Watering will be monitored throughout the year and adjusted accordingly to ensure appropriate watering. Watering (other than testing) will only take place within the hours stipulated by the Water Corporation (currently 6.00pm to 9.00am).

In general the Irrigation Schedule will be as outlined below, which is based on the landscape hydrozones:

- Turf will be separated from shrubbery and each will be supplied by different stations of irrigation and will be scheduled separately.
- Areas of turf subject to lower wear which are in sheltered environments and/or are not visually prominent will be scheduled to receive a lesser amount of irrigation than areas of turf which are subject to high levels of wear, in exposed environments and/or visually prominent locations.
- Lower water use shrubbery is scheduled to receive a lesser amount of water than higher water use shrubbery.
- Irrigation is to be progressively withdrawn from areas of native shrubbery.

As part of the landscape works, the topsoil in the landscaped areas will be improved to ensure free drainage and nutrient retention properties prior to planting.

6 Stormwater Management Strategy

6.1 Predevelopment Hydrology

As outlined in Section 4, the site grades gently up from Everest Way to a ridge line around a third across the site, then falls east to Baldivis Road. The site generally consists of Bassendean Sand with good permeability characteristics.

Although the topography indicates flow paths in a north-east direction, the flat grade and permeability of the surface allows infiltration to occur at a greater rate than runoff, so little or no runoff currently leaves the site. Based on this, it has been assumed that there is no predevelopment flow from the site. Drawing L-03 detailing the predevelopment catchments is included in Appendix B.

6.2 Pre- & Post Development Hydrology

The proposed drainage strategy is to infiltrate all stormwater on-site as close to the source as possible. Soakwells on lots and trapped pit bases in the road system are proposed to this end; however given the limited available opportunities for drainage disposal in the upper reaches of the catchments; the strategy ultimately relies on the two end-of-line infiltration basins. Soakage at-source without outflow will be employed up to and including the 5% AEP event for residential lots and for the first 1.5-2mm of runoff in road reserves.

The drainage strategy is to split the catchment and drain to basins in the south east and north-west corners of the site. In general, the site sand has good soakage characteristics which will facilitate infiltration of the various storm events. Given that the site is within

5m of MGL, improved soil media and appropriate planting are proposed in the bio-retention area of the basin to ensure nutrient uptake prior to infiltration to groundwater.

The basin will be constructed as a three-tiered swale within the POS area as follows:

- Lower tier: with planted bio-retention area at base to treat minor event runoff, and the capacity to the 1EY 15mm event.
- Middle Tier/Upper Tier: which will provide overflow capacity for a minimum of the 20% AEP storm, then will overflow to the higher tier.
- Upper tier: to form part of the wider usable POS area, to cater for the remaining storm events in excess of the 20% AEP.

The southern basin is proposed in locations where trees are located and as a result the upper tier has been split into two discrete sections. To ensure the storage is available and water will easily flow between the two sections, a balancing pipe is proposed between the two portions which is shown in Drawing L-05 in Appendix B.

Bioretention area will be planted with suitable species planted for drainage and water quality treatment purpose. The vegetation species will be in compliance with Vegetation Guidelines for Stormwater Biofilters in the South-West of Western Australia (Monash University, 2014)[12].

The site consists of two catchments draining both south-east and north-west from the centre of the site to the drainage basins in the POS areas. Drawing L-04 detailing the catchment boundaries and proposed drainages basin is included in Appendix B.

Given that Everest Way is on the western side of the ridge and has an established profile, it is proposed to provide a piped connection to the drainage basins in each catchment. The earthworks for the site will be undertaken to slightly lower the ridge level. For the major storm an overland flow path from Everest Way to the basins will not be possible, particularly at the southern end, and as a result it is proposed to provide extra pipe capacity and inlet pits to ensure that the major storm can be conveyed without impact on homes.

Modelling has been undertaken using the PC Sump software using the shallow water table calculations. In general this model restricts outflow through the base and sides of the basin, thereby increasing the required capacity established from more empirical methods.

Gross pollutant traps (GPTs) will be constructed at entry to the POS soakage area to ensure most litter and sediment is contained for easy cleaning.

The areas required to contain flows from the post development catchment are summarised in Table 6.1 below. Refer also to Appendices B and C for the catchment plan and detailed calculations.

Table 6.1 – Drainage basin details

Basin parameter	North Catchment (Catchment #2) (Overall)*	South Catchment (Catchment #3)
Impervious catchment (Ha) ($C_{1\%}$)	1.90	2.37
Storage provided (1%) (m^3)	1,787	1,939
Storage provided (20%) (m^3)	533	606

Basin parameter	North Catchment (Catchment #2) (Overall)*	South Catchment (Catchment #3)
Storage provided (1EY) (m^3)	203	202
Site area required (1%) (m^2)	2,483	3,357
Site area required (20%) (m^2)	1,256	1,016
Site area required (1EY (m^2)	924	644
$TWL_{1\%}$ (mAHD)	6.0	6.94
Base of Basin (mAHD)	4.8	5.80
Critical T_C (1%) (hrs)	9	1
Critical T_C (20%) (hrs)	2	1
Critical TC (63.2%) (1EY) (hrs)	1	1

- Allows for the combined catchment of Catchment and the Commercial Precinct on Lot 1.

6.3 63.2% AEP (1EY) event

6.3.1 General

The 63.2% AEP (1EY) event is typically accepted as generating the most dissolved nutrients and particulate matter in runoff. As the separation distance to MGL is less than 5m across the development, bio-retention is required to treat runoff prior to reaching groundwater.

It is proposed that the 63.2% AEP – 1 hour storm will be retained on-site without outflow in accordance with DWER requirements. This is proposed to be undertaken at the various levels as outlined in the following sections.

6.3.2 Lots

Lots will retain water on-site in rainwater tanks, infiltrate water in soakwells, or use a combination of both to ensure no outflow to the street drainage system. Residential lots are required be fitted with the equivalent of 2 by 1.5m diameter by 1.2m deep soakwells ($4.24m^3$) to achieve full retention of all storms up to the 5% AEP without outflow.

When capacity of the on-site storage is reached, stormwater will surcharge from the soakwells/tanks and run overland to the street drainage system. It is noted that some additional infiltration will occur in back and front yards which will supplement the constructed on-site storage.

6.3.3 Streets

The 63.2% AEP (1EY) storm for roadways will be contained within the end-of-line basins without overflow to any surrounding POS areas.

Internally, drainage pits will be laid with open bases to permit soakage for small rainfall events thereby encouraging soakage at-source. The baseless pits will cater for around 1.5-2.0mm of rainfall.

The 63.2% AEP – 1 hour event will be restricted to the bio-retention area in the lower tier of the basin, which will cause cause minimal inundation for lower ARI rainfall events, thereby maximising the usability of the POS area and associated swales. The bio-retention area will be installed in accordance with the *Adoption Guidelines for Stormwater Biofiltration Systems (CRCWSC, 2015)*.

GPTs will be installed prior to any inflow from the piped drainage system into the drainage basins to limit the siltation in the basins.

6.3.4 Detention basins

Beyond the measures employed in baseless pits, the remainder of the 63.2% AEP storm will be fully infiltrated within the lower tier basin. Details of the proposed basins are included on Drawing L-04 in Appendix B.

6.3.5 Non-structural measures

Non-structural measures will be employed to reduce the number of sources of nutrients as well as the amount of nutrients they produce. These measures are particularly important during house construction and garden establishment, and generally involve providing advice to limit sources of eroded particulate matter and the application of garden fertilisers in the new urban areas.

Non-structural minimisation of nutrient loading can effectively be achieved through:

- education of local residents and CoR maintenance personnel;
- implementing frequent street and stormwater maintenance programs – particularly during housing construction, and;
- Planting and maintaining appropriate native species.

6.4 20% AEP event

All piped drainage systems will be designed to accommodate the 20% AEP event, without any inundation of roadways.

6.5 1% AEP event

For the major event, volumes in excess of the 5% AEP storm for residential lots will surcharge and run overland.

All roads within the estate will be designed to accommodate and direct extreme event flows toward the POS and compensating basins. The land will form the same catchment area as detailed in the post development plan in Appendix B.

6.6 Finished Lot Levels (Relative to the 1% AEP Flood Levels)

As outlined in Section 2.3, lots will be set to ensure major storms will be conveyed along roadways without flooding homes. The land is proposed to be finished a minimum of 0.3m above the TWL of the drainage basin and the HGL in the road system.

6.7 POS Credits

As outlined in the LSP document, all POS credit calculations have been based upon current "Liveable Neighbourhood" policy guidelines. According to the guidelines, 100% of the area covered by the 63.2% event of the compensating basin is typically not included as a 'usable' POS area, and the 20% AEP event is designated as a 'restricted' area. The area between the 63.2% and the 20% AEP normally attracts a 100% credit, provided it comprises less than 20% of the total POS allocation.

The POS area affected by the drainage basin is detailed in Table 6.1.

6.8 Best Management Practices Water Quality Targets

The DWER's Stormwater Management Manual[11] provides guidelines and information on best management practices that may be applied at land development and construction sites to improve stormwater management and environmental performance.

Poorly managed land development sites can often be a major source of pollution. Certain construction activities can allow pollutants to be transported via existing stormwater systems or overland flow to adjoining receiving water bodies.

The major sources of pollutants from construction activities in the case of this project will potentially be from:

- Eroded materials in the interim period between opening up the surface of the site and implementing the drainage management measures.
- Litter and waste storage areas – that allow materials to be blown by wind or washed away by rainfall into existing stormwater systems.
- Wash-down areas – poor practices can allow materials to enter stormwater systems.
- Placement and storage of delivered products – particularly sand and soil stockpiles where such materials may be tracked by vehicles, blown, or washed onto roads, which then get into existing stormwater systems.
- Dewatering activities – which can cause sedimentation of downstream water bodies.

Consequently no construction activities will commence on the site until an appropriate approved Environmental Management Plan (EMP) is prepared that fully addresses:

- litter and waste management practices (non-hazardous and hazardous materials);
- vehicle and equipment washing-down practices;
- water conservation practices;
- erosion and sediment control;
- product placement and storage practices;
- dewatering activities (if applicable), and;
- Any other practices that may adversely impact upon receiving water bodies.

This will be prepared by the contractor undertaking the civil works on the subdivision together with the engineering consultant.

The Best Management measures proposed for this project are:

- Non-structural measures to reduce nutrient loading.

- On-site retention of the 63.2% AEP – 1 hour storm.

Urban StormWater: Best Practice Environmental Management Guidelines, (Victorian Stormwater Committee, 1999) has indicated that this approach will achieve reductions of at least 80% of total suspended solids, 60% of total phosphorus, 45% of total nitrogen and 70% of gross pollutants compared to a conventional drainage system.

7 Groundwater Management Strategy

7.1 Groundwater Level Management

MGLs for the site are plotted on Drawings L03 and L04 in Appendix B. In general MGLs are a minimum 2m below proposed site levels with the exception of the drainage basin in the north eastern corner of site.

Given the significant depth to groundwater in sand on the western side of the site, in combination with groundwater controls east of Baldivis Road, there is no need for further control of groundwater levels on-site.

7.2 Actions to Address Acid Sulphate Soils or Contamination

As mentioned in Section 4.2, the ASS mapping for the area indicates that the whole site has moderate to low risk of ASS occurring within 3m of natural soil surface, but high to moderate risk of ASS beyond 3m of natural soil surface. Construction work will not exceed this depth, therefore there is little to no risk of the development proposal encountering any ASS soils.

8 The Next Stage – Subdivision and Urban Water Management

The structure plan area is under the ownership of a single land owner, so it is anticipated that the ultimate drainage strategy will generally fit within the framework of this LWMS.

The UWMP will build on the concepts of this report providing ongoing monitoring results and addressing the following major points:

- Further detail in the design of the detention basin.
- Detailed geotechnical investigations including testing of the PRI and permeability of the existing soils both at the surface and at the depth of the base of the basin.
- Further detail in landscape proposals.
- Testing of groundwater levels and quality for the purposes of irrigation of public open space.

Once this data is received, the approach outlined herein will be reviewed with detailed work required to:

- Finalise the design of the swale in the POS and potential above-ground storage upstream in the catchment.
- Detail the drainage basin including the inlet configurations and edge treatments to ensure the overall functional and aesthetic outcomes are satisfactory.

- Review the drainage calculations relative to final planning proposals for the site to ensure that the land use assumptions within the drainage calculations herein are consistent.

9 Monitoring

9.1 General

Post development monitoring is proposed to be undertaken over the site quarterly following the completion of the first stage. It is proposed to use the same suite of bores used for the pre- development monitoring as detailed in Drawing L-03 in Appendix B.

It is acknowledged that some of these bores may be impacted by the works and if this occurs, they will be reinstated as close as possible to their original locations but in a suitably accessible location. It is expected that three bores will need to be installed for monitoring purposes and these are shown in Drawing L-04 in Appendix B.

The level will be measured and samples will be sent to a NATA registered laboratory to undertake the following tests:

Table 9.1 – Proposed Post Development testing regime

Test	Abbreviation	Trigger levels (Based on 10% Exceedance of Median Initial Levels) (mg/1)
Total Phosphorous	TP	0.055
Filterable Reactive Phosphorous		N/A
Nitrate and Nitrite	NOx	N/A
Ammonia-Nitrogen	NH_3	0.055
Total Kjeldahl Nitrogen	TKN	2.2
Salinity	EC or TDS	N/A
pH		N/A

The trigger level has been based on 10% exceedance of the median of the measured levels across all bores given the significant impact of the measured levels at MB4.

Further predevelopment testing will be undertaken at UWMP Stage and Trigger levels will be updated as part of that document.

The water will be sampled quarterly January, March, June and October commencing after the first stage of development has been completed and will be carried out for two years following completion of the last stage of civil construction and until hand over of the POS to the City of Rockingham, whichever is the latter.

Hand over to the City of Rockingham will occur two years after completion of establishment works. In the interim period, the developer will accept responsibility for the maintenance and monitoring of the landscaping and monitoring works.

An annual report will be submitted to the City of Rockingham and the Department of Water and Environmental Regulation until 3 years after the completion of the last stage. Monitoring reports shall be delivered to the City of Rockingham Strategic Planning and Environment Department.

9.2 Contingency Response

The initial results will be compared to those measured each year and from the predevelopment monitoring.

In the event that it is identified during the developers monitoring period that the median of the bore values for each parameter exceeds the trigger levels by 20% for two consecutive samples or;

A parameter in any bore exceed twice the established trigger levels.

Council and DWER will be notified and the matter will be investigated and rectified at the developers cost.

The investigation will follow the proposed approach:

- Confirm if the high level of the sample is not due to contamination or natural variation.
- Determine if the exceedance is an isolated occurrence, project related or a regional issue.

The possible contingency measures are as follows:

1. Identify and remove or mitigate any source of contamination.
2. Review of operational practices such as in irrigation or fertiliser use in key areas and review of timing.
3. Modify the stormwater system by
   (a) Soil amendment in high nutrient areas.
   (b) Increased planting of water and nutrient thirsty plants.
   (c) Potential installation of further basins.

The measures employed and the timing will be resolved at the time with the DWER and Council once the test results have been confirmed and agreed and the methodology and structure of the contingency measures are also agreed.

If standing water occurs within the basin areas for excessive periods of time within the maintenance period for the landscaping (That is two years following completion of the last stage of civil construction or until hand over of the POS to the City of Rockingham, whichever occurs first), the developer shall at its cost investigate the issue and provide a solution for approval by the Local Authority. Following agreement on a strategy, the developer shall implement the strategy and undertake any required rectification works at its cost.

10 Implementation

10.1 Commitments

The developer is committed to:

1) Physical outcomes – to be undertaken at the time of construction.

- Installing baseless manholes to ensure maximum soakage at source opportunities.
- Installing drainage systems to hold up to and including the 1% AEP storm event.
- Providing a water source for the open space areas.
- In-situ soil tests to assess viability as nutrient stripping media, at the base of the drainage basin. If the material does not meet the required specification as shown in Section 3, an alternative material will be provided for the basin bio-retention area.

2) Non-structural – to be undertaken as part of sales documentation, by providing information packages to all lot purchasers to:

- Fully inform residential lot owners of the requirement to install the equivalent of two 1.5m diameter by 1.2m deep soakwells with potential supplementation with rainwater tanks.
- Encourage the use of plumbed rainwater tanks.
- Utilise water-efficient devices and appliances throughout their homes, and to encourage all purchasers to install water- and nutrient-wise plants.

3) Further investigation and reporting:

- Prepare a UWMP to support further detailed subdivision planning.
- Undertake geotechnical investigations.

10.2 Maintenance Schedules (Incl. Roles & Responsibilities)

Maintenance schedules and arrangements will be resolved as part of the UWMP and will be dependent on the detailed design and operation of the mechanisms required. As a brief summary, Table 10.1 has been included to provide guidelines for likely maintenance responsibilities.

Table 10.1 – Proposed maintenance programme for the development

#	Drainage Element	Possible Maintenance and Inspection Frequency	Responsibility
1	Rainwater tank(s); soakwells and gutters	Annually inspect & clean-out (as necessary) – just prior to winter rains	Lot owner
2	Swale areas and detention basin	<u>During developer maintenance period</u> (2 years in conjunction with Landscaping): Inspect, clean-out & maintain plants at ~fortnightly intervals (depending on loading) – as part of POS maintenance works. Reticulation will be checked once/fortnight and once/month <u>After developer maintenance period</u>: Inspect, clean-out & maintain plants (as required) as part of standard Council POS maintenance program	Developer CoR
3	Drainage pipes and pits	<u>During developer maintenance period</u> (12 month Defects Liability Period): Inspect, clean-out & maintain structures annually – just prior to winter (& then again in Aug / Sept if necessary)	Developer

#	Drainage Element	Possible Maintenance and Inspection Frequency	Responsibility
		After developer maintenance period: Inspect, clean-out & maintain structures at least annually – just prior to winter – but inspection frequency will need to be higher during home construction phase	CoR
4	GPT	During developer maintenance period (12 month Defects Liability Period): Inspect, clean-out & maintain pits tri-annually – just prior to winter & then around June / July & again in Oct / Nov for the first two years. After developer maintenance period: Inspect, clean-out & maintain pits tri-annually – just prior to winter & then around June / Aug – but inspection frequency will need to be higher during home construction phase	Developer CoR
5	Base of compensating basin	Initial formal inspection & assessment of performance of bases (say) at around year 3 & then every 5 – 10 years.	CoR

10.3 Funding

The cost for the implementation of the capital water management measures will be borne by the developers. Maintenance costs will be borne by the developers for the periods as outlined in the maintenance schedule table in section 10.2 above.

10.4 Review

Following the approval of this document, it is not expected that the LWMS for this development will need to be reviewed as this forms the broad structure of the approach for the drainage in the area.

In general, minor amendments can be made provided they meet the outcomes sought within this report. In the event that the management measures used within the state have significantly changed, or the first subdivision application following the expiration of 4 years from the first subdivision approval, whichever is the later, the measures used for management of stormwater should be reviewed.

11 References

1. Rockingham: Part Sheets 2033 II and 2033 III, Perth Metropolitan Region, Environmental Geology Series, Geological Survey of Western Australia, Gozzard J. R., 1983.
2. Acid Sulphate Soil Risk Map, Swan Coastal Plain (DWER-055), Department of Water and Environmental Regulation, Shared Location Information Platform, Landgate, 2017.
3. Local Water Management Strategy Lots 312, 313, 2, 45, 7 and 8 Baldivis, Coterra Environment, May 2013.

4. Acid Sulphate Assessment – Lot 306 McDonald Road, Lot 2 Eighty Road, Lot 9504 Fifty Road, lot 9502 Baldivis Road and Lot 5 Ingram Road, Baldivis, WA, Emission Assessments, March 2015
5. Baldivis Homes Pty Ltd, C/- Terranovis Pty Ltd, Lot 1 Baldivis Road, Baldivis Local Water Management Strategy, Development Engineering Consultants, March 2021.
6. Perth Groundwater Atlas (Edition 4), Department of Environment, 2004.
7. Perth Groundwater Atlas, Waters and Rivers Commission, October 1997.
8. Geomorphic Wetlands, Swan Coastal Plain (DBCA-019), Department of Biodiversity, Conservation and Attractions, Shared Location Information Platform, Landgate, 2018
9. Water Register, Department of Water and Environmental Regulation, accessed 13th September 2023.
10. Stormwater Management Manual for Western Australia, Department of Water, 2007.
11. Australian Rainfall and Runoff Guidelines, 2019.
12. Vegetation Guidelines for Stormwater Biofilters in the South-west of Western Australia, Monash Water for Liveability Centre, Monash University, 2014.

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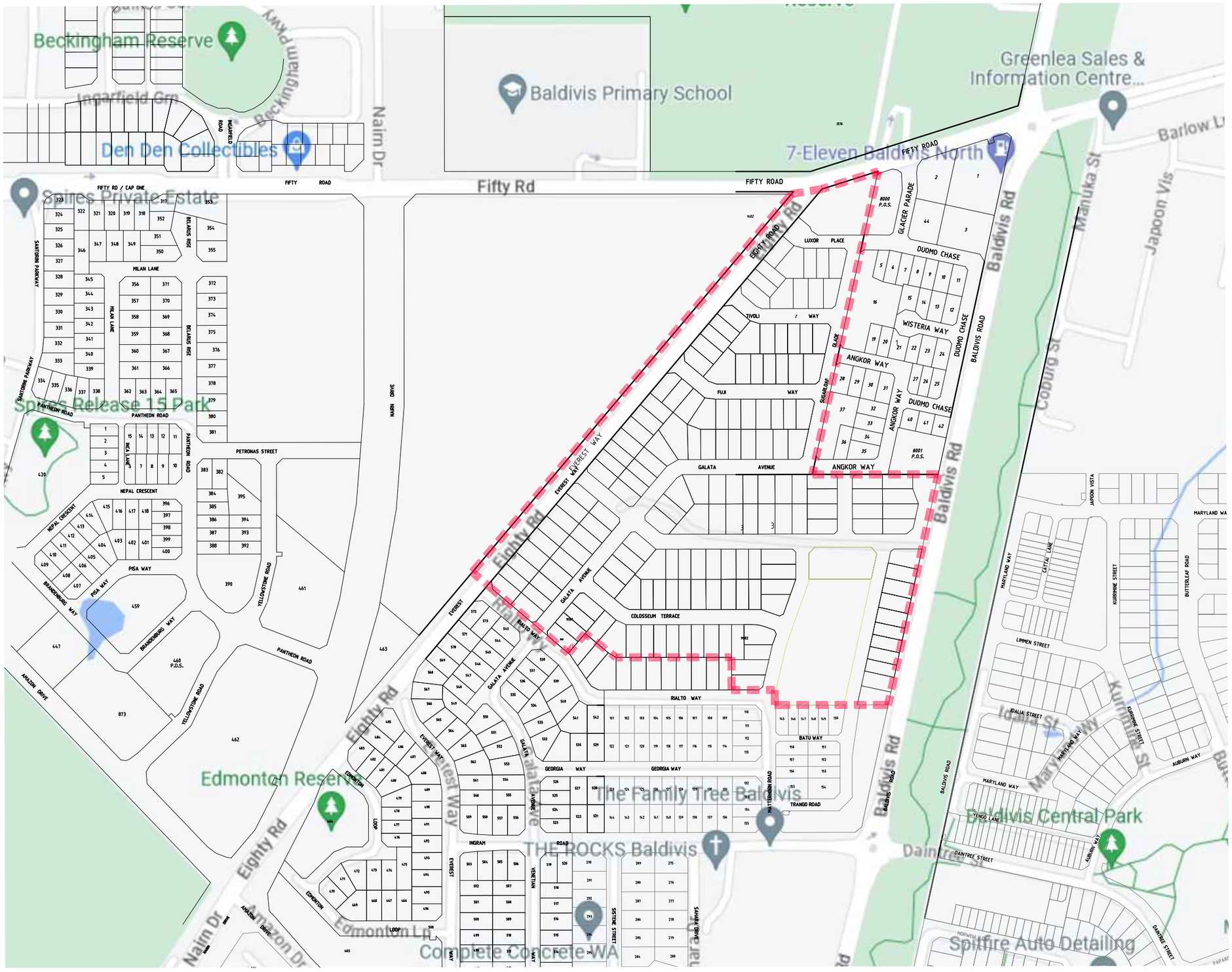
APPENDIX A

OVERALL PLANS

- **L01: Locality plan**
- **L02: Aerial photo plan**
- **Veris proposed subdivision plan**
- **Previous LWMS Catchment Plan**



LEGEND

SITE BOUNDARY

1:2000 (A1)

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No.	DATE	BY	REVISION
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PROJECT: **THE SPIRES BALDIVIS STAGE 16B**
W.A.P.C. No. - 156452

DRAWING: **LOCAL WATER MANAGEMENT STRATEGY**
LOCALITY PLAN
COORDINATE SYSTEM: PCG94, VERTICAL DATUM: AHD

SCALE	DRAWN	CHECK	REV No.
1:2000	JEG	SRA	A
DATE	DESIGNED	APPROVED	
14/9/23	JEG	SRA	

PROJECT NUMBER **BDVCAN26** DRAWING NUMBER **L01**

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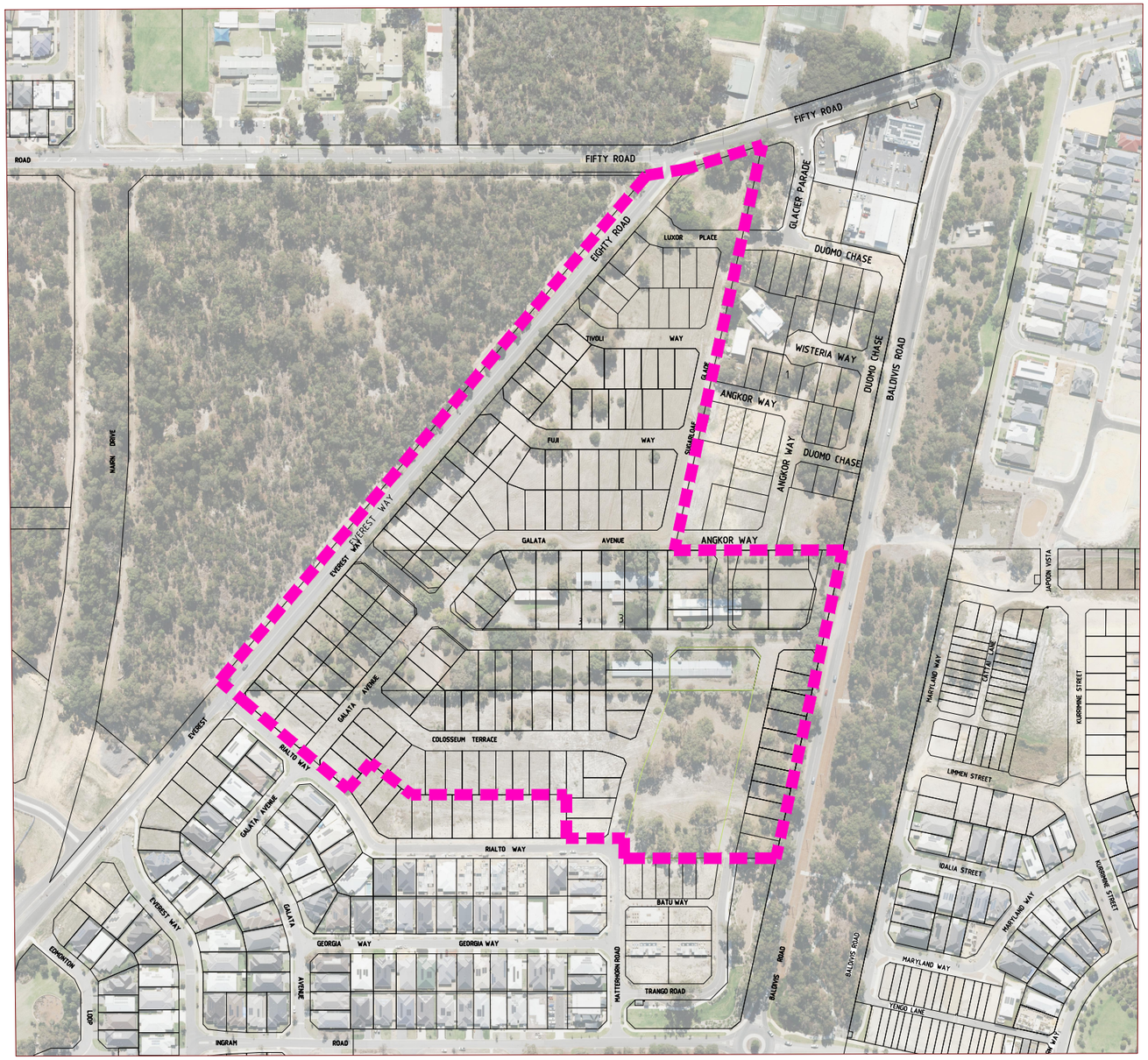

LEGEND

SITE BOUNDARY

1:2000 (A1)

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Ph: (08) 9481 1900
Fax: (08) 9481 1700

PROJECT: THE SPIRES BALDIVIS STAGE 16B
W.A.P.C. No. - 156452

DRAWING: LOCAL WATER MANAGEMENT STRATEGY
AERIAL PHOTO
COORDINATE SYSTEM: PCG94, VERTICAL DATUM: AHD

SCALE	DRAWN	CHECK	REV No.
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14/9/23	JEG	SRA	

PROJECT NUMBER: BDVCAN26
DRAWING NUMBER: L02
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CONCEPT SUBDIVISION PLAN

Lot 3 Everest Way, BALDIVIS

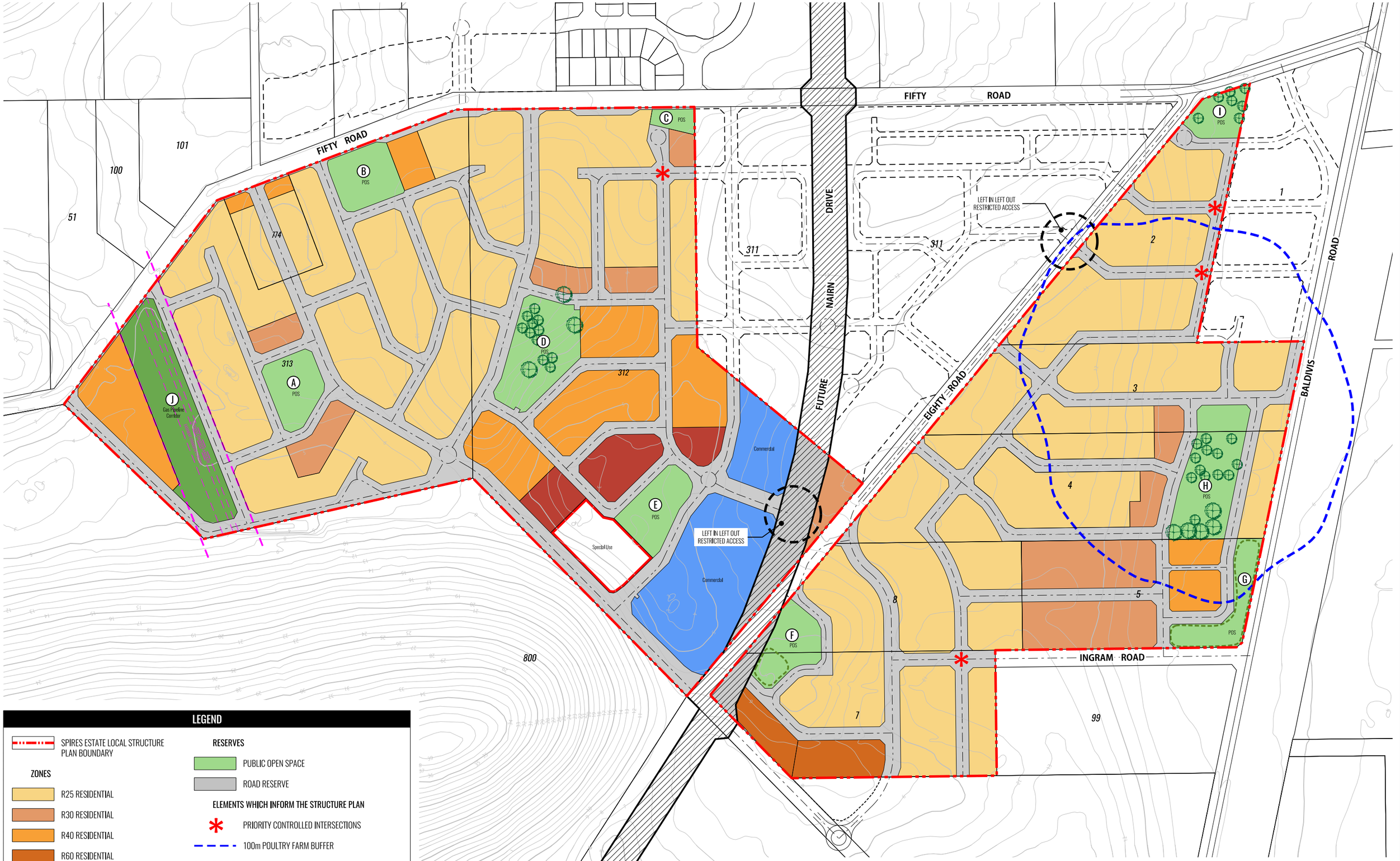
Aerial supplied by:
Aerial Date Stamp:
Survey supplied by: MNG
Plan Number: NPS1022 - 007
Revision Number:
Drawn By: JP
Client: SPG

0 15 30 45 60 75 90m

Scale: 1:1500 @A3 | Date Issued: 13.09.2023 | ©Niche Planning Studio

DISCLAIMER: This Concept Plan has been prepared based on the Spires LSP.
Town Planning compliance is subject to approval from the City of Rockingham and a suitable town planner will need to be appointed.
All Dimensions, Areas and Calculations are subject to Detailed Survey and Design before Town Planning Permit application.
Built Form is illustrative only and subject to Architectural Design and approval from an RAIA qualified architect. This plan has been prepared for illustrative purposes only and should not be used as a means to judge any properties value or yield potential.

NICHE STUDIO



LEGEND

- SPIRES ESTATE LOCAL STRUCTURE PLAN BOUNDARY

ZONES

- R25 RESIDENTIAL
- R30 RESIDENTIAL
- R40 RESIDENTIAL
- R60 RESIDENTIAL
- R100 RESIDENTIAL
- COMMERCIAL
- SPECIAL USE

RESERVES

- PUBLIC OPEN SPACE
- ROAD RESERVE

ELEMENTS WHICH INFORM THE STRUCTURE PLAN

- PRIORITY CONTROLLED INTERSECTIONS
- 100m POULTRY FARM BUFFER
- GAS PIPELINE CORRIDOR
- TREES TO BE RETAINED (SUBJECT TO SURVEY)
- REMNANT VEGETATION TO BE RETAINED SUBJECT TO ENGINEERING AND DETAILED DESIGN

NOTE: Lots within 100m of classified vegetation identified by Bushfire Management Plan (BMP), require a detailed BAL assessment at Building License stage.

PLAN 1 - SPIRES ESTATE STRUCTURE PLAN (PHASE 2)

Various Lots, Fifty & Eighty Road, BALDIVIS

Aerial supplied by: Nearmap
Aerial Date Stamp: N/A
Survey supplied by: N/A
Plan Number: NPS1022 - 005
Revision Number:
Drawn By: JP
Client: Spatial Property Group

0 80 160 240 320 400 480m

Scale: 1:4000 @A3 | Date Issued: 05.04.2023 | ©Niche Planning Studio

DISCLAIMER:
Town Planning compliance is subject to approval from the Tamala Park Regional Council and a suitable town planner will need to be appointed.
All Dimensions, Areas and Calculations are subject to Detailed Survey and Design before Town Planning Permit application.
Built Form is illustrative only and subject to Architectural Design and approval from an RAIA qualified architect, This plan has been prepared for illustrative purposes only and should not be used as a means to judge any properties value or yield potential.

NICHE STUDIO

CATCHMENT 10B BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.87ha
100yr STORAGE REQUIRED	237m³
AREA AT TWL (100yr)	2597m²
RL (TWL) (100yr)	5.60m AHD
5yr STORAGE REQUIRED	1095m³
AREA AT TWL (5yr)	1766m²
RL (TWL) (5yr)	5.01m AHD
1yr STORAGE REQUIRED	556m³
AREA AT TWL (1yr)	1320m²
RL (TWL) (1yr)	4.66m AHD
LWL	4.10m AHD

CATCHMENT 9 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.53ha
100yr STORAGE REQUIRED	1616m³
AREA AT TWL (100yr)	1770m²
RL (TWL) (100yr)	8.50m AHD
5yr STORAGE REQUIRED	724m³
AREA AT TWL (5yr)	1172m²
RL (TWL) (5yr)	7.89m AHD
1yr STORAGE REQUIRED	366m³
AREA AT TWL (1yr)	877m²
RL (TWL) (1yr)	7.54m AHD
LWL	7.00m AHD

CATCHMENT 8 BASIN DETAILS

TOTAL IMPERVIOUS AREA	0.92ha
100rr STORAGE REQUIRED	1048m³
AREA AT TWL (100yr)	1281m²
RL (TWL) (100yr)	6.40m AHD
5yr STORAGE REQUIRED	471m³
AREA AT TWL (5yr)	832m²
RL (TWL) (5yr)	5.85m AHD
1yr STORAGE REQUIRED	234m³
AREA AT TWL (1yr)	605m²
RL (TWL) (1yr)	5.52m AHD
LWL	5.00m AHD

CATCHMENT 11 BASIN DETAILS

TOTAL IMPERVIOUS AREA	0.43ha
100yr STORAGE REQUIRED	596m³
AREA AT TWL (100yr)	798m²
RL (TWL) (100yr)	6.50m AHD
5yr STORAGE REQUIRED	257m³
AREA AT TWL (5yr)	474m²
RL (TWL) (5yr)	5.96m AHD
1yr STORAGE REQUIRED	127m³
AREA AT TWL (1yr)	317m²
RL (TWL) (1yr)	5.63m AHD
LWL	5.00m AHD

LEGEND

- DRAINAGE CATCHMENT BOUNDARY
- TREES
- INDICATIVE LOCATION OF COMPENSATING BASIN (SHOWING ~ 1 IN 5 YEAR FLOOD AREA)
- 2.50 AAMGL CONTOURS PER 2003 PERTH GROUNDWATER LEVEL ATLAS
- MONITORING BORES
- FLOW ARROWS
- STORAGE - 1 IN 100 YEAR LEVEL
- STORAGE - 1 IN 10 YEAR LEVEL
- STORAGE - 1 IN 5 YEAR LEVEL
- STORAGE - 1 IN 1 YEAR LEVEL

CATCHMENT 2 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.50ha
100yr STORAGE REQUIRED	1562m³
AREA AT TWL (100yr)	1680m²
RL (TWL) (100yr)	6.60m AHD
5yr STORAGE REQUIRED	689m³
AREA AT TWL (5yr)	1110m²
RL (TWL) (5yr)	5.97m AHD
1yr STORAGE REQUIRED	348m³
AREA AT TWL (1yr)	842m²
RL (TWL) (1yr)	5.62m AHD
LWL	5.10m AHD

CATCHMENT 1 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.95ha
100yr STORAGE REQUIRID	2009m³
AREA AT TWL (100yr)	2050m²
RL (TWL) (100yr)	6.00m AHD
5yr STORAGE REQUIRED	838m³
AREA AT TWL (5yr)	1365m²
RL (TWL) (5yr)	5.31m AHD
1yr STORAGE REQUIRED	424m³
AREA AT TWL (1yr)	1078m²
RL (TWL) (1yr)	4.97m AHD
LWL	4.50m AHD

CATCHMENT 3 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.18ha
100yr STORAGE REQUIRED	1341m³
AREA AT TWL (100yr)	1560m²
RL (TWL) (100yr)	7.00m AHD
5yr STORAGE REQUIRED	590m³
AREA AT TWL (5yr)	1001m²
RL (TWL) (5yr)	6.41m AHD
1yr STORAGE REQUIRED	298m³
AREA AT TWL (1yr)	725m²
RL (TWL) (1yr)	6.07m AHD
LWL	5.50m AHD

CATCHMENT 4 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.40ha
100yr STORAGE REQUIRED	1466m³
AREA AT TWL (100yr)	1598m²
RL (TWL) (100yr)	7.20m AHD
5yr STORAGE REQUIRED	650m³
AREA AT TWL (5yr)	1051m²
RL (TWL) (5yr)	6.58m AHD
1yr STORAGE REQUIRED	329m³
AREA AT TWL (1yr)	791m²
RL (TWL) (1yr)	6.23m AHD
LWL	5.70m AHD

CATCHMENT 5 BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.46ha
100yr STORAGE REQUIRED	1529m³
AREA AT TWL (100yr)	1640m²
RL (TWL) (100yr)	6.50m AHD
5yr STORAGE REQUIRED	655m³
AREA AT TWL (5yr)	1019m²

CATCHMENT 10A BASIN DETAILS

TOTAL IMPERVIOUS AREA	1.23ha
100yr STORAGE REQUIRED	1437m³
AREA AT TWL (100yr)	1624m²
RL (TWL) (100yr)	6.80m AHD
5yr STORAGE REQUIRED	659m³
AREA AT TWL (5yr)	1074m²
RL (TWL) (5yr)	6.22m AHD
1yr STORAGE REQUIRED	327m³
AREA AT TWL (1yr)	781m²
RL (TWL) (1yr)	5.86m AHD
LWL	5.30m AHD

CATCHMENT 7 BASIN DETAILS

TOTAL IMPERVIOUS AREA	2.96ha
100yr STORAGE REQUIRED	3071m³
AREA AT TWL (100yr)	2987m²
RL (TWL) (100yr)	5.73m AHD
5yr STORAGE REQUIRED	1221m³
AREA AT TWL (5yr)	2107m²
RL (TWL) (5yr)	5.00m AHD
1yr STORAGE REQUIRED	620m³
AREA AT TWL (1yr)	1779m²
RL (TWL) (1yr)	4.69m AHD
LWL	4.30m AHD

CATCHMENT 6 BASIN DETAILS

TOTAL IMPERVIOUS AREA	2.52ha
100yr STORAGE REQUIRED	2549m³
AREA AT TWL (100yr)	2491m²
RL (TWL) (100yr)	4.50m AHD
5yr STORAGE REQUIRED	1048m³
AREA AT TWL (5yr)	1702m²
RL (TWL) (5yr)	3.78m AHD
1yr STORAGE REQUIRED	525m³
AREA AT TWL (1yr)	1381m²
RL (TWL) (1yr)	3.55m AHD
LWL	3.00m AHD

CATCHMENT AREA INFORMATION

CATCHMENT	TOTAL AREA	LOT AREA	ROAD RESERVE AREA	POS AREA
1	50881m²	23032m²	23281m²	4568m²
2	49030m²	28901m²	16948m²	3181m²
3	43278m²	28095m²	13337m²	1846m²
4	58739m²	33706m²	16691m²	8342m²
5	61897m²	39899m²	16975m²	5023m²
6	72095m²	26034m²	40405m²	5650m²
7	135858m²	87873m²	36985m²	11000m²
8	40955m²	24042m²	11466m²	5447m²
9	67369m²	43350m²	17829m²	6190m²
10A	51872m²	29902m²	15366m²	6604m²
10B	73296m²	37663m²	23458m²	12175m²
11	20960m²	14495m²	5425m²	1040m²

Legend
- Site Boundary
- Public Open Space
- Pipeline Easement
- Overland Flow Path

DEVELOPMENT ENGINEERING CONSULTANTS

N

0 50 100 150 200m

SCALE 1 : 4 000 at A3 (MGA)

SOURCE: Development Engineering Consultants, Dwg No. BDVCAN10 LW04 Rev D, 07-12-12.

PINPOINT CARTOGRAPHICS (08) 9562 7136 SPABAL06-f10.dgn

COTERRA ENVIRONMENT

Spatial Property Group
LOCAL WATER MANAGEMENT STRATEGY
NORTH BALDIVIS

Drawn: L. Coulson | Date: 10 Jan 2013
Job: SPABAL06 | Revision: A

STORMWATER CATCHMENT PLAN, OVERLAND FLOW PATHS AND POS LOCATIONS

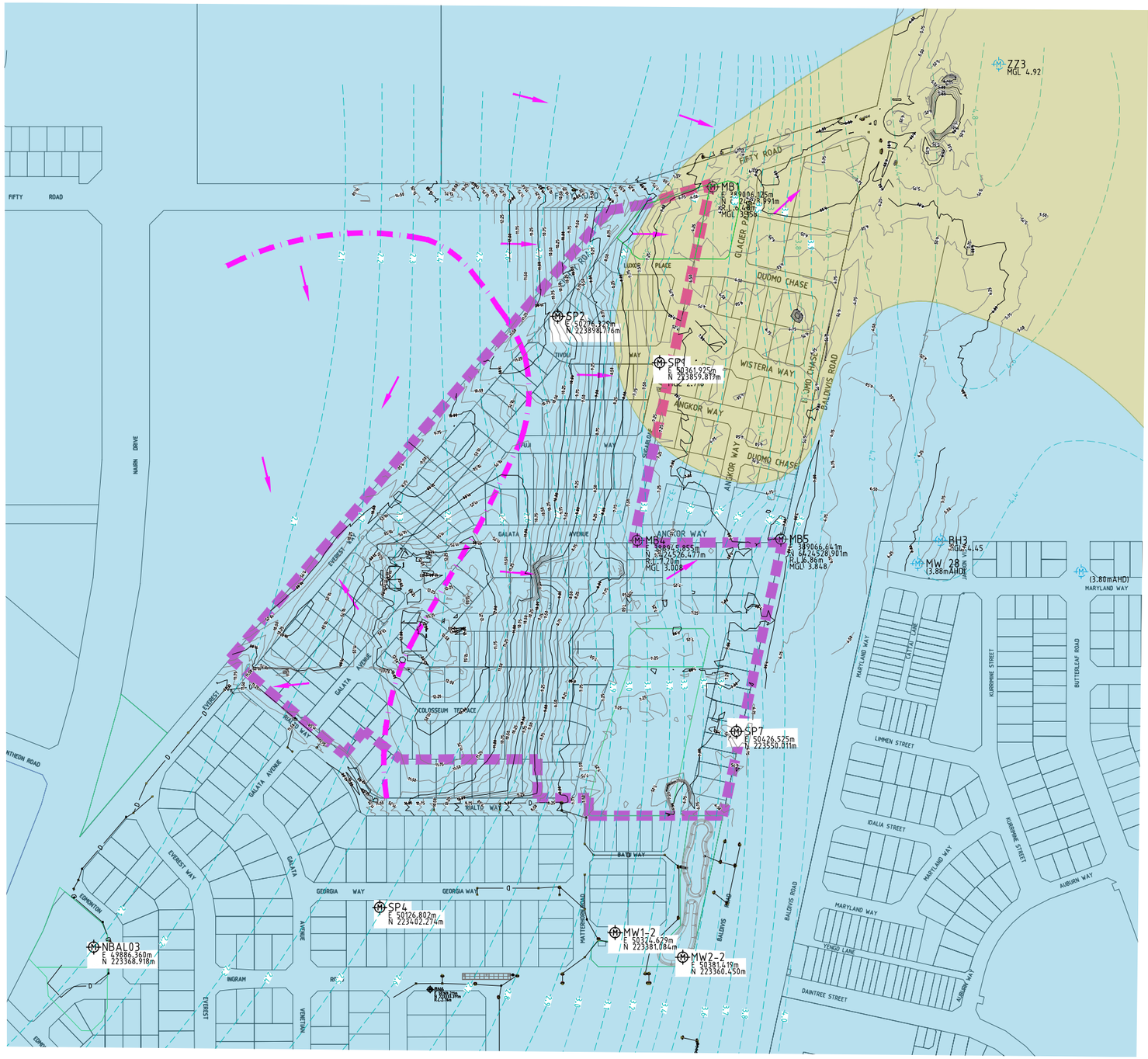
Figure 10

DEVELOPMENT
ENGINEERING
CONSULTANTS

APPENDIX B

DRAINAGE CATCHMENT PLANS

- **L-03: Predevelopment catchment plan**
- **L-04: Post development catchment plan**
- **L-05: Northern Basin Plan and Section**
- **L-06: Southern Basin Plan and Section**



LEGEND

- SITE BOUNARY
- 23 — EXISTING SURFACE CONTOURS
- 2.90 — 95% MGL WATER CONTOURS
- IMPLIED NATURAL RIDGE
- FLOW ARROW
- EX-MB, SP2 — EXISTING MONITORING BORE
- MB01 (NAME, E 452.036m, N 451.151m, R.L.7.00m) — PROPOSED MONITORING BORE
- SOIL TYPE - S8 BASSENDEAN SAND
- SOIL TYPE - M4 GUILDFORD FORMATION SILT

* SOIL TYPE PER PERTH ENVIRONMENTAL GEOLOGY MAPPING - ROCKINGHAM SHEET

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Ph: (08) 9481 1900
Fax: (08) 9481 1700

PROJECT: **THE SPIRES BALDIVIS STAGE 16B**
W.A.P.C. No. - 156452

DRAWING: **LOCAL WATER MANAGEMENT STRATEGY PRE-DEVELOPOMENT CATCHMENT PLAN**
COORDINATE SYSTEM: PCG94, VERTICAL DATUM: AHD

SCALE	DRAWN	CHECK	REV No.
1:2000	JEG	SRA	A
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14/9/23	JEG	SRA	

PROJECT NUMBER **BDVCAN26** DRAWING NUMBER **L03**

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AREA OF LOT 1 ALLOWED

NORTH CATCHMENT

SOUTH CATCHMENT

GLACIER PARADE

DUOMO CHASE

WISTERIA WAY

ANGKOR WAY

SWALE

MB1
E 50406.692m
N 224007.362m
R.L. 6.48
MGL 3.848

SP1
E 50361.925m
N 223859.819m
MGL 2.718

MB
E 50334.215m
N 223966.323m

SP2
E 50276.329m
N 223898.776m
MGL 3.35

SP7
E 50426.525m
N 223550.011m

MB
E 50324.706m
N 223549.281m

MB
E 50097.101m
N 223700.605m

PROPOSED NEW MONITORING BORE

PIPE THROUGH HILL

EVEREST WAY

GALATA AVENUE

FIFTY ROAD

BASIN DETAILS

TOTAL IMPERVIOUS AREA (1% AEP)	1.90ha
1% AEP STORAGE REQUIRED	1787m³
AREA AT TWL (1% AEP)	2483m²
RL (TWL) (1% AEP)	6.00m AHD
10% AEP STORAGE REQUIRED	788m³
AREA AT TWL (10% AEP)	1427m²
RL (TWL) (10% AEP)	5.51m AHD
20% AEP STORAGE REQUIRED	533m³
AREA AT TWL (20% AEP)	1256m²
RL (TWL) (20% AEP)	5.32m AHD
1EY STORAGE REQUIRED	203m³
AREA AT TWL (1EY)	924m²
RL (TWL) (1EY)	5.02m AHD
PEAK OUTFLOW (1% AEP)	0.0l/s

BASIN DETAILS

TOTAL IMPERVIOUS AREA (1% AEP)	2.37ha
1% AEP STORAGE REQUIRED	1939m³
AREA AT TWL (1% AEP)	3357m²
RL (TWL) (1% AEP)	6.94m AHD
10% AEP STORAGE REQUIRED	802m³
AREA AT TWL (10% AEP)	1171m²
RL (TWL) (10% AEP)	6.79m AHD
20% AEP STORAGE REQUIRED	606m³
AREA AT TWL (20% AEP)	1016m²
RL (TWL) (20% AEP)	6.61m AHD
1EY STORAGE REQUIRED	202m³
AREA AT TWL (1EY)	644m³
RL (TWL) (1EY)	6.12m AHD
PEAK OUTFLOW (1% AEP)	0.0l/s

LEGEND

- CATCHMENT AREA
- EXISTING SURFACE CONTOURS
- 95% MGL WATER CONTOURS
- DRAINAGE BASIN
- OVERLAND FLOW ARROW
- PIPE FLOW ARROW
- MB01 (NAME) E 680,258m N 467,982m R.L.0.00m (SURFACE LEVEL) 2.5m (DEPTH) Ø150 (BORE DIAMETER) — MONITORING BORE
- 63.2% AEP STORAGE
- 20% AEP STORAGE
- 10% AEP STORAGE
- 1% AEP STORAGE
- PROPOSED DRAINAGE PIPE, JUNCTION PIT & SIDE ENTRY PIT
- PROPOSED SUB-SOIL DRAINAGE PIPE, JUNCTION PIT & SIDE ENTRY PIT
- EXISTING DRAINAGE PIPE, JUNCTION PIT & SIDE ENTRY PIT

NOTE:
REFER TO DRAWING BDVCAN26 L05/L06 FOR BASIN DETAILS

CATCHMENT DATA

CATCHMENT	TOTAL (m²)	LOT AREA - RESIDENTIAL (m²)	LOT AREA - COMMERCIAL (m²)	ROAD RESERVE (m²)	POS (m²)
LOT 1	17609	3201	8379	4283	1746
2 (NORTH)	40169	23971	0	13030	3168
2 (NORTH) & LOT 1 COMBINED	57778	27172	8379	17313	4914
3 (SOUTH)	83090	47949	0	24430	10711

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F	19/12/24	EF	AMMENDED BASIN DETAILS	SRA
E	12/12/24	EF	PIPE FLOW DIRECTION ARROWS ADDED	SRA
D	18/11/24	PMS	BASIN DETAILS AND CATCHMENT AREAS UPDATED	SRA
C	2/08/24	PMS	SOUTH CATCHMENT BASIN LAYOUT UPDATED	SRA
B	23/1/24	JEG	MONITORING BORES AND SWALES ADDED	SRA
A	14/9/23	JEG	INITIAL ISSUE	SRA

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SPATIAL Property Group™

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Ph: (08) 9481 1900
Fax: (08) 9481 1700

PROJECT: THE SPIRES BALDIVIS STAGE 16B
W.A.P.C. No. - 156452, 200414

DRAWING: LOCAL WATER MANAGEMENT STRATEGY POST-DEVELOPMENT CATCHMENT PLAN
COORDINATE SYSTEM: PCG94, VERTICAL DATUM: AHD

SCALE	DRAWN	CHECK	REV No.
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DATE	DESIGNED	APPROVED	
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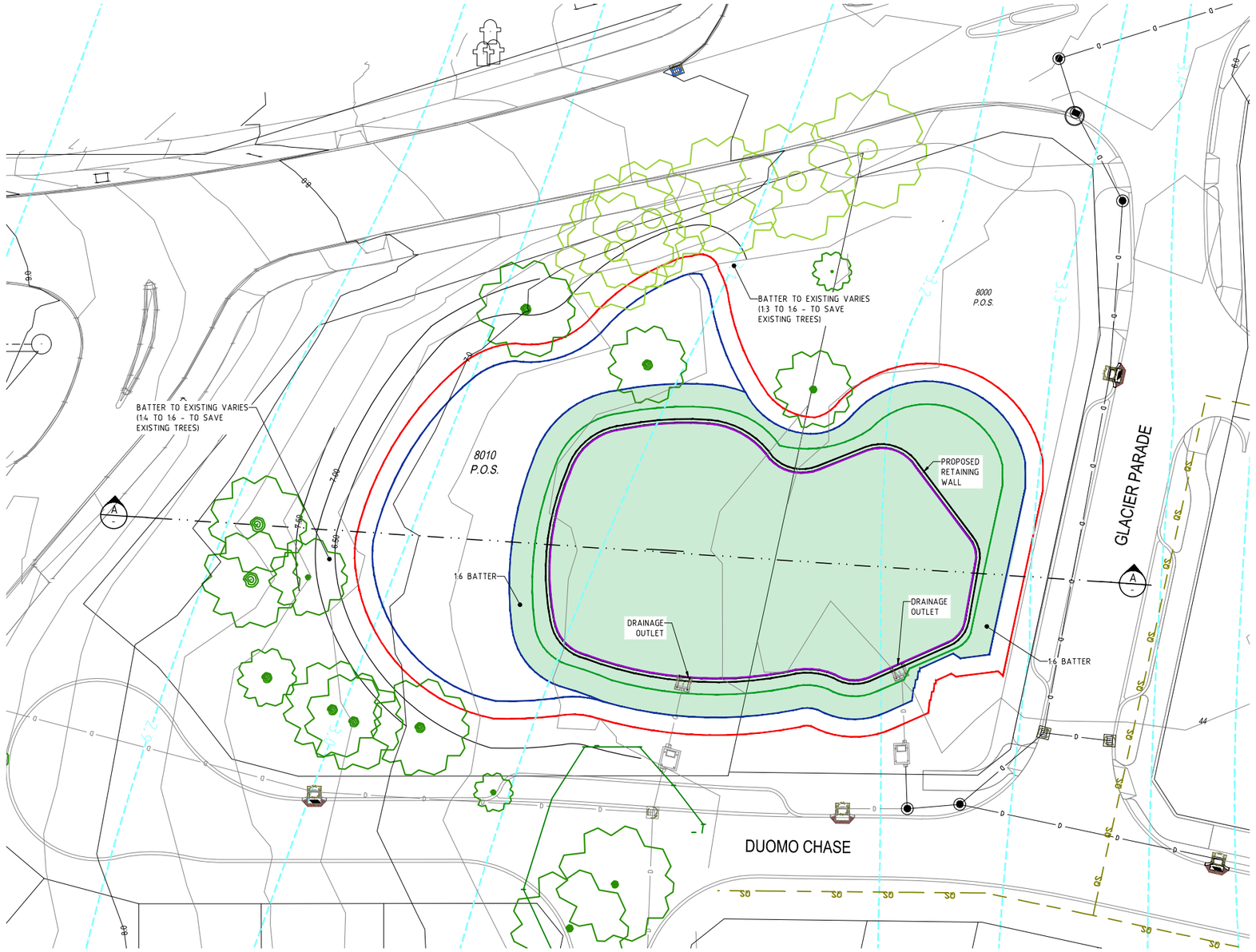
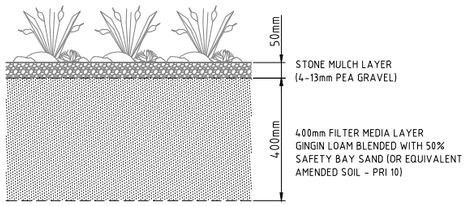


NORTH CATCHMENT BASIN PLAN
1:250

LEGEND

- 23 — NATURAL SURFACE CONTOURS
- DRAINAGE BASIN
- 23 — GROUND WATER CONTOURS
- 63.2% AEP STORAGE
- 20% AEP STORAGE
- 10% AEP STORAGE
- 1% AEP STORAGE
- PROPOSED DRAINAGE PIPE, JUNCTION PIT & SIDE ENTRY PIT
- PROPOSED SUB-SOIL DRAINAGE PIPE, JUNCTION PIT & SIDE ENTRY PIT
- EXISTING DRAINAGE PIPE, JUNCTION PIT & SIDE ENTRY PIT



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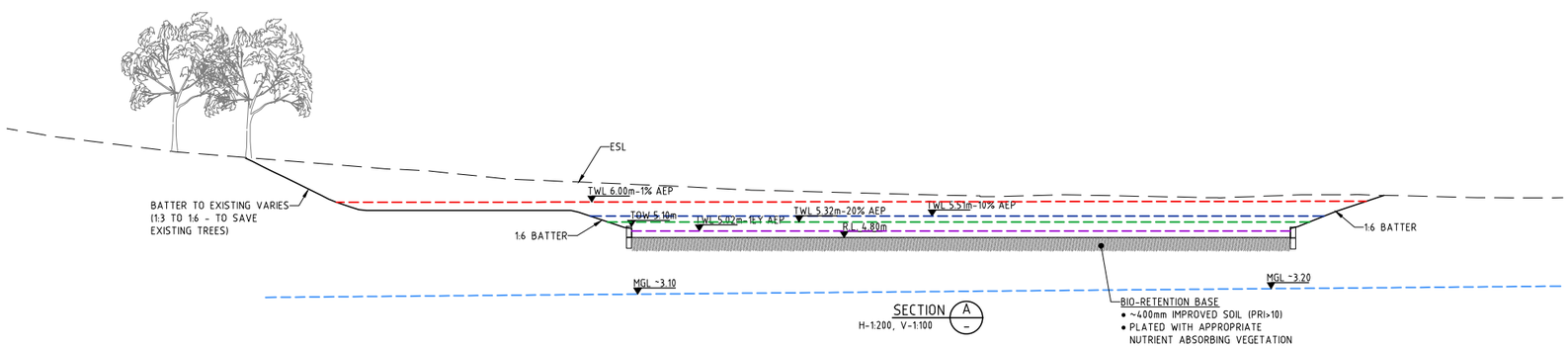

SECTION A
H-1:200, V-1:100

HORIZ- 1:200 (A1)
VERT- 1:100 (A1)
1:250 (A1)

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C	18/11/24	PMS	BASIN STORAGE LEVELS UPDATED	SRA
B	23/1/24	JEG	NOTATIONS AMENDED	SRA
A	14/9/23	JEG	INITIAL ISSUE	SRA

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SPATIAL Property Group

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WESTERN AUSTRALIA
Ph: (08) 9481 1900
Fax: (08) 9481 1700

PROJECT: THE SPIRES
BALDIVIS
STAGE 16B
W.A.P.C. No. - 156452, 200414

DRAWING: LOCAL WATER MANAGEMENT STRATEGY
NORTHERN CATCHMENT
BASIN DETAILS
COORDINATE SYSTEM: PCG94, VERTICAL DATUM: AHD

SCALE	DRAWN	CHECK	REV No.
1:250	JEG	SRA	C
DATE	DESIGNED	APPROVED	
14/9/23	JEG	SRA	

PROJECT NUMBER: BDVCAN26
DRAWING NUMBER: L05

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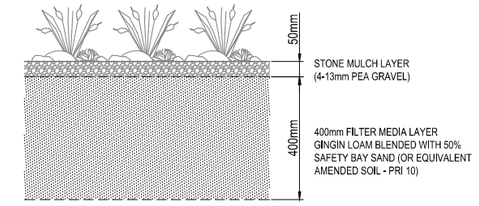
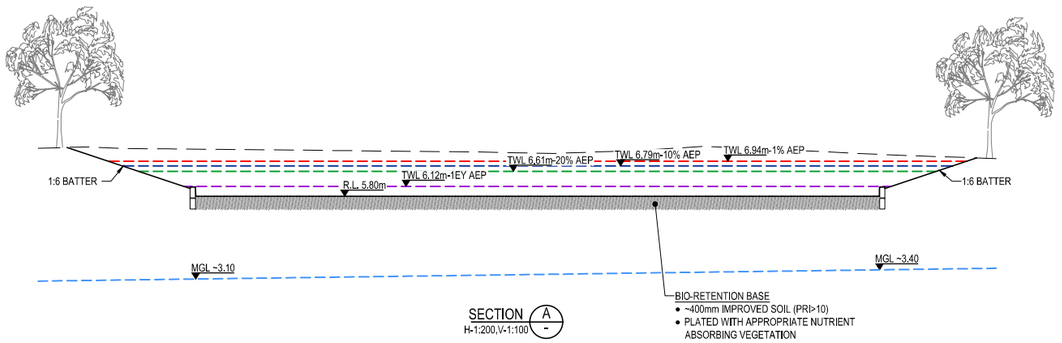
SOUTH CATCHMENT BASIN PLAN
1:250

LEGEND

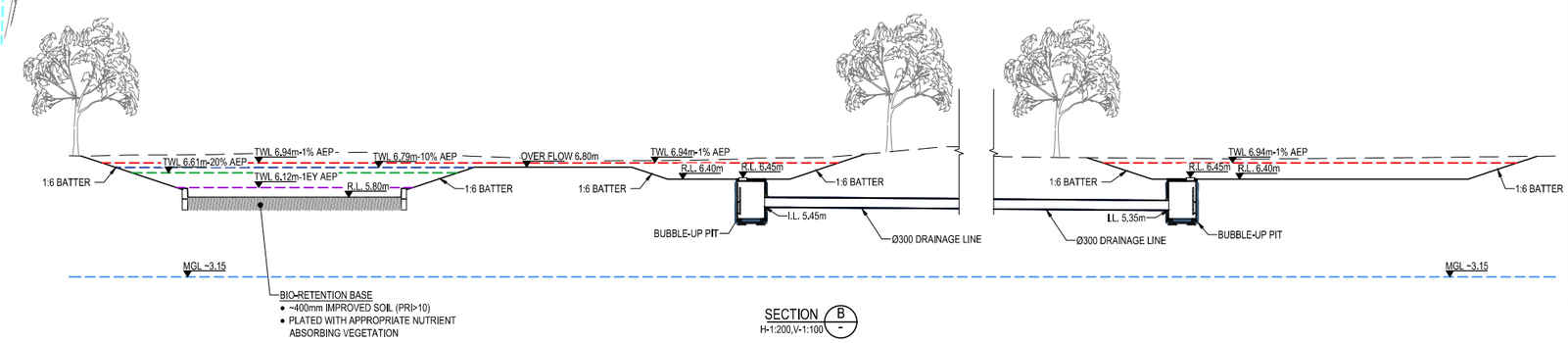
- 23 — NATURAL SURFACE CONTOURS
- DRAINAGE BASIN
- 23 — GROUND WATER CONTOURS
- 63.2% AEP STORAGE
- 20% AEP STORAGE
- 10% AEP STORAGE
- 1% AEP STORAGE
- PROPOSED DRAINAGE PIPE, JUNCTION PIT & SIDE ENTRY PIT
- PROPOSED SUB-SOIL DRAINAGE PIPE, JUNCTION PIT & SIDE ENTRY PIT
- D — EXISTING DRAINAGE PIPE, JUNCTION PIT & SIDE ENTRY PIT



BIOFILTER ELEMENTS SECTION
N.T.S.



SECTION A
H-1:200,V-1:100



SECTION B
H-1:200,V-1:100

HORIZ. 1:200 (A1)
VERT:- 1:100 (A1)
1:250 (A1)

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No.	DATE	BY	REVISION	
E	12/12/24	EF	ADDED DRAINAGE LAYOUT	SRA
D	18/11/24	PMS	BASIN STORAGE LEVELS UPDATED	SRA
C	5/08/24	PMS	SOUTH CATCHMENT BASIN LAYOUT UPDATED	SRA
B	23/1/24	JEG	NOTATIONS AMENDED	SRA
A	14/9/23	JEG	INITIAL ISSUE	SRA

CLIENT:
CARCIONE NOMINEES PTY LTD
SPATIAL Property Group™

DEVELOPMENT ENGINEERING CONSULTANTS
SUITE 3, 123A COLIN ST,
WEST PERTH, 6005
WESTERN AUSTRALIA
Ph: (08) 9481 1900
Fax: (08) 9481 1700

PROJECT:
THE SPIRES
BALDIVIS
STAGE 16B
W.A.P.C. No. - 156452, 200414

DRAWING:
LOCAL WATER MANAGEMENT STRATEGY
SOUTHERN CATCHMENT
BASIN DETAILS

SCALE	DRAWN	CHECK	REV No.
1:250	JEG	SRA	E
DATE	DESIGNED	APPROVED	
14/9/23	JEG	SRA	

PROJECT NUMBER: BDVCAN26 L06
DRAWING NUMBER
S:\CAN\BDVCAN26\Drawings\BDVCAN26 L06.dwg 12/12/2024

DEVELOPMENT
ENGINEERING
CONSULTANTS

APPENDIX C

DRAINAGE CALCULATIONS

- **Drainage basin calculations**
- **At-lot detention calculations**

Development Engineering Consultants - Drainage asin Spreadsheet

Project: Spires East - Catchment 3
Client: Carcione Nominees Pty Ltd
Location: Southern Catchment - Catchment 3
Designer: SRA

DEVELOPMENT ENGINEERING CONSULTANTS

Location: aldivis Road aldivis
Nearest grid cell: Latitude 32.3125(S) Longitude 115.8125(E)

Data to be input

			ARI	v Descriptor v
Rainfall AEP (percentage)	1			
1 EY - 1hr impervious catchment (Ha)	1.71		100	Infrequent
Required bio-retention area (2%) (m^2)	342			
Required storage (1EY - 1hr) (m^3)	257			
Available storage (m^3)	1939			
Soakage outflow (L/s/m^2)	0.007	*0.60 m/day*		

Catchment details	Roads	Community centre/ commercial	Group housing/ retirement	Standard lots (unconnected)	School/POS	Drainage basin	Total		
Gross area (Ha)	**2.4430**	**0**	**0**	**4.7 4**	**0. 405**	**0.1306**	**8.30 0**		
Runoff coefficient (C_{10})	0.70	0.28	0.22	0.11	0	1.00			
ARI multiplier	1.00	1.00	1.00	1.00	0.62	1.00			
Runoff coefficient (C_y)	0.70	0.28	0.22	0.11	0.00	1.00			
Impervious area (Ha)	**1.71**	**0.00**	**0.00**	**0.53**	**0.00**	**0.13**	**2.37**	**0.2**	**Effective C**

T_C (min)	T_C (hr)	I (mm/hr)	Q_{IN} (L/s)	$_{IN}$ (m^3)	Preliminary height (m)	Q_{OUT} (soa age) (L/s)	$_{OUT}$ (soa age) (m^3)	Net storage (after soa age) (m^3)	Time of water in basin (hr)	$_{OUT}$ re uired (m^3)	Q_{OUT} (L/s)
10	0.17	131.00	862	517	0.40	19.3	12	505	7.4	0	0.0
15	0.25	106.00	697	628	0.40	19.3	17	610	9.0	0	0.0
20	0.33	89.10	586	703	0.40	19.3	23	680	10.1	0	0.0
30	0.50	69.10	455	818	0.40	19.3	35	783	11.7	0	0.0
45	0.75	53.10	349	943	0.40	19.3	52	891	13.5	0	0.0
60	1.00	44.10	290	1044	0.40	19.3	70	975	15.0	0	0.0
90	1.50	34.20	225	1215	0.40	19.3	104	1110	17.4	0	0.0
120	2.00	28.60	188	1355	0.40	19.3	139	1215	19.5	0	0.0
150	2.50	25.00	164	1480	0.40	19.3	174	1306	21.3	0	0.0
180	3.00	22.50	148	1599	0.40	19.3	209	1390	23.0	0	0.0
240	4.00	19.00	125	1800	0.40	19.3	279	1521	25.8	0	0.0
300	5.00	16.70	110	1977	0.40	19.3	348	1629	28.4	0	0.0
360	6.00	15.00	99	2131	0.40	19.3	418	1714	30.6	0	0.0
480	8.00	12.60	83	2387	0.40	19.3	557	1830	34.3	0	0.0
720	12.00	9.76	64	2774	0.40	19.3	836	1938	39.8	0	0.0
960	16.00	8.02	53	3039	0.40	19.3	1114	1925	43.6	0	0.0
1440	24.00	5.95	39	3382	0.40	19.3	1671	1710	48.6	0	0.0
2880	48.00	3.35	22	3808	0.40	19.3	3343	465	54.7	0	0.0
4320	72.00	2.35	15	4007	0.40	19.3	5014	-1007	57.5	0	0.0

Project: Spires East - Catchment 3
Client: Carcione Nominees Pty Ltd
Location: Southern Catchment - Catchment 3
Designer: SRA

DEVELOPMENT ENGINEERING CONSULTANTS

Calculation of storage in above ground basin

Lower tier drainage basin dimensions:

Side slopes 1:	Length (m)	Breadth (m)
0	15	42

RL (Base) 5.8

TWL (mAHD)	Height (m)	Area at TWL (m^2)	Average area	olume (m^3)	Treatment storage above LWL (m^3)	The designated height allows storage for
5.8	0	630	2520	0	0	Static water level
6.08	0.28	630	2520	176	176	First 15mm
6.1	0.3	630	2520	189	189	1EY
6.1	0.3	630	2520	189	189	Top of Lower Tier

TOTAL STORAGE TO TOP OF LOWER TIER **18** m^3

Middle tier drainage basin dimensions:

Side Slopes 1:	Length (m)	Breadth (m)
6	15	42

RL (Base) 6.1

TWL (mAHD)	Height (m)	Total depth to TWL (m)	Area at TWL (m^2)	Average area	olume (m^3)	Total storage above LWL (m^3)	The Designated Height allows Storage for
6.1	0	0.3	630	2520	0	189	Bottom of Middle Tier
6.12	0.02	0.32	644	2547	13	202	1EY
6.61	0.51	0.81	1016	3255	417	606	20% AEP
6.79	0.69	0.99	1171	3532	613	802	10% AEP
6.94	0.84	1.14	1306	3771	799	988	Top of Middle Tier

TOTAL STORAGE TO TOP OF MIDDLE TIER **88** m^3

Upper tier drainage basin dimensions:

Side slopes 1:	Length (m)	Breadth (m)
6	53	28

RL (Base) 6.4

TWL (mAHD)	Height (m)	Total depth to TWL (m)	Area at TWL (m^2)	Average area	olume (m^3)	Total basin storage above LWL (m^3)	The designated height allows storage for
6.4	0	0	1484	5936	0	988	Bottom of upper tier
6.94	0.54	0.54	2051	7028	951	1939	1% AEP

TOTAL STORAGE TO TOP OF UPPER TIER **1 3** m^3

PCSump Version 6.1

Environmental and Water Resource Software

Project Number/Name: Spires East - BDVCAN26

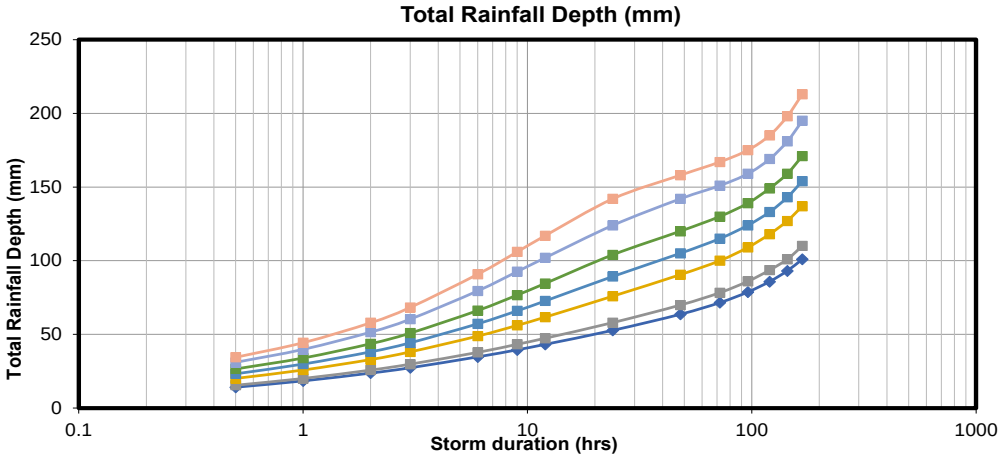
Project Description: Basin #3 - Central Basin - Southern Catchment

Model Selection:	Shallow Water Table Model
Design AEP(EY)/ARI	10% AEP (10 year ARI)
Design Rainfall Region:	Perth Metro
Design Rainfall Location:	Medina
Latitude:	-32.236185
Longitude:	115.805323
Temporal Pattern:	West Flatlands
Climate Change Selection (Y/N)	N
Effective Service Life	
Consequence of Failure	
Adjustment Applied	

Swale Selection (Y/N)	N

Total Rainfall Depth (mm)

Duration	EY	Annual Exceedance Probability (AEP)					
	1 EY	50%	20%	10%	5%	2%	1%
30 min	14.1	15.5	20.1	23.3	26.6	31	34.5
1 hour	18.4	20.1	25.8	29.9	34	39.8	44.4
2 hour	23.7	25.8	32.9	38.2	43.7	51.5	57.9
3 hour	27.3	29.8	38.1	44.3	50.9	60.3	68.3
6 hour	34.7	37.8	48.8	57.2	66.2	79.5	90.8
9 hour	39.5	43.3	56.1	66	76.7	92.6	106
12 hour	43.2	47.4	61.7	72.7	84.6	102	117
24 hour	52.7	58	75.9	89.3	104	124	142
48 hour	63.6	69.9	90.5	105	120	142	158
72 hour	71.5	78.3	100	115	130	151	167
96 hour	78.7	86	109	124	139	159	175
120 hour	85.8	93.6	118	133	149	169	185
144 hour	93.1	101	127	143	159	181	198
168 hour	101	110	137	154	171	195	213



Basin:

Type	Area (ha)	IL (mm)	CL (mm/hr)	PL(%)
Roads	2.443			30.0%
Resi Lots	4.7949	13.6	9.71	
Basin	0.1			0.0%
POS	0.975			100.0%

Basin Parameters:

Soil Characteristics:	
Saturated Hydraulic Cond. (m/day)	5
Clogged Layer Permeability (m/day)	
Clogged Layer Thickness (mm)	
Soil Suction (cm)	
Porosity	
Aquifer Storage Coefficient	0.2
Base of Aquifer (mAHD)	-16
Design Groundwater Level (mAHD)	3.2
Initial Conditions:	
Water Depth in Basin (m)	0
Wetting Front Depth (m)	0
Initial Degree of Soil Saturation (%)	20%
Basin Geometry:	
Stage-Area-Volume Relationship Entered (Y/N)	Y
Base Length (m)	40
Base Width (m)	12
Average Slope (1 in X)	13
Basin Base Elevation (mAHD)	5.8
Maximum Allowable TWL (mAHD)	7

Stage-Area-Volume Relationship:

Stage (mAHD)	Area (m^2)	Volume (m^3)
5.8	630	0
6.1	630	189
6.8	1179	814
6.805	2663	1299
7	3481	1955

Pipe Outflow:

Entrance Type	
Pipe Diameter (mm)	
Pipe Length (m)	
Upstream Invert Level (mAHD)	
Downstream Invert Level (mAHD)	

Weir Outflow:

Weir Type:	
Weir Coefficient	
Weir Width (m)	
Weir Level (mAHD)	

PCSUMP
Environmental and Water Resource Software

Project Number / Name:

Spires East - BDVCAN26

Project Description:

Basin #3 - Central Basin - Southern Catchment

Model Selection: **Shallow Water Table Model**

Results:

	Design Storms				Maximum (Mean of Temporal Patterns)					
	Storm	Duration hrs	Rainfall Depth mm	EY/AEP	Depth m	Level mAHD	Clearance to Allowable TWL m	olume m^3	Area m^2	Temporal Pattern No.
	1	30 min	34.5	1%	1.02	6.82	0.18	1,348	2,724	8
	2	1 hour	44.4	1%	1.12	6.92	0.08	1,685	3,144	7
	3	2 hour	57.9	1%	1.19	6.99	0.01	1,928	3,447	9
	4	3 hour	68.3	1%	1.19	6.99	0.01	1,903	3,416	2
	5	6 hour	90.8	1%	1.17	6.97	0.03	1,855	3,356	8
	6	9 hour	106.0	1%	1.16	6.96	0.04	1,832	3,328	1
	7	12 hour	117.0	1%	1	6.80	0.20	933	1,542	4
	8	24 hour	142.0	1%	0.75	6.55	0.45	586	979	7
	9	48 hour	158.0	1%	0	5.80	1.20	-	630	10
	10	72 hour	167.0	1%	0	5.80	1.20	-	630	1
Critical	***3***	***2 hour***	***57.9***	***1%***	***1.19***	***6.99***	***0.01***	***1,928***	***3,447***	***9***

Notes:

Temporal pattern matching closest to mean water level

If Water Level is coloured Red, Maximum Capacity of the Basin has been Exceeded

PCSUMP
Environmental and Water Resource Software

Project Number / Name:

Spires East - BDVCAN26

Project Description:

Basin #3 - Central Basin - Southern Catchment

Model Selection: **Shallow Water Table Model**

Results:

	Design Storms				Maximum (Mean of Temporal Patterns)					
	Storm	Duration hrs	Rainfall Depth mm	EY/AEP	Depth m	Level mAHD	Clearance to Allowable TWL m	olume m^3	Area m^2	Temporal Pattern No.
	1	30 min	23.3	10%	0.81	6.61	0.39	643	1,029	8
	2	1 hour	29.9	10%	0.99	6.79	0.21	802	1,169	7
	3	2 hour	38.2	10%	0.97	6.77	0.23	783	1,152	7
	4	3 hour	44.3	10%	0.97	6.77	0.23	788	1,156	6
	5	6 hour	57.2	10%	0.61	6.41	0.59	465	872	7
	6	9 hour	66.0	10%	0.37	6.17	0.83	255	688	2
	7	12 hour	72.7	10%	0.05	5.85	1.15	33	630	1
	8	24 hour	89.3	10%	0	5.80	1.20	-	630	10
	9	48 hour	105.0	10%	0	5.80	1.20	-	630	1
	10	72 hour	115.0	10%	0	5.80	1.20	-	630	1
Critical	***2***	***1 hour***	***29.9***	***10%***	***0.99***	***6.79***	***0.21***	***802***	***1,169***	***7***

Notes:

Temporal pattern matching closest to mean water level

If Water Level is coloured Red, Maximum Capacity of the Basin has been Exceeded

PCSUMP
Environmental and Water Resource Software

Project Number / Name:

Spires East - BDVCAN26

Project Description:

Basin #3 - Central Basin - Southern Catchment

Model Selection: **Shallow Water Table Model**

Results:

	Design Storms				Maximum (Mean of Temporal Patterns)					
	Storm	Duration hrs	Rainfall Depth mm	EY/AEP	Depth m	Level mAHD	Clearance to Allowable TWL m	olume m^3	Area m^2	Temporal Pattern No.
	1	30 min	20.1	20%	0.6	6.40	0.60	458	866	8
	2	1 hour	25.8	20%	0.76	6.56	0.44	599	990	2
	3	2 hour	32.9	20%	0.71	6.51	0.49	551	948	6
	4	3 hour	38.1	20%	0.61	6.41	0.59	464	871	6
	5	6 hour	48.8	20%	0.31	6.11	0.89	194	635	7
	6	9 hour	56.1	20%	0.13	5.93	1.07	82	630	6
	7	12 hour	61.7	20%	0.01	5.81	1.19	8	630	3
	8	24 hour	75.9	20%	0	5.80	1.20	-	630	9
	9	48 hour	90.5	20%	0	5.80	1.20	-	630	1
	10	72 hour	100.0	20%	0	5.80	1.20	-	630	1
Critical	***2***	***1 hour***	***25.8***	***20%***	***0.76***	***6.56***	***0.44***	***599***	***990***	***2***

Notes:

Temporal pattern matching closest to mean water level

If Water Level is coloured Red, Maximum Capacity of the Basin has been Exceeded

PCSUMP
Environmental and Water Resource Software

Project Number / Name:

Spires East - BDVCAN26

Project Description:

Basin #3 - Central Basin - Southern Catchment

Model Selection: **Shallow Water Table Model**

Results:

	Design Storms				Maximum (Mean of Temporal Patterns)					
	Storm	Duration hrs	Rainfall Depth mm	EY/AEP	Depth m	Level mAHD	Clearance to Allowable TWL m	olume m^3	Area m^2	Temporal Pattern No.
	1	30 min	14.1	1 EY	0.23	6.03	0.97	143	630	1
	2	1 hour	18.4	1 EY	0.31	6.11	0.89	200	640	7
	3	2 hour	23.7	1 EY	0.27	6.07	0.93	171	630	2
	4	3 hour	27.3	1 EY	0.08	5.88	1.12	47	630	1
	5	6 hour	34.7	1 EY	0	5.80	1.20	-	630	10
	6	9 hour	39.5	1 EY	0	5.80	1.20	-	630	10
	7	12 hour	43.2	1 EY	0	5.80	1.20	-	630	9
	8	24 hour	52.7	1 EY	0	5.80	1.20	-	630	1
	9	48 hour	63.6	1 EY	0	5.80	1.20	-	630	1
	10	72 hour	71.5	1 EY	0	5.80	1.20	-	630	1
Critical	***2***	***1 hour***	***18.4***	***1 EY***	***0.31***	***6.11***	***0.89***	***200***	***640***	***7***

Notes:

Temporal pattern matching closest to mean water level

If Water Level is coloured Red, Maximum Capacity of the Basin has been Exceeded

Development Engineering Consultants - Drainage asin Spreadsheet

Project: Spires East - Catchment 2

Client: Carcione Nominees Pty Ltd

Location: Northern Catchment - Catchment 2 Combined with Lot 1 asin

Designer: SRA

DEVELOPMENT ENGINEERING CONSULTANTS

Location: aldivis Road aldivis

Nearest grid cell: Latitude 32.3125(S) Longitude 115.8125(E)

Data to be input

Rainfall AEP (percentage)	1	ARI	**v** Descriptor **v**
1 EY - 1hr impervious catchment (Ha)	1.21	100	Infrequent
Required bio-retention area (2%) (m^2)	242		
Required storage (1EY - 1hr) (m^3)	182		
Available storage (m^3)	1787		
Soakage outflow (L/s/m^2)	0.006	*0.50 m/day*	

Catchment details	Roads	Community centre/ commercial	Group housing/ retirement	Standard lots (unconnected)	School/POS	Drainage basin	Total		
Gross area (Ha)	**1.7313**	**0.837**	**0**	**2.7172**	**0.3344**	**0.1570**	**5.7778**		
Runoff coefficient (C_{10})	0.70	0.28	0.22	0.11	0	1.00			
ARI multiplier	1.00	1.00	1.00	1.00	0.62	1.00			
Runoff coefficient (C_y)	0.70	0.28	0.22	0.11	0.00	1.00			
Impervious area (Ha)	**1.21**	**0.23**	**0.00**	**0.30**	**0.00**	**0.16**	**1. 0**	**0.33**	**Effective C**

T_C (min)	T_C (hr)	I (mm/hr)	Q_{IN} (L/s)	$_{IN}$ (m^3)	Preliminary height (m)	Q_{OUT} (soa age) (L/s)	$_{OUT}$ (soa age) (m^3)	Net storage (after soa age) (m^3)	Time of water in basin (hr)	$_{OUT}$ re uired (m^3)	Q_{OUT} (L/s)
10	0.17	131.00	692	415	0.30	14.0	8	407	8.2	0	0.0
15	0.25	106.00	560	504	0.30	14.0	13	492	10.0	0	0.0
20	0.33	89.10	471	565	0.30	14.0	17	548	11.2	0	0.0
30	0.50	69.10	365	657	0.30	14.0	25	632	13.0	0	0.0
45	0.75	53.10	281	758	0.30	14.0	38	720	15.0	0	0.0
60	1.00	44.10	233	839	0.30	14.0	51	788	16.6	0	0.0
90	1.50	34.20	181	976	0.30	14.0	76	900	19.3	0	0.0
120	2.00	28.60	151	1088	0.30	14.0	101	987	21.5	0	0.0
150	2.50	25.00	132	1189	0.30	14.0	126	1063	23.5	0	0.0
180	3.00	22.50	119	1284	0.30	14.0	152	1133	25.4	0	0.0
240	4.00	19.00	100	1446	0.30	14.0	202	1244	28.6	0	0.0
300	5.00	16.70	88	1588	0.30	14.0	253	1336	31.4	0	0.0
360	6.00	15.00	79	1712	0.30	14.0	303	1409	33.9	0	0.0
480	8.00	12.60	67	1918	0.30	14.0	404	1513	37.9	0	0.0
720	12.00	9.76	52	2228	0.30	14.0	606	1622	44.1	0	0.0
960	16.00	8.02	42	2441	0.30	14.0	809	1633	48.3	0	0.0
1440	24.00	5.95	31	2717	0.30	14.0	1213	1504	53.8	0	0.0
2880	48.00	3.35	18	3059	0.30	14.0	2426	634	60.5	0	0.0
4320	72.00	2.35	12	3219	0.30	14.0	3638	-419	63.7	0	0.0

Project: Spires East - Catchment 2
Client: Carcione Nominees Pty Ltd
Location: Northern Catchment - Catchment 2 Combined with Lot 1 asin
Designer: SRA

DEVELOPMENT ENGINEERING CONSULTANTS

Calculation of storage in above ground basin

Lower tier drainage basin dimensions:

Side slopes 1:	Length (m)	Breadth (m)
0	42	22

RL (Base) 4.8

TWL (mAHD)	Height (m)	Area at TWL (m^2)	Average area	olume (m^3)	Treatment storage above LWL (m^3)	The designated height allows storage for
4.8	0	924	3696	0	0	Static water level
5.02	0.22	924	3696	203	203	First 15mm
5.02	0.22	924	3696	203	203	1EY
5.1	0.3	924	3696	277	277	Top of Lower Tier

TOTAL STORAGE TO TOP OF LOWER TIER **277** m^3

Middle tier drainage basin dimensions:

Side Slopes 1:	Length (m)	Breadth (m)
6	42	25.5

RL (Base) 5.1

TWL (mAHD)	Height (m)	Total depth to TWL (m)	Area at TWL (m^2)	Average area	olume (m^3)	Total storage above LWL (m^3)	The Designated Height allows Storage for
5.1	0	0.3	1071	4284	0	277	Bottom of Middle Tier
5.32	0.22	0.52	1256	4647	256	533	20% AEP
5.51	0.41	0.71	1427	4972	510	788	10% AEP
5.66	0.56	0.86	1570	5236	735	1012	Top of Middle Tier

TOTAL STORAGE TO TOP OF MIDDLE TIER **1012** m^3

Upper tier drainage basin dimensions:

Side slopes 1:	Length (m)	Breadth (m)
6	62	33.5

RL (Base) 5.66

TWL (mAHD)	Height (m)	Total depth to TWL (m)	Area at TWL (m^2)	Average area	olume (m^3)	Total basin storage above LWL (m^3)	The designated height allows storage for
5.66	0	0.86	2077	8308	0	1012	Bottom of upper tier
6	0.34	1.2	2483	9104	774	1787	1% AEP

TOTAL STORAGE TO TOP OF UPPER TIER **1787** m^3

PCSump Version 6.1

Environmental and Water Resource Software

Project Number/Name: Spires East - BDVCAN26

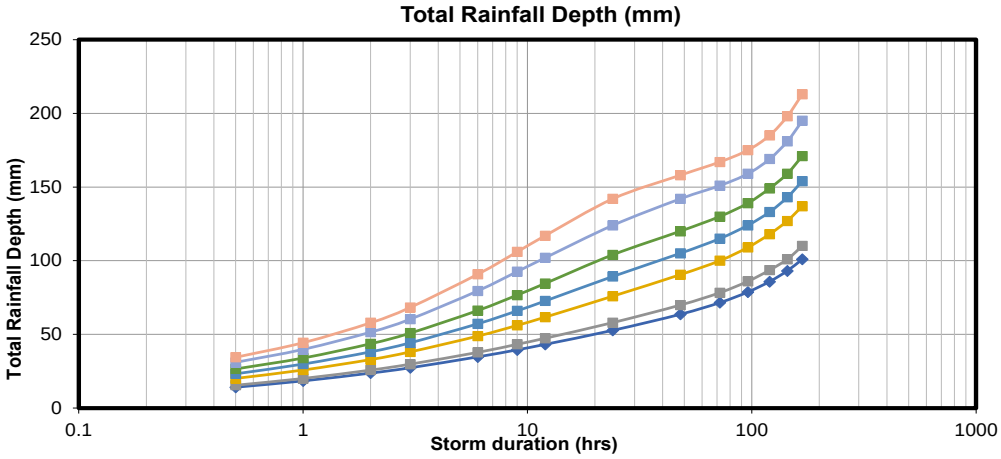
Project Description: Basin #2 - North East Corner (Combined with Lot 1 Basin)

Model Selection:	Shallow Water Table Model
Design AEP(EY)/ARI	1% AEP (100 year ARI)
Design Rainfall Region:	Perth Metro
Design Rainfall Location:	Medina
Latitude:	-32.236185
Longitude:	115.805323
Temporal Pattern:	West Flatlands
Climate Change Selection (Y/N)	N
Effective Service Life	
Consequence of Failure	
Adjustment Applied	

Swale Selection (Y/N)	N

Total Rainfall Depth (mm)

Duration	EY	Annual Exceedance Probability (AEP)					
	1 EY	50%	20%	10%	5%	2%	1%
30 min	14.1	15.5	20.1	23.3	26.6	31	34.5
1 hour	18.4	20.1	25.8	29.9	34	39.8	44.4
2 hour	23.7	25.8	32.9	38.2	43.7	51.5	57.9
3 hour	27.3	29.8	38.1	44.3	50.9	60.3	68.3
6 hour	34.7	37.8	48.8	57.2	66.2	79.5	90.8
9 hour	39.5	43.3	56.1	66	76.7	92.6	106
12 hour	43.2	47.4	61.7	72.7	84.6	102	117
24 hour	52.7	58	75.9	89.3	104	124	142
48 hour	63.6	69.9	90.5	105	120	142	158
72 hour	71.5	78.3	100	115	130	151	167
96 hour	78.7	86	109	124	139	159	175
120 hour	85.8	93.6	118	133	149	169	185
144 hour	93.1	101	127	143	159	181	198
168 hour	101	110	137	154	171	195	213



Basin:

Type	Area (ha)	IL (mm)	CL (mm/hr)	PL(%)
Roads	1.7313			30.0%
Resi Lots	3.7172	13.6	9.71	
Basin	0.15			0.0%
POS	0.3414			100.0%
Comm Lots	0.8379	24.43	4.57	

Basin Parameters:

Soil Characteristics:	
Saturated Hydraulic Cond. (m/day)	5
Clogged Layer Permeability (m/day)	
Clogged Layer Thickness (mm)	
Soil Suction (cm)	
Porosity	
Aquifer Storage Coefficient	0.2
Base of Aquifer (mAHD)	-16
Design Groundwater Level (mAHD)	3.2
Initial Conditions:	
Water Depth in Basin (m)	0
Wetting Front Depth (m)	0
Initial Degree of Soil Saturation (%)	20%
Basin Geometry:	
Stage-Area-Volume Relationship Entered (Y/N)	Y
Base Length (m)	40.5
Base Width (m)	21
Average Slope (1 in X)	6.5
Basin Base Elevation (mAHD)	4.8
Maximum Allowable TWL (mAHD)	6

Pipe Outflow:

Entrance Type	
Pipe Diameter (mm)	
Pipe Length (m)	
Upstream Invert Level (mAHD)	
Downstream Invert Level (mAHD)	

Weir Outflow:

Weir Type:	
Weir Coefficient	
Weir Width (m)	
Weir Level (mAHD)	

Stage-Area-Volume Relationship:

Stage (mAHD)	Area (m^2)	Volume (m^3)
4.8	924	0
5.1	924	277
5.105	1071	278
5.66	1570	1012
5.6605	2077	1015
6	2483	1787

PCSUMP
Environmental and Water Resource Software

Project Number / Name:

Spires East - BDVCAN26

Project Description:

Basin #2 - North East Corner (Combined with Lot 1 Basin)

Model Selection: **Shallow Water Table Model**

Results:

	Design Storms				Maximum (Mean of Temporal Patterns)					
	Storm	Duration hrs	Rainfall Depth mm	EY/AEP	Depth m	Level mAHD	Clearance to Allowable TWL m	olume m^3	Area m^2	Temporal Pattern No.
	1	30 min	34.5	1%	0.9	5.70	0.30	1,115	2,129	8
	2	1 hour	44.4	1%	1.05	5.85	0.15	1,454	2,308	7
	3	2 hour	57.9	1%	1.18	5.98	0.02	1,745	2,461	4
	4	3 hour	68.3	1%	1.2	6.00	0.00	1,796	2,488	1
	5	6 hour	90.8	1%	1.22	6.02	-0.02	1,831	2,506	8
	6	9 hour	106.0	1%	1.24	6.04	-0.04	1,884	2,534	1
	7	12 hour	117.0	1%	1	5.80	0.20	1,333	2,244	9
	8	24 hour	142.0	1%	0.79	5.59	0.41	918	1,506	10
	9	48 hour	158.0	1%	0.22	5.02	0.98	207	924	3
	10	72 hour	167.0	1%	0.06	4.86	1.14	57	924	3
Critical	***6***	***9 hour***	***106.0***	***1%***	***1.24***	***6.04***	***-0.04***	***1,884***	***2,534***	***1***

Notes:

Temporal pattern matching closest to mean water level

If Water Level is coloured Red, Maximum Capacity of the Basin has been Exceeded

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PCSUMP
Environmental and Water Resource Software

Project Number / Name:

Spires East - BDVCAN26

Project Description:

Basin #2 - North East Corner (Combined with Lot 1 Basin)

Model Selection: **Shallow Water Table Model**

Results:

	Design Storms				Maximum (Mean of Temporal Patterns)					
	Storm	Duration hrs	Rainfall Depth mm	EY/AEP	Depth m	Level mAHD	Clearance to Allowable TWL m	olume m^3	Area m^2	Temporal Pattern No.
	1	30 min	23.3	10%	0.47	5.27	0.73	500	1,222	8
	2	1 hour	29.9	10%	0.63	5.43	0.57	705	1,361	6
	3	2 hour	38.2	10%	0.66	5.46	0.54	751	1,393	2
	4	3 hour	44.3	10%	0.69	5.49	0.51	787	1,417	4
	5	6 hour	57.2	10%	0.54	5.34	0.66	587	1,281	4
	6	9 hour	66.0	10%	0.42	5.22	0.78	431	1,175	3
	7	12 hour	72.7	10%	0.28	5.08	0.92	259	924	5
	8	24 hour	89.3	10%	0.07	4.87	1.13	63	924	1
	9	48 hour	105.0	10%	0	4.80	1.20	-	924	1
	10	72 hour	115.0	10%	0	4.80	1.20	-	924	10
Critical	***4***	***3 hour***	***44.3***	***10%***	***0.69***	***5.49***	***0.51***	***787***	***1,417***	***4***

Notes:

Temporal pattern matching closest to mean water level

If Water Level is coloured Red, Maximum Capacity of the Basin has been Exceeded

PCSump Version 6.1: Licenced to Development Engineering Consultants

PCSUMP
Environmental and Water Resource Software

Project Number / Name:

Spires East - BDVCAN26

Project Description:

Basin #2 - North East Corner (Combined with Lot 1 Basin)

Model Selection: **Shallow Water Table Model**

Results:

	Design Storms				Maximum (Mean of Temporal Patterns)					
	Storm	Duration hrs	Rainfall Depth mm	EY/AEP	Depth m	Level mAHD	Clearance to Allowable TWL m	olume m^3	Area m^2	Temporal Pattern No.
	1	30 min	20.1	20%	0.37	5.17	0.83	358	1,126	8
	2	1 hour	25.8	20%	0.47	5.27	0.73	491	1,216	2
	3	2 hour	32.9	20%	0.5	5.30	0.70	529	1,242	6
	4	3 hour	38.1	20%	0.47	5.27	0.73	490	1,215	9
	5	6 hour	48.8	20%	0.36	5.16	0.84	344	1,116	3
	6	9 hour	56.1	20%	0.27	5.07	0.93	245	924	7
	7	12 hour	61.7	20%	0.12	4.92	1.08	107	924	10
	8	24 hour	75.9	20%	0.02	4.82	1.18	21	924	10
	9	48 hour	90.5	20%	0	4.80	1.20	-	924	1
	10	72 hour	100.0	20%	0	4.80	1.20	-	924	10
Critical	***3***	***2 hour***	***32.9***	***20%***	***0.5***	***5.30***	***0.70***	***529***	***1,242***	***6***

Notes:

Temporal pattern matching closest to mean water level

If Water Level is coloured Red, Maximum Capacity of the Basin has been Exceeded

PCSUMP
Environmental and Water Resource Software

Project Number / Name:

Spires East - BDVCAN26

Project Description:

Basin #2 - North East Corner (Combined with Lot 1 Basin)

Model Selection: **Shallow Water Table Model**

Results:

	Design Storms				Maximum (Mean of Temporal Patterns)					
	Storm	Duration hrs	Rainfall Depth mm	EY/AEP	Depth m	Level mAHD	Clearance to Allowable TWL m	olume m^3	Area m^2	Temporal Pattern No.
	1	30 min	14.1	1 EY	0.13	4.93	1.07	118	924	1
	2	1 hour	18.4	1 EY	0.22	5.02	0.98	200	924	2
	3	2 hour	23.7	1 EY	0.2	5.00	1.00	185	924	3
	4	3 hour	27.3	1 EY	0.15	4.95	1.05	134	924	1
	5	6 hour	34.7	1 EY	0.03	4.83	1.17	30	924	1
	6	9 hour	39.5	1 EY	0	4.80	1.20	-	924	10
	7	12 hour	43.2	1 EY	0	4.80	1.20	-	924	9
	8	24 hour	52.7	1 EY	0	4.80	1.20	-	924	1
	9	48 hour	63.6	1 EY	0	4.80	1.20	-	924	1
	10	72 hour	71.5	1 EY	0	4.80	1.20	-	924	1
Critical	***2***	***1 hour***	***18.4***	***1 EY***	***0.22***	***5.02***	***0.98***	***200***	***924***	***2***

Notes:

Temporal pattern matching closest to mean water level

If Water Level is coloured Red, Maximum Capacity of the Basin has been Exceeded

Project: Spires West Structure Plan
Client: Carcione Nominees Pty Ltd
Location: At-lot detention calculations to establish runoff coefficient
Designer: SRA

DEVELOPMENT ENGINEERING CONSULTANTS

Location:	**aldivis Road**			
Nearest grid cell:	**Latitude**	**32.3125(S)**	**Longitude**	**115.8125(E)**

Data to be input

Rainfall AEP (percentage)	1	ARI	v Descriptor v
1EY impervious catchment (Ha)	0.025	100	Infrequent
Required storage (1EY - 1hr) (m^3)	3.881		

Catchment details	Paved area	Unpaved area	Total
Lot area (m^2)			**400.00**
Proportion paved	**70**	**30**	**100**
Area paved (Ha)	**0.028**	**0.012**	**0.040**
Runoff coefficient (C_{10})	0.90	0.00	
ARI multiplier	1.00	1.20	
Runoff coefficient (C_y)	0.90	0.00	
Impervious area (Ha)	**0.025**	**0.000**	**0.025**

Effective C
0.63

AEP	ARI	Effective C	Multiplier
63.2	1	0	-
50	1.44	0	-
20	4.48	0	-
10	9.49	0	-
5	20	0	-
2	50	0.05	-
1	100	0.11	-

olume and dimensions of available storage

Area above ground inundated to 0.03m deep (backyard and front yard) (m^2)	40.00	0.03	1.20
Storage provided manholes/pipe (m^3)	-		
Number of soakwells	2.00		
Diameter of soakwells (m)	1.50		
Depth of each soakwell (m)	1.20		
Storage required soakwells (m^3)	**4.24**		
Strorage provided (m^3)	5.44		
Effective Initial Loss (mm)	**13.60**		
Soakage rate (L/s/m^2)	0.020	*1.70 m/day*	

NOTE: All water is retained in soakwells up to and including 5% AEP (1 in 20yr ARI) without surcharge. For greater AEP storms water will surcharge soakwells and soak over an area of 40m^2 to a maximum depth of 30mm within the lot, and then enter the road drainage system.

olume of storage re uired is 1m^3 per 5 .42 m^2 of paved lot area

olume of storage re uired is 1m^3 per 73.51 m^2 of total lot area

T_C (min)	T_C (hr)	I (mm/hr)	Q_{IN} (L/s)	Total $_{IN}$ (m^3)	Q_{OUT} (soa age) (L/s)	Effective Continuing Loss (mm/hr)	OUT (soa age) (m^3)	Net storage (after soa age) (m^3)	OUT re uired (m^3)	Q_{OUT} (L/s)
10	0.17	131.00	9.2	5.50	1.08	**.71**	0.65	4.85	0.00	0.00
15	0.25	106.00	7.4	6.68	1.08	**.71**	0.97	5.71	0.27	0.30
20	0.33	89.10	6.2	7.48	1.08	**.71**	1.29	6.19	0.75	0.62
30	0.50	69.10	4.8	8.71	1.08	**.71**	1.94	6.76	1.32	0.74
45	0.75	53.10	3.7	10.04	1.08	**.71**	2.91	7.12	1.68	0.62
60	1.00	44.10	3.1	11.11	1.08	**.71**	3.88	7.23	1.79	0.50
90	1.50	34.20	2.4	12.93	1.08	**.71**	5.83	7.10	1.66	0.31
120	2.00	28.60	2.0	14.41	1.08	**.71**	7.77	6.64	1.20	0.17
150	2.50	25.00	1.8	15.75	1.08	**.71**	9.71	6.04	0.60	0.07
180	3.00	22.50	1.6	17.01	1.08	**.71**	11.65	5.36	0.00	0.00
240	4.00	19.00	1.3	19.15	1.08	**.71**	15.54	3.61	0.00	0.00
300	5.00	16.70	1.2	21.04	1.08	**.71**	19.42	1.62	0.00	0.00
360	6.00	15.00	1.1	22.68	1.08	**.71**	23.31	-0.63	0.00	0.00
480	8.00	12.60	0.9	25.40	1.08	**.71**	31.08	-5.68	0.00	0.00
720	12.00	9.76	0.7	29.51	1.08	**.71**	46.62	-17.10	0.00	0.00
960	16.00	8.02	0.6	32.34	1.08	**.71**	62.16	-29.82	0.00	0.00
1440	24.00	5.95	0.4	35.99	1.08	**.71**	93.23	-57.25	0.00	0.00
2880	48.00	3.35	0.2	40.52	1.08	**.71**	186.47	-145.95	0.00	0.00
4320	72.00	2.35	0.2	42.64	1.08	**.71**	279.70	-237.07	0.00	0.00

DEVELOPMENT
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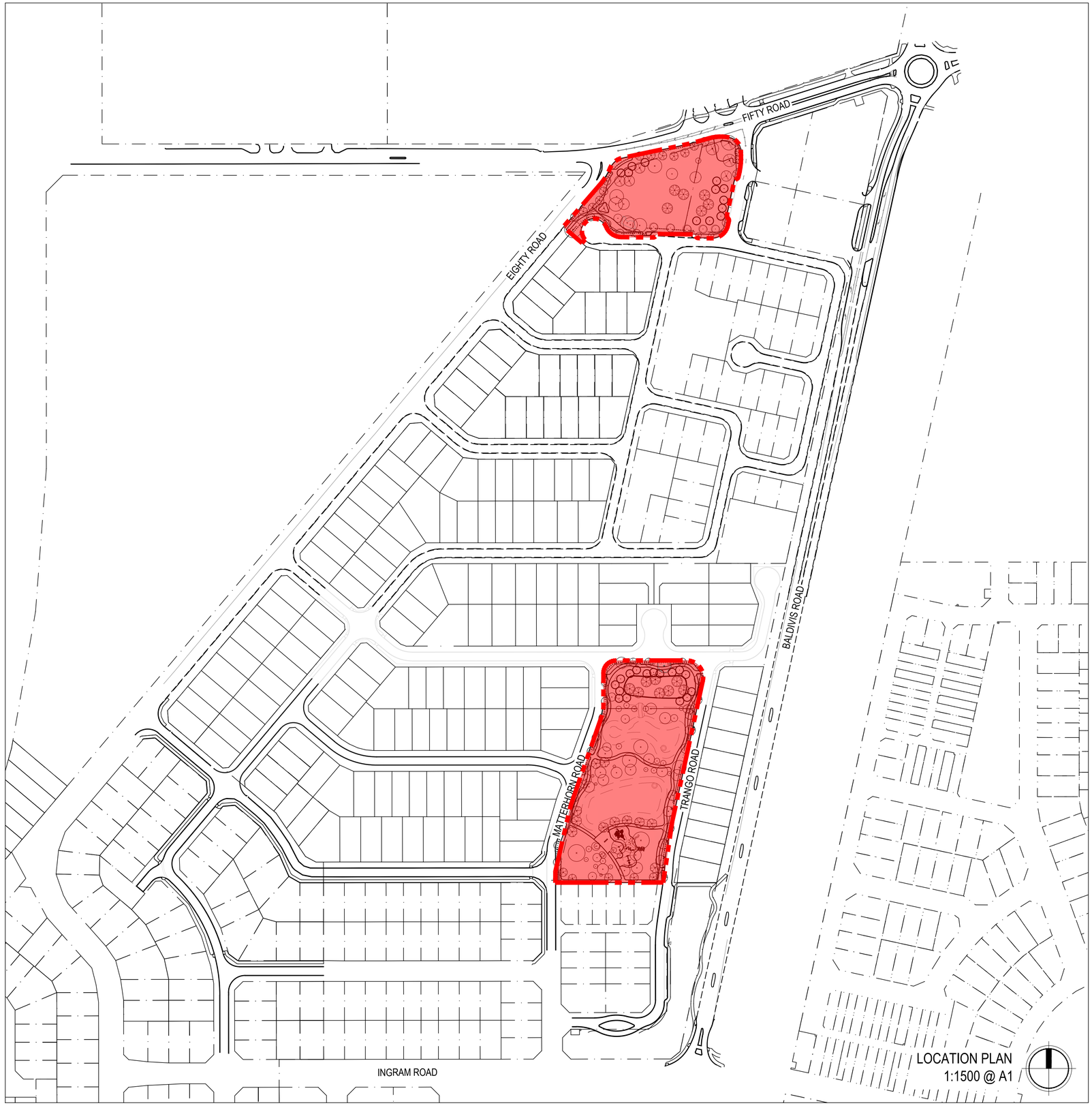
APPENDIX D
DRAINAGE DETAILS

- **Landscape concept plan**



SPIRES ESTATES

BALDIVIS, WA

STAGE 16B

NORTHEN POS & SOUTHERN POS

LANDSCAPE CONTRACT: IR34

LANDSCAPE & IRRIGATION WORKS

CLIENT:CARCIONE NOMINEES PTY LTD

ISSUE FOR: ***COUNCIL APPROVAL***

DATE: **SEPTEMBER 2024**

Sheet List Table

SHEET	REVISION	SHEET TITLE
IR34-000	B	COVER PAGE
IR34-300	B	NORTHEN POS - GRADING PLAN
IR34-400	B	NORTHEN POS - FINISHES PLAN
IR34-500	B	NORTHEN POS - PLANTING PLAN
IR34-301	B	SOUTHERN POS - GRADING PLAN
IR34-401	B	SOUTHERN POS - FINISHES PLAN
IR34-501	B	SOUTHERN POS - PLANTING PLAN
IR34-900	B	HARDSCAPE DETAILS
IR34-910	B	WALLS DETAILS
IR34-920	B	CUSTOM SHELTER 1 OF 3
IR34-921	B	CUSTOM SHELTER 2 OF 3
IR34-922	B	CUSTOM SHELTER 3 OF 3
IR34-950	B	FURNITURE DETAILS
IR34-960	B	PLAY EQUIPMENT
IR34-970	B	SOFTWORKS DETAILS

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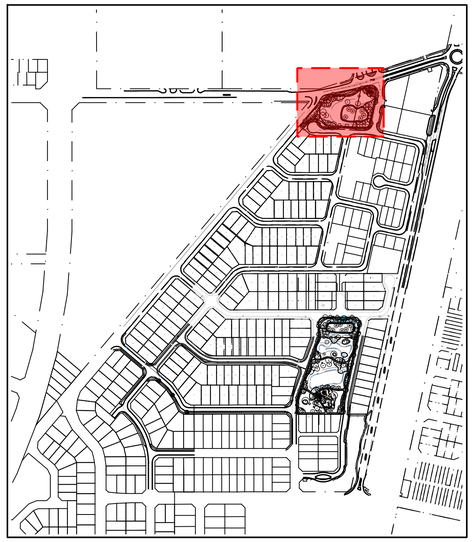

LOCATION PLAN

FIFTY ROAD

EIGHTY ROAD

LUXOR PLACE

DUOMO CHASE

GLACIER PARADE

950 / 901 BENCH SEAT ON CONCRETE PAD

ROLL ON TURF

A1 / 920 CUSTOM SHELTER WITH 2X PICNIC SETTING & LED STRIP LIGHTING.

3 / 950 FIXED BOLLARDS

POLE TOP LIGHT 9 / 950

MK

BB

5 / 950 2x RUBBISH BIN

2 / 900 REINFORCED CONCRETE MAINTENANCE CROSSING BY CIVIL

6 / 950 CITY OF ROCKINGHAM STANDARD MAINTENANCE GATE

5 / 900 CONCRETE MOW KERB

1 / 950 BENCH SEAT ON CONCRETE PAD

2 / 910 LIMESTONE WALL

PRELIMINARY
NOT FOR CONSTRUCTION
INFORMATION ONLY

LEGEND

- EXTENT OF WORKS
- PROPOSED CONCRETE PATH — 1 / 900
- EXPOSED AGGREGATE HARDSTAND. HOLCIM 'ACACIA' — 1 / 900
- EXPOSED AGGREGATE HARDSTAND. HOLCIM 'TUART' — 1 / 900
- SOFTFALL MULCH — 6 / 900
- GABION WALL — 3 / 910
- LIMESTONE WALL - BASIN (BY CIVIL) — 2 / 910
- MK CONCRETE MOW KERB — 5 / 900
- PROPOSED PLANTING — 1&2 / 970
- BASIN PLANTING — 1&2 / 970
- TURF — 3 / 970
- PROPOSED TREES — 4 / 970

STANDARD NOTES

1. **SET OUT & DIMENSIONS.** THE CONTRACTOR SHALL SET OUT ALL PATHS, WALLS, HARD SURFACES AND ELEMENTS EITHER ON OR OFF-SITE PRIOR TO CONSTRUCTION AND SHALL OBTAIN THE SUPERINTENDENTS SET OUT APPROVAL PRIOR TO WORKS COMMENCING. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALE. CHECK ALL DRAWING SCALES IN CONJUNCTION WITH DRAWING SIZE.
2. **SERVICES & SITE ASSETS.** THE CONTRACTOR SHALL INVESTIGATE THE NATURE AND LOCATION OF ALL EXISTING SERVICES AND RETAINED SITE ASSETS AFFECTED BY THEIR WORKS. FAILURE TO TAKE DUE CARE SHALL NOT LIMIT THE CONTRACTORS LIABILITIES
3. **REFERENCE.** THE CONTRACTOR SHALL REFER TO ALL CONTRACT DOCUMENTS, THE SPECIFICATION AND DRAWINGS PRIOR TO AND DURING THE WORKS.
4. **DISCREPANCIES.** NOTIFY SUPERINTENDENT OF ANY SUSPECTED OR KNOWN DISCREPANCIES OR ERRORS PRIOR TO THE ORDERING OF AFFECTED MATERIALS AND OR CONSTRUCTION OF AFFECTED WORKS.
5. **RELEVANT STANDARDS.** THE CONTRACTOR SHALL UNDERTAKE ALL PRICING AND WORKS IN ACCORDANCE WITH CURRENT INDUSTRY BEST PRACTICE AND ALL RELEVANT AUSTRALIAN STANDARDS.
6. **SERVICE LOCATOR.** THE CONTRACTOR SHALL UNDERTAKE A DIAL BEFORE YOU DIG PROCESS PRIOR TO COMMENCING WORKS ON SITE. THE CONTRACTOR SHALL ENGAGE A SERVICE LOCATOR TO MAP THE SPECIFIC LOCATIONS AND DEPTH OF ALL SERVICES AND ADVISE ALL RELEVANT STAFF AND SUBCONTRACTORS IN WRITING PRIOR TO COMMENCING WORKS ON SITE.

REV	DATE	BY	ISSUE OR AMENDMENT
B	18.09.24	DM	ISSUE FOR COUNCIL APPROVAL
A	11.07.24	DM	ISSUE FOR CLIENT REVIEW

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PROJECT
SPIRES ESTATES
BALDIVIS, WA
STAGE OR PHASE
STAGE 16B
NORTHEN POS
DRAWING TITLE
NORTHEN POS - FINISHES PLAN
CLIENT
CARCIONE NOMINEES PTY LTD

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DATE INITIALLY DRAWN	18.07.2024		

SCALE 1: 200 @ A1 METRES (0 2 4 6 8 10)

DRAWING NUMBER IR34-400

REV B

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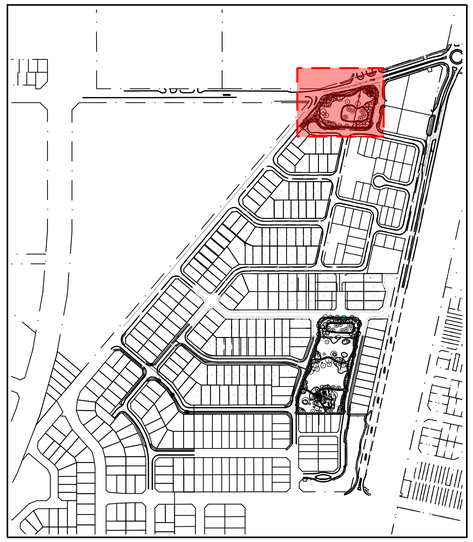

LOCATION PLAN

FIFTY ROAD

EIGHTY ROAD

LUXOR PLACE

DUOMO CHASE

GLACIER PARADE

RL +08.05
RL +07.00
RL +07.40
RL +06.75
RL +06.50
RL +06.25
RL +08.50
RL +08.80
RL +07.80
RL +08.20
RL +07.75
RL +08.10
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RL +05.70
RL +04.80
RL +06.80
RL +06.50
RL +06.25
RL +06.15
RL +06.00
RL +06.10
TW +06.75
BW +06.25
TW +05.10
BW +04.80
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B

7.00
7.50
16.00
9.00
8.50
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7.50
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6.00
5.70

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LEGEND

- EXTENT OF WORKS
- 0.00 PROPOSED CONTOURS
- 0.00 PROPOSED T.W.L.
- RL 8.00 SPOT LEVELS
- TW 8.00 BW 7.50 WALL SPOT HEIGHTS

STANDARD NOTES

1. **SET OUT & DIMENSIONS.** THE CONTRACTOR SHALL SET OUT ALL PATHS, WALLS, HARD SURFACES AND ELEMENTS EITHER ON OR OFFSITE PRIOR TO CONSTRUCTION AND SHALL OBTAIN THE SUPERINTENDENTS SET OUT APPROVAL PRIOR TO WORKS COMMENCING. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALE. CHECK ALL DRAWING SCALES IN CONJUNCTION WITH DRAWING SIZE.
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BALDIVIS, WA
STAGE OR PHASE
STAGE 16B
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DRAWING NUMBER IR34-300
REV B

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LOCATION PLAN

PLANT MIX A - SWALE

Sym.	Key	Botanic Name	Common Name	Pot	Qty.
	BAJU	Baumea juncea	Bare Twig Rush	Tube	695
	CAIN	Carex inversa	Knob Sedge	Tube	1391
	JUKR	Juncus Kraussi	Sea Rush	Tube	695
	SARES	Samolus repens	Creeping Brookweed	Tube	695

PLANT MIX B

Sym.	Key	Botanic Name	Common Name	Pot	Qty.
	DIRE	Dianella revoluta 'Little Rev'	Native Flax	140mm	248
	FINO	Ficinia nodosa	Knobby Club Rush	140mm	497
	GRBR	Grevillea 'Bronze Rambler'	Tootbrush Grevillea	140mm	248
	JUCO	Juniperus conferta	Shore Conifer	140mm	248

PLANT MIX C

Sym.	Key	Botanic Name	Common Name	Pot	Qty.
	COMO	Convolvulus 'MoroccCan Beauty'	Blue Morning Glory	140mm	144
	ERGL	Eremophila glabra	Tar Bush	140mm	144
	SCMA	Scaevola 'Mauve Cluster'	Fan Flower	140mm	144
	SCCR	Scaevola crassifolia	Cushion Fan flower	140mm	144
	WEFR	Westringia fruticosa 'Mundi'	Coastal Rosemary	140mm	144

PLANT MIX D

Sym.	Key	Botanic Name	Common Name	Pot	Qty.
	ADSE	Adenanthos sericeus Dwarf	Dwarf Wolly Bush	140mm	218
	ADCO	Adenathos 'Coral Carpet'	Coastal Jug Flower	140mm	218
	CAGR	Callistemon ' Great Balls of Fire'	Bottlebrush	140mm	218
	COCA	Conostylis candicans	Cotton Heads	140mm	218
	MYPA	Myoporum parvifolium	Creeping Boobialla	140mm	218

PLANT AND TREE NUMBERS IN SCHEDULE ARE TO BE USED AS GUIDE ONLY. TENDERERS TO REFER LABELS ON PLANS FOR NUMBERS. PLANT NUMBERS AND SPECIES ARE SUBJECT TO AVAILABILITY.

TREE LIST

Sym.	Key	Botanic Name	Common Name	Pot	Qty.
	GLTR '500L'	Gleditsia triacanthos 'Shademaster'	Honey Locust	500 Litre	2
	GLTR '200L'	Gleditsia triacanthos 'Shademaster'	Honey Locust	200 Litre	5
	GLTR '1000L'	Gleditsia triacanthos 'Shademaster'	Honey Locust	1000 Litre	1
	LIST	Liquidambar styraciflua	Sweet Gum	200 Litre	9
	MEQU	Melaleuca quinquenervia	Broad-leaved Paperbark	200 Litre	6
	OLEU 'SH'	Olea europaea 'Swan Hill'	Swan Hill Olive	200mm	12
	PYNI	Pyrus nivalis	Snow Pear	200 Litre	17

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LEGEND

- EXTENT OF WORKS
- PROPOSED TREES (5/970)
- EXISTING TREE TO BE RETAINED AND PROTECTED
- PROPOSED PLANTING (1/970)
- BASIN PLANTING (3/970)

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BALDIVIS, WA
STAGE OR PHASE
STAGE 16B
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DRAWING TITLE
NORTHEN POS - PLANTING PLAN
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LOCATION PLAN

LEGEND

- EXTENT OF WORKS
- 0.00 PROPOSED CONTOURS
- 0.00 PROPOSED T.W.L.
- RL 8.00 SPOT LEVELS
- TW 8.00 BW 7.50 WALL SPOT HEIGHTS

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STAGE OR PHASE
STAGE 16B
SOUTHERN POS
DRAWING TITLE
SOUTHERN POS - GRADING PLAN
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SCALE 1: 250 @ A1 METRES
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DRAWING NUMBER IR34-301
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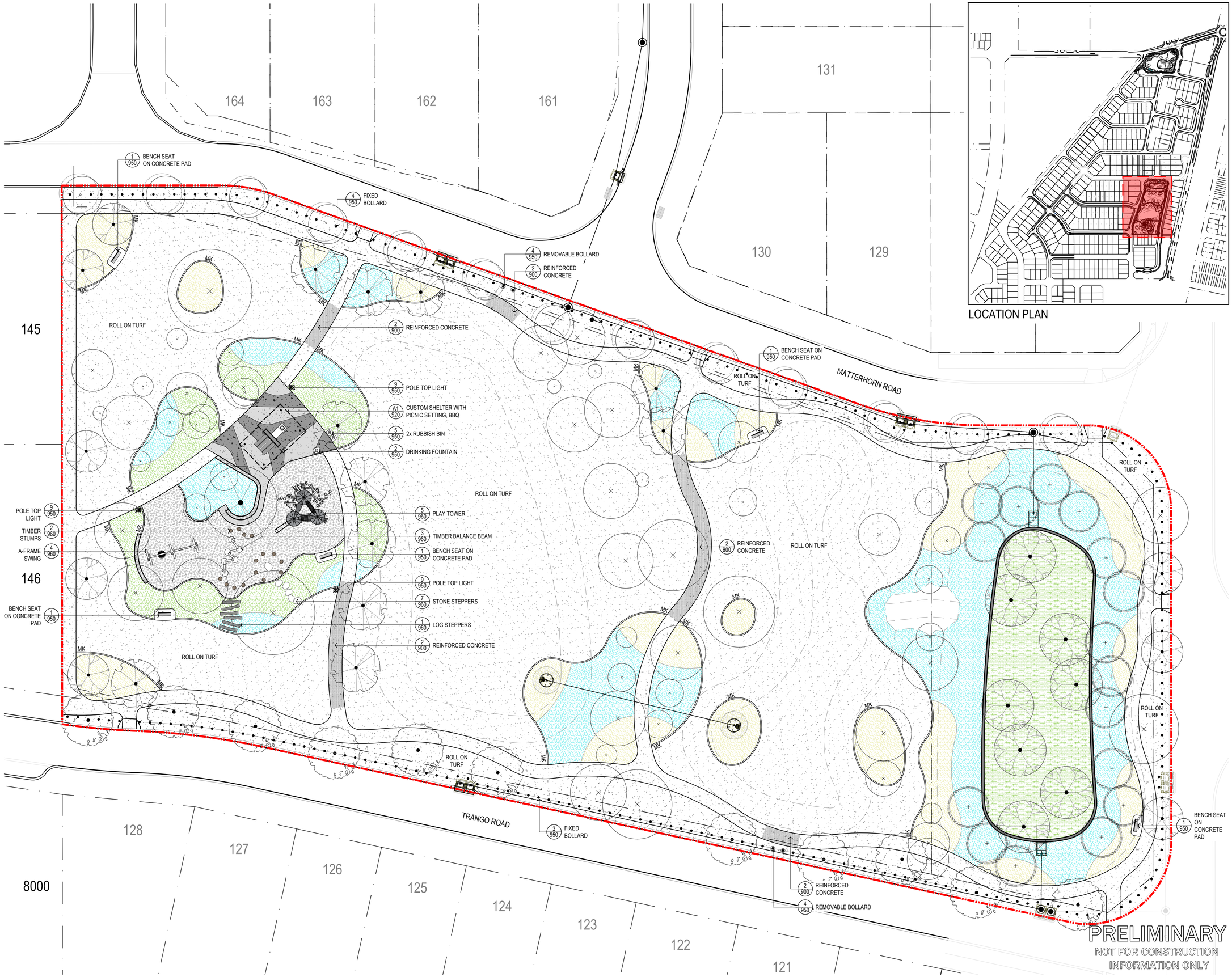

LEGEND

- EXTENT OF WORKS
- PROPOSED CONCRETE PATH — 1/900
- EXPOSED AGGREGATE HARDSTAND. HOLCIM 'ACACIA' — 1/900
- EXPOSED AGGREGATE HARDSTAND. HOLCIM 'TUART' — 1/900
- SOFTFALL MULCH — 6/900
- GABION WALL — 3/910
- LIMESTONE WALL - BASIN (BY CIVIL) — 2/910
- MK CONCRETE MOW KERB — 5/900
- PROPOSED PLANTING — 1&2/970
- BASIN PLANTING — 1&2/970
- TURF — 3/970
- PROPOSED TREES — 4/970

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TREE LIST

Sym.	Key	Common Name	Botanic Name	Pot	Qty.
	AGFL	Willow Myrtle	Agonis flexuosa	200 Litre	11
	GLTR '1000L'	Honey Locust	Gleditsia triacanthos 'Shademaster'	1000 Litre	1
	JAMI	Jacaranda	Jacaranda mimosifolia	200 Litre	11
	LIST	Sweet Gum	Liquidambar styraciflua	200 Litre	13
	MEQU	Broad-leaved Paperbark	Melaleuca quinquenervia	200 Litre	8
	OLEU 'SH'	Swan Hill Olive	Olea europaea 'Swan Hill'	200mm	16
	PYNI	Snow Pear	Pyrus nivalis	200 Litre	8

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PLANT MIX A - SWALE

Sym.	Key	Botanic Name	Common Name	Pot	Qty.
	BAJU	Baumea juncea	Bare Twig Rush	Tube	468
	CAIN	Carex inversa	Knob Sedge	Tube	936
	JUKR	Juncus Kraussi	Sea Rush	Tube	468
	SARES	Samolus repens	Creeping Brookweed	Tube	468

PLANT MIX B

Sym.	Key	Botanic Name	Common Name	Pot	Qty.
	DIRE	Dianella revoluta 'Little Rev'	Native Flax	140mm	228
	FINO	Ficinia nodosa	Knobby Club Rush	140mm	461
	GRBR	Grevillea 'Bronze Rambler'	Tootbrush Grevillea	140mm	228
	JUCO	Juniperus conferta	Shore Conifer	140mm	228

PLANT MIX C

Sym.	Key	Botanic Name	Common Name	Pot	Qty.
	COMO	Convolvulus 'MoroccCan Beauty'	Blue Morning Glory	140mm	779
	ERGL	Eremophila glabra	Tar Bush	140mm	779
	SCMA	Scaevola 'Mauve Cluster'	Fan Flower	140mm	779
	SCCR	Scaevola crassifolia	Cushion Fan flower	140mm	779
	WEFR	Westringia fruticosa 'Mundi'	Coastal Rosemary	140mm	779

PLANT MIX D

Sym.	Key	Botanic Name	Common Name	Pot	Qty.
	ADSE	Adenanthos sericeus Dwarf	Dwarf Wolly Bush	140mm	524
	ADCO	Adenathos 'Coral Carpet'	Coastal Jug Flower	140mm	524
	CAGR	Callistemon ' Great Balls of Fire'	Bottlebrush	140mm	524
	COCA	Conostylis candicans	Cotton Heads	140mm	524
	MYPA	Myoporum parvifolium	Creeping Boobialla	140mm	524

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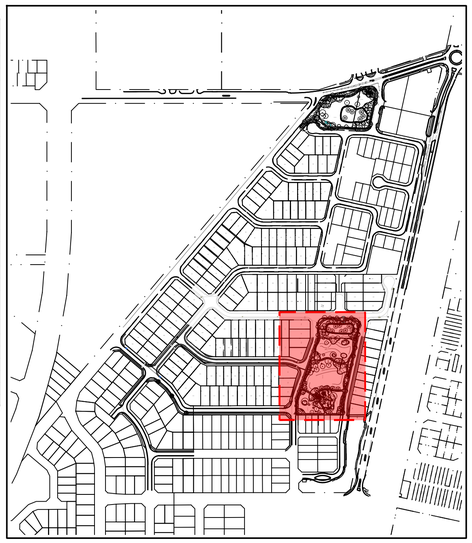

LOCATION PLAN

LEGEND

- EXTENT OF WORKS
- PROPOSED TREES (5 / 970)
- EXISTING TREE TO BE RETAINED AND PROTECTED
- PROPOSED PLANTING (1 / 970)
- BASIN PLANTING (3 / 970)

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emerge ASSOCIATES
Integrated Science & Design
PERTH (08) 9380 4988 • MARGARET RIVER (08) 9758 8159

PROJECT
SPIRES ESTATES
BALDIVIS, WA
STAGE OR PHASE
STAGE 16B
SOUTHERN POS
DRAWING TITLE
SOUTHERN POS - PLANTING PLAN
CLIENT
CARCIONE NOMINEES PTY LTD

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DESIGNED BY	MM	PRELIM DESIGN REVIEWED BY	A
DRAWN BY	DM	PRELIM DWG REVIEWED BY	-
DATE INITIALLY DRAWN	18.07.2024		

SCALE 1: 250 @ A1 METRES (0 2.5 5 7.5 10 12.5)

DRAWING NUMBER IR34-501 REV. B

PRELIMINARY
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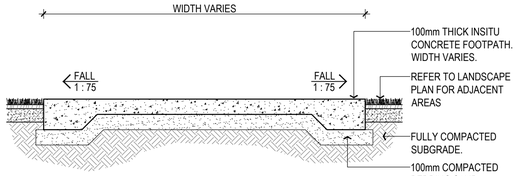
INFORMATION ONLY

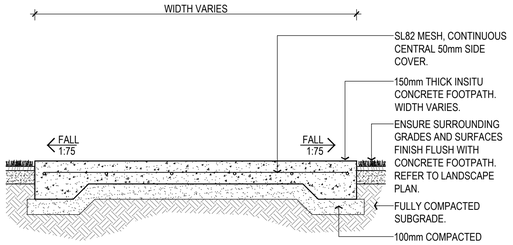
REF: C:\USERS\DAMIEN.RAJBANDHARI\DRIVE - EMERGE ASSOCIATES\DOCUMENTS\PROJECTS\16B_DBS.DWG



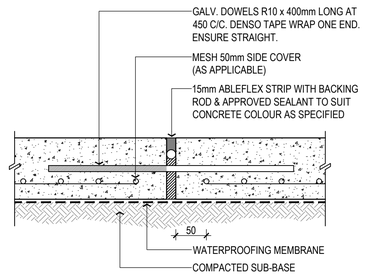
NOTES

1. FOUNDATION TO BE COMPACTED TO 95% MDD.
2. ALL CONCRETE FOOTPATH CONSTRUCTION TO BE A MIN 25MPa, 20mm AGGREGATE AND MAX SLUMP OF 80-100mm.
3. BEDDING - SAND (100mm MINIMUM).
4. EXPANSION JOINT EVERY 5.0M AS. SEE DETAIL 03/910
5. CONTRACTION JOINT EVERY 2.5M. SEE DETAIL 04/900
6. SURFACE TO BE BROOM FINISH, NON-SLIP, WITH SMOOTH EDGE APPROX 75mm WIDE AT EDGES AND JOINTS.
7. LONGITUDINAL GRADE SHOULD NOT EXCEED 1 IN 20.
8. WHERE LONGITUDINAL GRADE IS GREATER THAN 1 IN 14, LANDINGS WILL BE PROVIDED EVERY 6m.
9. VERTICAL CLEARANCES ALONG PATHS SHOULD BE A MINIMUM OF 2m.
10. WHERE STREET FURNITURE (POLES, BENCHES, RUBBISH BINS, POSTS, ETC) ARE LOCATED IN PATH, A MIN UNOBSTRUCTED WIDTH OF 1.2m MUST BE MAINTAINED.

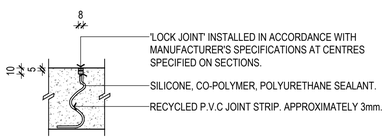
1/900 INSITU CONCRETE FOOTPATH - TYPICAL
SECTION — SCALE 1:20



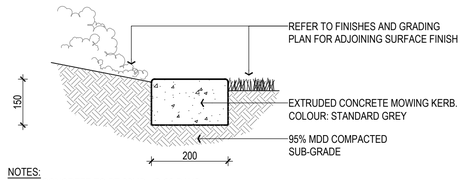
2/900 REINFORCED CONCRETE PATH FOR MAINTENANCE VEHICLE ACCESS
SECTION — SCALE 1:20



3/900 TYPICAL EDGE DETAIL (NON-TRAFFICABLE)
SECTION — SCALE 1:5

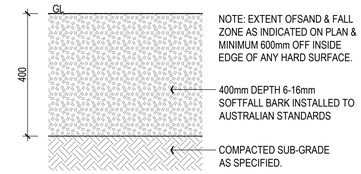


4/900 TYPICAL CONTRACTION JOINT
SECTION — SCALE 1:5

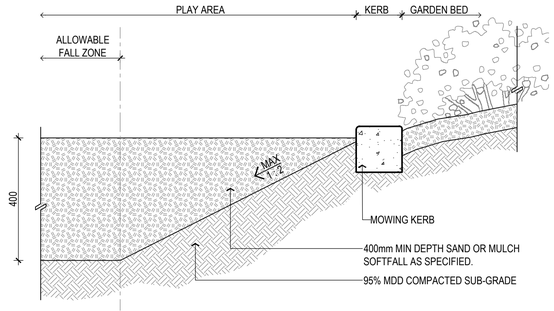


NOTES:
1. ALL CONCRETE TO BE 32MPa @ 28 DAYS
2. CONTRACTION JOINTS: RULED / STAMPED AT 2.0M INTERVALS
3. EXPANSION JOINTS: 6.0M INTERVALS TO LINE UP WITH FOOTPATH JOINTS.

5/900 MOWING KERB
SECTION — SCALE 1:10

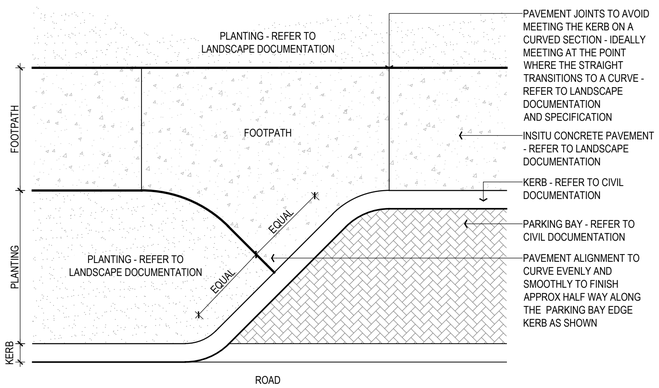


6/900 MULCH SOFTFALL
SECTION — SCALE 1:10



NOTE:
ENSURE FALL ZONES ARE WITHIN THE FULL DEPTH OF ANY SOFTFALL SURFACES / MATERIAL.

7/900 MULCH SOFTFALL TO PLANTING AREA
SECTION — SCALE 1:10



8/900 INSITU CONCRETE PAVEMENT - PARKING BAY INTERFACE
SECTION — SCALE 1:50

STANDARD NOTES

1. **SET OUT & DIMENSIONS.** THE CONTRACTOR SHALL SET OUT ALL PATHS, WALLS, HARD SURFACES AND ELEMENTS EITHER ON OR OFFSITE PRIOR TO CONSTRUCTION AND SHALL OBTAIN THE SUPERINTENDENTS SET OUT APPROVAL PRIOR TO WORKS COMMENCING. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALE. CHECK ALL DRAWING SCALES IN CONJUNCTION WITH DRAWING SIZE.
2. **SERVICES & SITE ASSETS.** THE CONTRACTOR SHALL INVESTIGATE THE NATURE AND LOCATION OF ALL EXISTING SERVICES AND RETAINED SITE ASSETS AFFECTED BY THEIR WORKS. FAILURE TO TAKE DUE CARE SHALL NOT LIMIT THE CONTRACTORS LIABILITIES.
3. **REFERENCE.** THE CONTRACTOR SHALL REFER TO ALL CONTRACT DOCUMENTS. THE SPECIFICATION AND DRAWINGS PRIOR TO AND DURING THE WORKS.
4. **DISCREPANCIES.** NOTIFY SUPERINTENDENT OF ANY SUSPECTED OR KNOWN DISCREPANCIES OR ERRORS PRIOR TO THE ORDERING OF AFFECTED MATERIALS AND OR CONSTRUCTION OF AFFECTED WORKS.
5. **RELEVANT STANDARDS.** THE CONTRACTOR SHALL UNDERTAKE ALL PRICING AND WORKS IN ACCORDANCE WITH CURRENT INDUSTRY BEST PRACTICE AND ALL RELEVANT AUSTRALIAN STANDARDS.
6. **SERVICE LOCATOR.** THE CONTRACTOR SHALL UNDERTAKE A DIAL BEFORE YOU DIG PROCESS PRIOR TO COMMENCING WORKS ON SITE. THE CONTRACTOR SHALL ENGAGE A SERVICE LOCATOR TO MAP THE SPECIFIC LOCATIONS AND DEPTH OF ALL SERVICES AND ADVISE ALL RELEVANT STAFF AND SUBCONTRACTORS IN WRITING PRIOR TO COMMENCING WORKS ON SITE.

REV	DATE	BY	ISSUE OR AMENDMENT
B	18.09.2024	DM	ISSUE FOR COUNCIL APPROVAL
A	11.07.2024	CW	ISSUE FOR CLIENT REVIEW

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PROJECT
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BALDIVIS, WA
STAGE OR PHASE
STAGE 16B

DRAWING TITLE
HARDSCAPE DETAILS
.
CLIENT
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DESIGNED BY	MM	PRELIM DESIGN REVIEWED BY	A
DRAWN BY	CW	PRELIM DWG REVIEWED BY	.
DATE INITIALLY DRAWN	18.07.2024		
SCALE	AS SHOWN		
DRAWING NUMBER	IR34-900	REV	B

REF: C:\USERS\EMERGE-INGA\ONEDRIVE - EMERGE ASSOCIATES\DOCUMENTS\SPIRES\STAGE 16B_SET.DWG

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APPENDIX E

- **95 Percentile Groundwater Calculations**
- **DWER Bore Locations**
- **Measured Groundwater Levels Bores**

Comparison Between DWER Bore Records and Site Measured Records

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DWER records - 2018

	Last 20 years				Difference between:		
Bore	AAMGL	Historic MGL	95th %ile MGL	2018 MGL	2018 MGL & AAMGL	2018 MGL & historic MGL	2018 MGL & 95th %ile MGL
61410063	1.749	2.525	2.351	2.377	-0.628	0.148	-0.026
61410064	1.955	2.560	2.490	2.508	-0.554	0.052	-0.018
61410073	1.685	2.028	2.002	N/A	N/A	N/A	N/A
Average					**-0.628**	**0.100**	**-0.022**

On-site monitoring records - 2018

Bore	Recorded level (mAHD)	Add diff. between 2018 & 95th %ile	Effective 95th %ile GWL	Add diff. between 2018 & AAMGL	Effective AAMGL
MB1	3.180	-0.022	3.158	-0.628	2.552
MB2	4.190	-0.022	4.168	-0.628	3.562
MB3	3.270	-0.022	3.248	-0.628	2.642
MB4	3.030	-0.022	3.008	-0.628	2.402
MB5	3.870	-0.022	3.848	-0.628	3.242

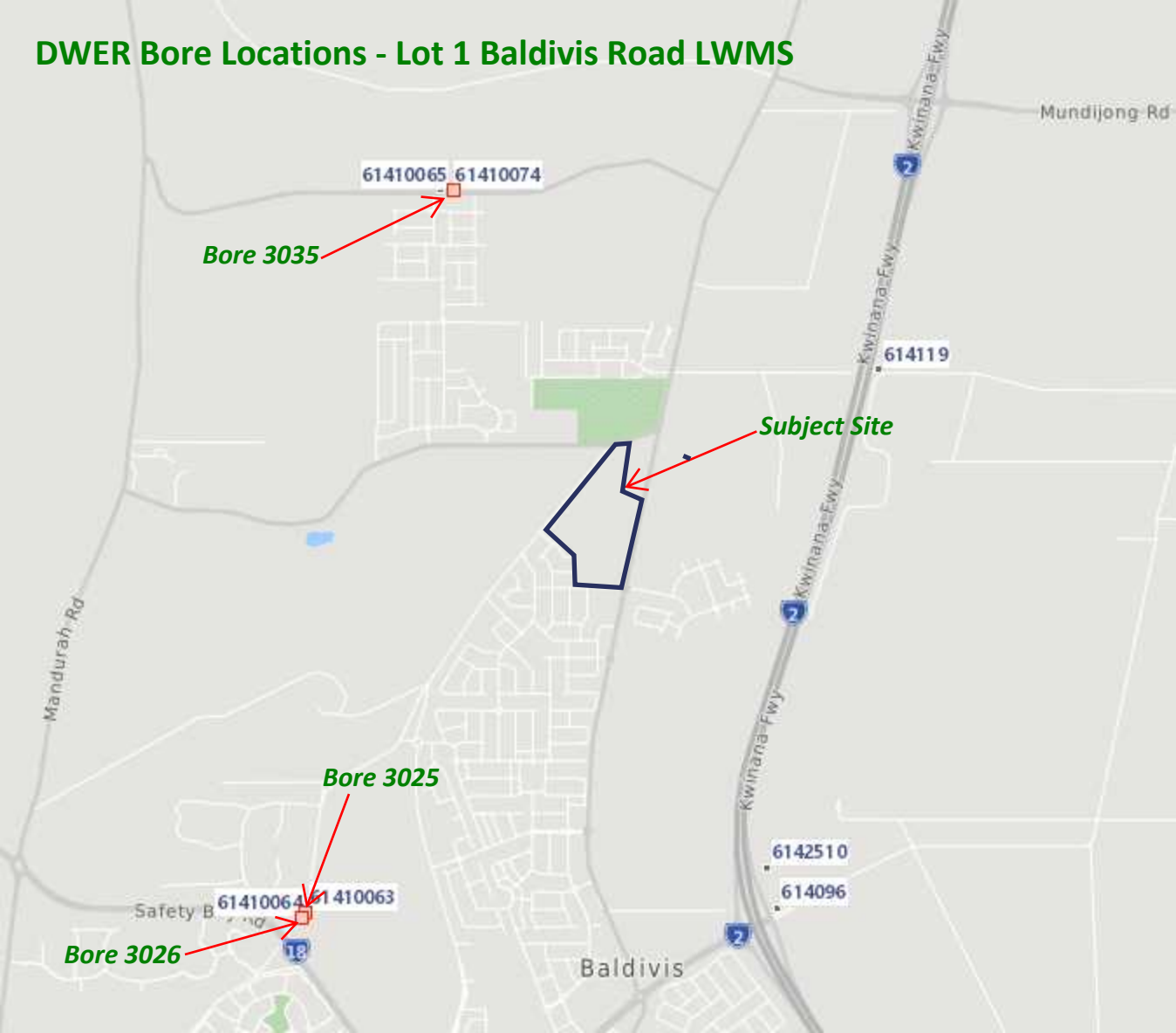
DWER records - 2016

	Last 20 years				Difference between:		
Bore	AAMGL	Historic MGL	95th %ile MGL	2016 MGL	2016 MGL & AAMGL	2016 MGL & historic MGL	2016 MGL & 95th %ile MGL
61410063	1.749	2.525	2.351	1.737	0.012	0.788	0.614
61410064	1.955	2.560	2.490	1.728	0.227	0.832	0.762
61410073	1.685	2.028	2.002	N/A	N/A	N/A	N/A
Average					**0.012**	**0.810**	**0.688**

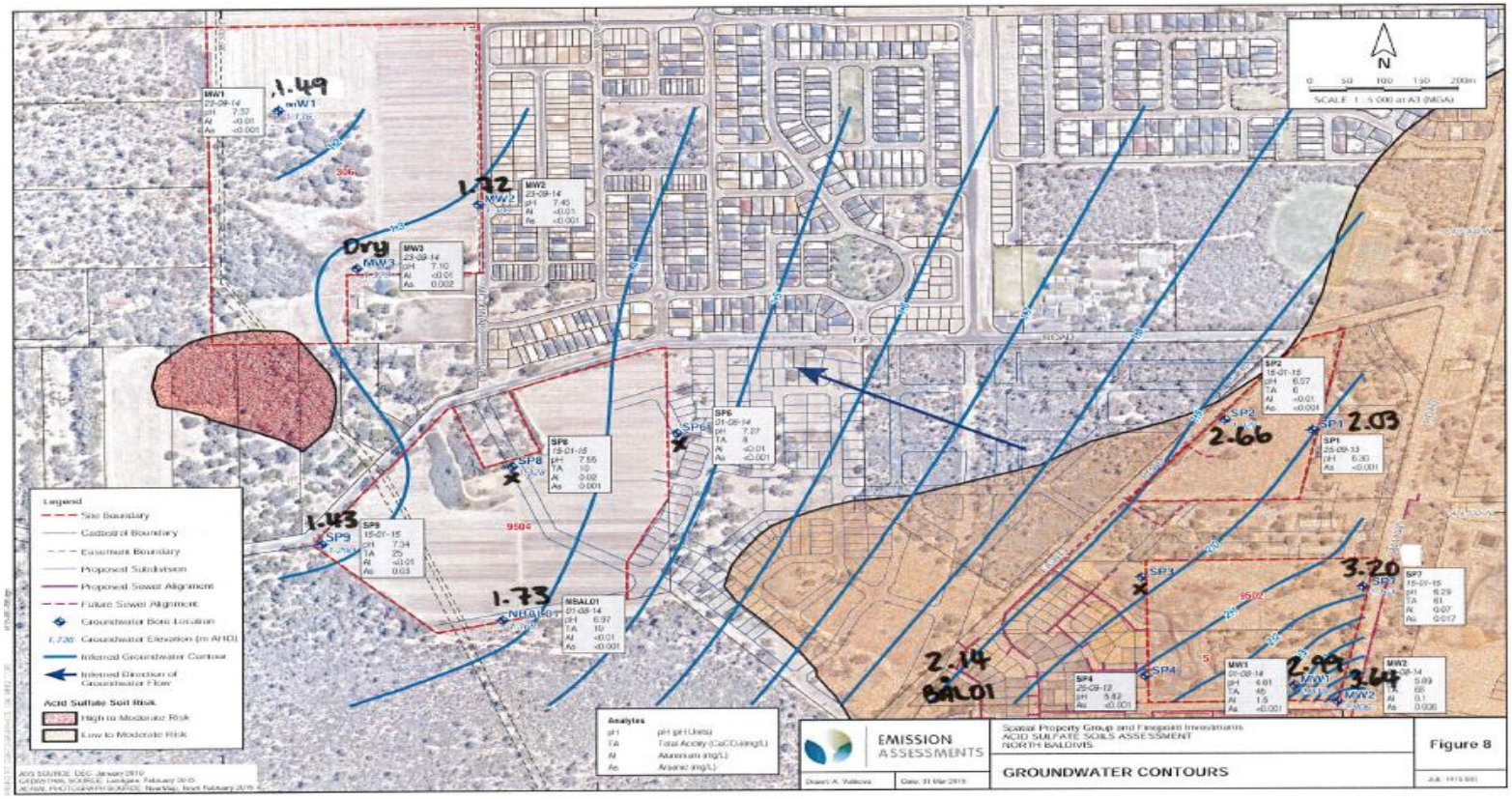
On-site monitoring records - 2016

Bore	Recorded level (mAHD)	Add diff. between 2016 & 95th %ile	Effective 95th %ile GWL	Add diff. between 2016 & AAMGL	Effective AAMGL
MW1	1.495	0.688	2.183	0.012	1.507
MW2	1.725	0.688	2.413	0.012	1.737
SP1	2.030	0.688	2.718	0.012	2.042
SP2	2.662	0.688	3.350	0.012	2.674
SP9	1.437	0.688	2.125	0.012	1.449
NBAL01	1.735	0.688	2.423	0.012	1.747
NBAL03	2.140	0.688	2.828	0.012	2.152

DWER Bore Locations - Lot 1 Baldivis Road LWMS



	October 2016 event					Previous Studies			
	Groundwater Level (mbtoc)	TOC stick up (m)	Groundwater Level (mbgl)	Approx ground level (mAHD)	Approx Groundwater Level (mAHD)	LWMS groundwater contours (mAHD)	Difference between Oct16 and LWMS contours	Emission Assessment level	Difference between Oct 16 and Emission Assessment level
SP1	5.79	0.82	**4.97**	7	2.03	2	0.03	-	-
SP2	9.168	0.83	**8.338**	11	2.662	1.9	0.762	1.928	0.734
SP3	Destroyed/Missing								
SP4	Destroyed/Missing								
SP6	Destroyed/Missing								
SP7	3.925	0.43	**3.495**	6.7	3.205	2.2	1.005	2.161	1.044
SP8	Non viable - caved in								0
SP9	4.013	0.45	**3.563**	5	1.437	1.3	0.137	1.29	0.147
MW1 (Baldivis Rd)	4.237	0.63	**3.607**	6.6	2.993	2.4	0.593	2.319	0.674
MW2 (Baldivis Rd)	3.22	0.56	**2.66**	6.3	3.64	2.7	0.94	2.806	0.834
NBAL01	3.465	0.51	**2.955**	4.69	1.735	1.4	0.335	1.368	0.367
NBAL02	Destroyed/Missing								
BAL01	5.82	0.46	**5.36**	7.5	2.14	1.9	0.24		
MW1 (McDonald Rd)	13.455	0.65	**12.805**	14.3	1.495	1.2	0.295	1.136	0.359
MW2 (McDonald Rd)	5.365	0.64	**4.725**	6.45	1.725	1.3	0.425	1.309	0.416
MW3 (McDonald Rd)	Damp Bottom	0.47	**Dry**	4.53	N/a	1.3	N/a	1.329	-



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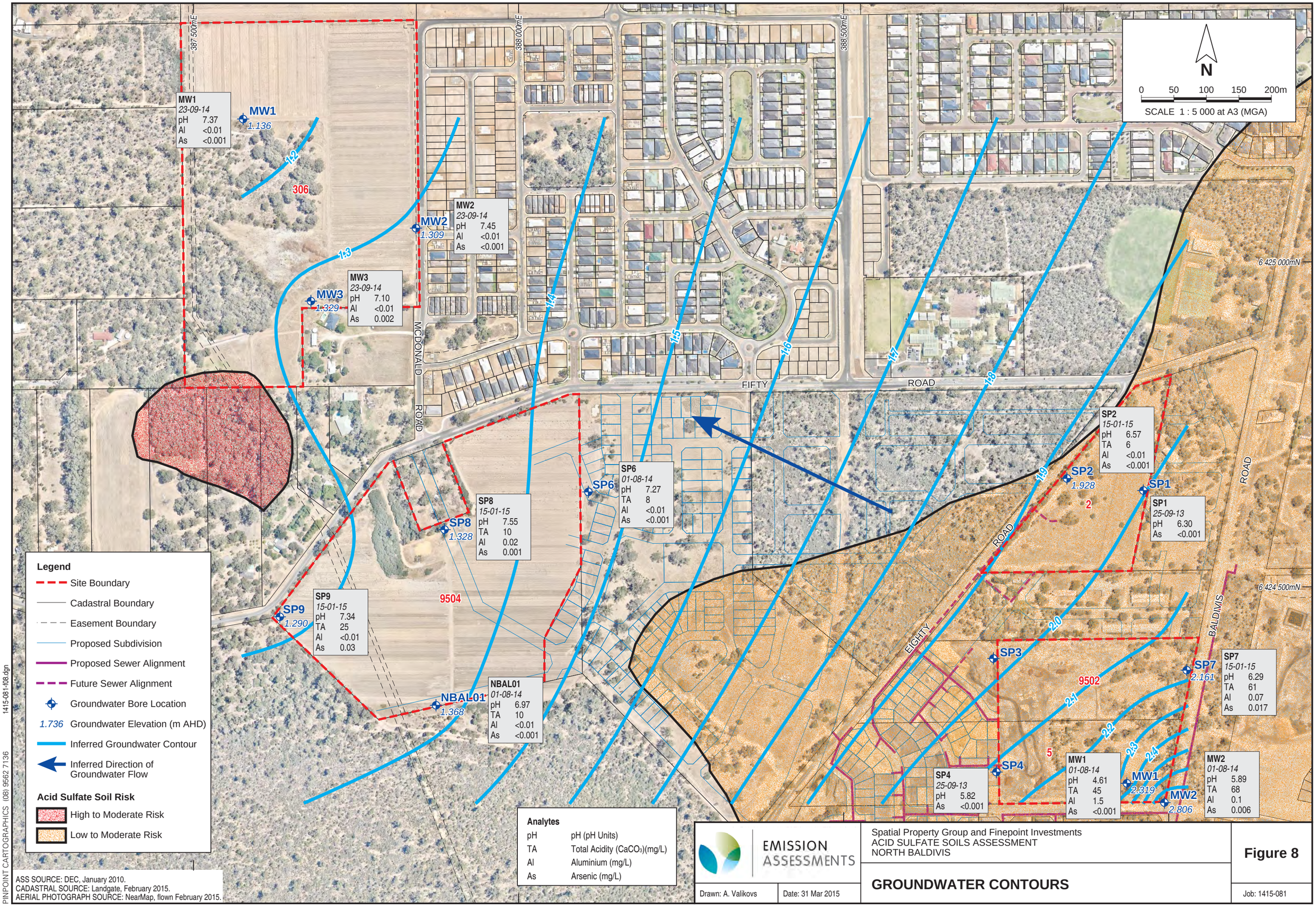
APPENDIX F

- **Previous Soil Investigation Plans and Bore Records**


387 500mE
388 000mE
388 500mE
6 425 000mN
6 424 500mN
N
0 50 100 150 200m
SCALE 1 : 5 000 at A3 (MGA)
MW1
23-09-14
pH 7.37
Al <0.01
As <0.001
MW1
1.136
MW2
23-09-14
pH 7.45
Al <0.01
As <0.001
MW2
1.309
MW3
23-09-14
pH 7.10
Al <0.01
As 0.002
MW3
1.329
SP6
01-08-14
pH 7.27
TA 8
Al <0.01
As <0.001
SP6
SP8
15-01-15
pH 7.55
TA 10
Al 0.02
As 0.001
SP8
1.328
SP9
15-01-15
pH 7.34
TA 25
Al <0.01
As 0.03
SP9
1.290
NBAL01
01-08-14
pH 6.97
TA 10
Al <0.01
As <0.001
NBAL01
1.368
SP2
15-01-15
pH 6.57
TA 6
Al <0.01
As <0.001
SP2
1.928
SP1
25-09-13
pH 6.30
As <0.001
SP1
SP3
SP4
25-09-13
pH 5.82
As <0.001
SP4
SP7
15-01-15
pH 6.29
TA 61
Al 0.07
As 0.017
SP7
2.161
MW1
01-08-14
pH 4.61
TA 45
Al 1.5
As <0.001
MW1
2.319
MW2
01-08-14
pH 5.89
TA 68
Al 0.1
As 0.006
MW2
2.806
306
9504
9502
2
5
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2.0
2.1
2.2
2.3
2.4
MCDONALD ROAD
FIFTY ROAD
EIGHTY ROAD
BALDIVIS ROAD
Legend
Site Boundary
Cadastral Boundary
Easement Boundary
Proposed Subdivision
Proposed Sewer Alignment
Future Sewer Alignment
Groundwater Bore Location
1.736 Groundwater Elevation (m AHD)
Inferred Groundwater Contour
Inferred Direction of Groundwater Flow
Acid Sulfate Soil Risk
High to Moderate Risk
Low to Moderate Risk
Analytes
pH pH (pH Units)
TA Total Acidity (CaCO3)(mg/L)
Al Aluminium (mg/L)
As Arsenic (mg/L)
ASS SOURCE: DEC, January 2010.
CADASTRAL SOURCE: Landgate, February 2015.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown February 2015.
1415-081-f08.dgn
PINPOINT CARTOGRAPHICS (08) 9562 7136
EMISSION ASSESSMENTS
Spatial Property Group and Finepoint Investments
ACID SULFATE SOILS ASSESSMENT
NORTH BALDIVIS
GROUNDWATER CONTOURS
Figure 8
Drawn: A. Valikovs
Date: 31 Mar 2015
Job: 1415-081

EMISSION ASSESSMENTS
Emission Assessments Pty Ltd
Unit 6, Sustainable Ave
Bibra Lake, 6164
Telephone: 9494 2958

BOREHOLE NUMBER MW1

CLIENT Spatial Property Group & Finepoint Investments **PROJECT NAME** Detailed Site Investigation

PROJECT NUMBER 1314-039 & 1314-037 **PROJECT LOCATION** Baldivis

DATE STARTED 9/9/13 **COMPLETED** 9/9/13

DRILLING CONTRACTOR Strataprobe **EASTING** 388931 **NORTHING** 6424197

EQUIPMENT Hollow Stem Auger **HOLE LOCATION** Lot 5 - south-west portion of Lot

HOLE SIZE 50mm **LOGGED BY** A. Valikovs **CHECKED BY** J. Cox

NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
	▼			1		0	SAND, grey/orange, coarse, moist		
				2		0	SAND, pale orange, coarse, moist		
				3					
				4					
				5					
				6					
				7		0	SAND, pale orange/white, coarse moist		
				8					
				9					
				10					

Borehole MW1 terminated at 10m

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Telephone: 9494 2958

BOREHOLE NUMBER MW2

CLIENT Spatial Property Group & Finepoint Investments
PROJECT NAME Detailed Site Investigation
PROJECT NUMBER 1314-039 & 1314-037
PROJECT LOCATION Baldivis

DATE STARTED 9/9/13 **COMPLETED** 9/9/13
DRILLING CONTRACTOR Strataprobe **EASTING** 388988 **NORTHING** 6424177
EQUIPMENT Hollow Stem Auger **HOLE LOCATION** Lot 5 - south-west corner
HOLE SIZE 50mm **LOGGED BY** A. Valikovs **CHECKED BY** J. Cox
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
				0		0	SAND, grey/brown, coarse, moist		
				2		0	SAND, orange/grey, coarse, moist		
	▼			5		0	SAND, pale orange/white, coarse moist		
				7			Borehole MW2 terminated at 7m		

BOREHOLE / TEST PIT BALDIVIS_1314-039,1314-037.GPJ GINT STD AUSTRALIA.GDT 6/11/13

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Bibra Lake, 6164
Telephone: 9494 2958

BOREHOLE NUMBER SP1

CLIENT Spatial Property Group & Finepoint Investments
PROJECT NAME Detailed Site Investigation
PROJECT NUMBER 1314-039 & 1314-037
PROJECT LOCATION Baldivis

DATE STARTED 2/9/13 **COMPLETED** 2/9/13
DRILLING CONTRACTOR Strataprobe **EASTING** 388963 **NORTHING** 6424676
EQUIPMENT Hollow Stem Auger **HOLE LOCATION** Lot 2 - eastern boundary
HOLE SIZE 50mm **LOGGED BY** A. Valikovs **CHECKED BY** J. Cox
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						0	SAND, brown/orange, coarse, moist		
						0	SAND, cream/orange, coarse, moist		
				2					
				4					
				6					
				8					
				10		0	SAND, orange, coarse, wet at 0.5m bgl		
				12					

Borehole SP1 terminated at 12m

BOREHOLE / TEST PIT BALDIVIS_1314-039,1314-037.GPJ GINT STD AUSTRALIA.GDT 6/11/13

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Bibra Lake, 6164
Telephone: 9494 2958

BOREHOLE NUMBER SP2

CLIENT Spatial Property Group & Finepoint Investments
PROJECT NAME Detailed Site Investigation
PROJECT NUMBER 1314-039 & 1314-037
PROJECT LOCATION Baldivis

DATE STARTED 2/9/13 **COMPLETED** 2/9/13
DRILLING CONTRACTOR Strataprobe **EASTING** 388876 **NORTHING** 6424710
EQUIPMENT Hollow Stem Auger **HOLE LOCATION** Lot 2 - western boundary
HOLE SIZE 50mm **LOGGED BY** A. Valikovs **CHECKED BY** J. Cox
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
				0		0	SAND, brown/orange, coarse, moist		
				1		0	SAND, orange, coarse, moist		
				2					
				3					
				4					
				5					
				6					
				7					
				8					
	▼			9		0	SAND, white/orange, coarse, moist		
				10					
				11					

Borehole SP2 terminated at 11.5m

BOREHOLE / TEST PIT BALDIVIS_1314-039,1314-037.GPJ GINT STD AUSTRALIA.GDT 6/11/13

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Emission Assessments Pty Ltd
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Bibra Lake, 6164
Telephone: 9494 2958

BOREHOLE NUMBER SP4

CLIENT Spatial Property Group & Finepoint Investments
PROJECT NAME Detailed Site Investigation
PROJECT NUMBER 1314-039 & 1314-037
PROJECT LOCATION Baldivis

DATE STARTED 9/9/13 **COMPLETED** 9/9/13
DRILLING CONTRACTOR Strataprobe **EASTING** 388733 **NORTHING** 6424216
EQUIPMENT Hollow Stem Auger **HOLE LOCATION** Lot 8 - eastern boundary
HOLE SIZE 50mm **LOGGED BY** A. Valikovs **CHECKED BY** J. Cox
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
				0		0	SAND, grey, coarse, moist		
				2		0	SAND, orange, coarse, moist		
				4					
				6					
	▼			8					
				10		0	SAND, pale orange/white, coarse, moist		
				12					

Borehole SP4 terminated at 12m

BOREHOLE / TEST PIT BALDIVIS_1314-039,1314-037.GPJ GINT STD AUSTRALIA.GDT 6/11/13

EMISSION ASSESSMENTS
Emission Assessments Pty Ltd
Unit 6, 35 Sustainable Ave, Bibra Lake
6163
Telephone: (08) 9494 2958
Fax: (08) 9494 2959

BOREHOLE NUMBER SP7

CLIENT Spatial Property Group **PROJECT NAME** DSI - North Baldivis

PROJECT NUMBER 1415-080 **PROJECT LOCATION** North Baldivis

DATE STARTED 17/12/14 **COMPLETED** 17/12/14

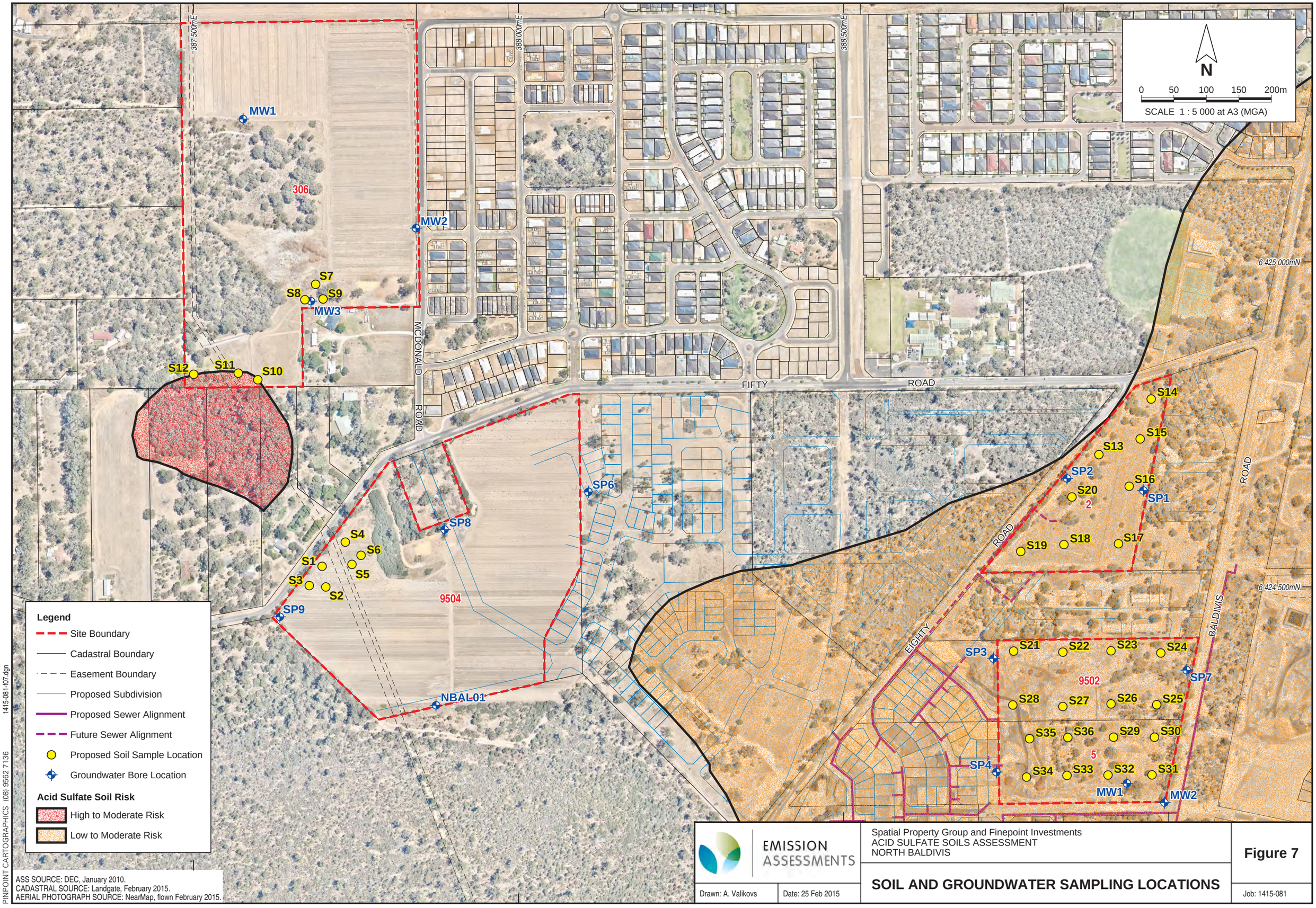
DRILLING CONTRACTOR Strataprobe **EASTING** 389028 **NORTHING** 6424372

EQUIPMENT Hollow Stem Auger **HOLE LOCATION** Lot 9502 Baldivis Rd

HOLE SIZE **LOGGED BY** AV **CHECKED BY** JC

NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	PID (ppm)	Additional Observations
				1		0	SAND, pale grey, fine to medium grained, loose, dry			
				2		0	SAND, yellow, medium grained, loose, moist			
	▼			3		0	SAND, grey, medium to coarse grained, loose, moist			
				4						
				5						
				6						
				7						
							Borehole SP7 terminated at 7.5m			



ASS SOURCE: DEC, January 2010.
CADASTRAL SOURCE: Landgate, February 2015.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown February 2015.

PINPOINT CARTOGRAPHICS (08) 9562 7136 1415-081-f07.dgn

EMISSION ASSESSMENTS

Spatial Property Group and Finepoint Investments
ACID SULFATE SOILS ASSESSMENT
NORTH BALDIVIS

SOIL AND GROUNDWATER SAMPLING LOCATIONS

Figure 7

Drawn: A. Valikovs | Date: 25 Feb 2015 | Job: 1415-081

DEVELOPMENT
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APPENDIX B

DRAINAGE CATCHMENT PLANS

- **L-03: Predevelopment catchment plan**
- **L-04: Post development catchment plan**
- **L-05: Northern Basin Plan and Section**
- **L-06: Southern Basin Plan and Section**

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APPENDIX C

DRAINAGE CALCULATIONS

- **Drainage basin calculations**
- **At-lot detention calculations**

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APPENDIX D
DRAINAGE DETAILS

- **Landscape concept plan**

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APPENDIX E

- **95 Percentile Groundwater Calculations**
- **DWER Bore Locations**
- **Measured Groundwater Levels Bores**

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APPENDIX F

- **Previous Soil Investigation Plans and Bore Records**

APPENDIX 5: BUSHFIRE MANAGEMENT PLAN

Name:	Talitha Broughton	Date:	21 September 2023
Company:	Spatial Property Group	Job/Doc. No.:	65079/152,873
Email:	talitha@spatialproperty.com.au	Inquiries:	Zac Cockerill

Bushfire Management Plan Addendum: Spires Estate Structure Plan Amendment

1. Introduction

Spatial Property Group is lodging a Structure Plan Amendment over Spires Estate Baldivis to facilitate incorporation of Lot 3 Baldivis Road (hereon referred to as the project area) into the overall Structure Plan area. The Structure Plan Amendment, as depicted in **Figure 1**, provides for the inclusion of Lot 3 Baldivis Road within the existing approved Spires Estate Structure Plan area, which otherwise covers various lots on Fifty Road and Eighty Road, Baldivis in the City of Rockingham.

Strategen, now known as JBS&G, prepared a comprehensive Fire Management Plan (FMP) in 2014 to support Spatial Property Group in their original Local Structure Plan submission for Spires Estate. Subdivision has since been approved throughout the Structure Plan area, supported by a detailed subdivision stage Bushfire Management Plan (BMP; Strategen 2018).

This BMP is an addendum to the original Spires Estate Structure Plan FMP (Strategen 2014) and provides for an updated strategic level bushfire assessment specific to the project area, as required to support the proposed Structure Plan Amendment. This BMP addendum should be read in conjunction with the original Structure Plan FMP (Strategen 2014), as well as the updated assessment documented in the subdivision stage BMP (Strategen 2018) and includes the following information:

1. A revised bushfire assessment including:
    a. updated pre and post-development vegetation classification and effective slope maps specific to the project area and current/proposed vegetation conditions (**Figure 2** and **Figure 3**)
    b. updated pre-development Bushfire Hazard Level (BHL) and post-development Bushfire Attack Level (BAL) assessments specific to the project area and current/proposed vegetation conditions mapped from Item 1a above (**Figure 4** and **Figure 5**)
2. A revised assessment against the bushfire protection criteria of *Guidelines for Planning in Bushfire-Prone Areas Version 1.4* (the Guidelines; WAPC 2021) demonstrating that compliance can be achieved at subsequent planning stages (**Table 5**).
3. A list of responsibilities for implementation of the bushfire management measures to guide future planning stages of the development.

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1.1 Purpose

The project area is designated bushfire prone on the Map of Bush Fire Prone Areas (refer to **Plate 1**; DFES 2021); therefore, bushfire risk considerations and assessment are required to inform the Structure Plan Amendment as per requirements under Policy Measure 6.3 of *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (SPP3.7; WAPC 2015).

This BMP addendum has been prepared to accompany the proposed Structure Plan Amendment to address strategic planning requirements under Policy Measure 6.3 of SPP3.7 in accordance with the Guidelines.

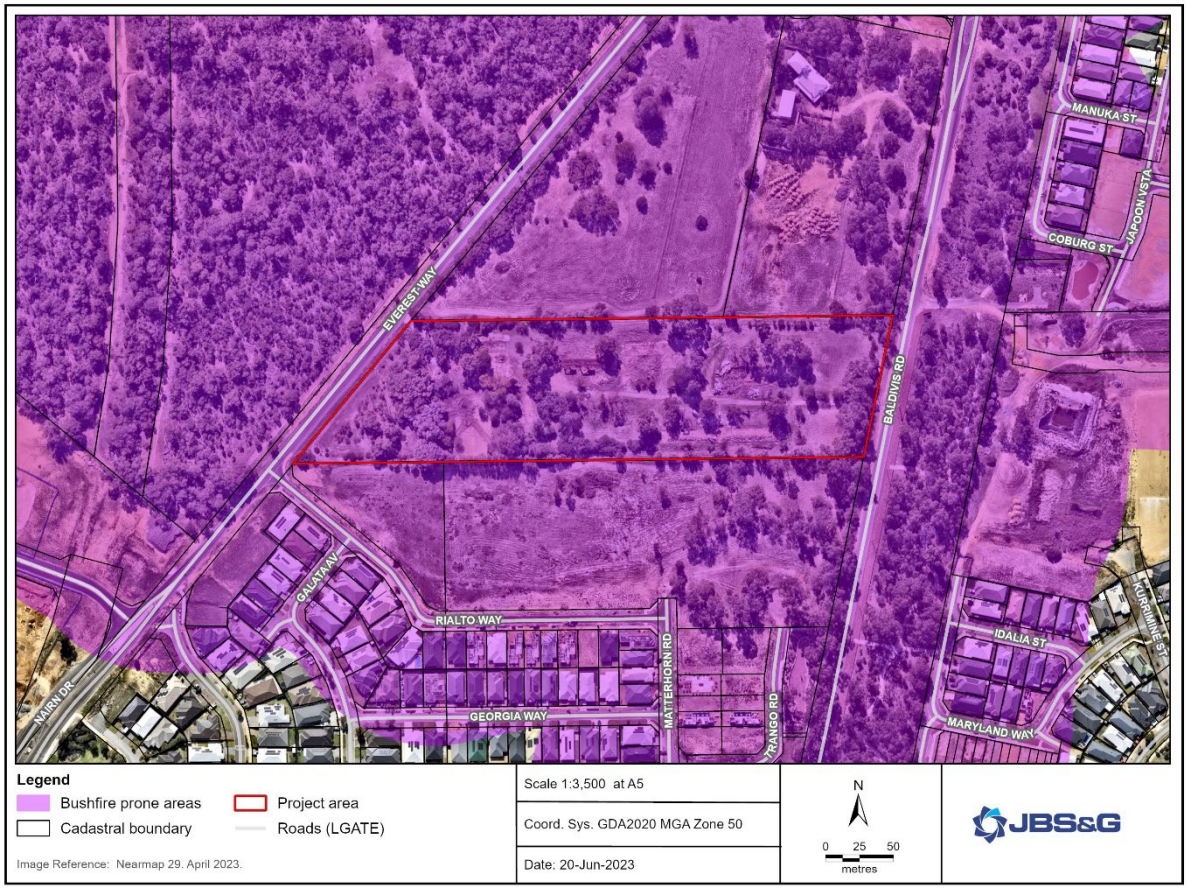
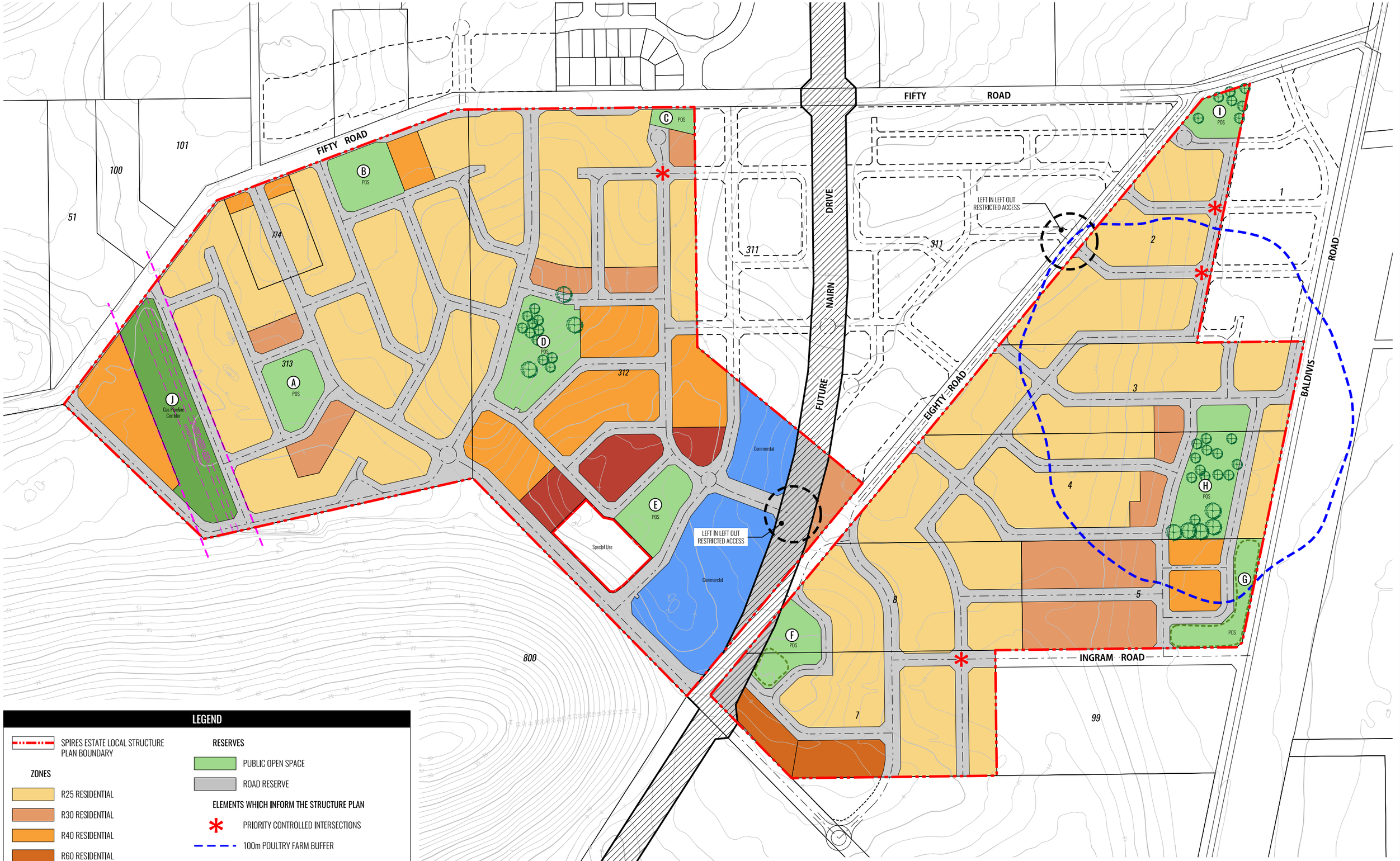


Plate 1: Designated bushfire prone status of the project area (DFES 2021)



LEGEND

- SPIRES ESTATE LOCAL STRUCTURE PLAN BOUNDARY

ZONES

- R25 RESIDENTIAL
- R30 RESIDENTIAL
- R40 RESIDENTIAL
- R60 RESIDENTIAL
- R100 RESIDENTIAL
- COMMERCIAL
- SPECIAL USE

RESERVES

- PUBLIC OPEN SPACE
- ROAD RESERVE

ELEMENTS WHICH INFORM THE STRUCTURE PLAN

- PRIORITY CONTROLLED INTERSECTIONS
- 100m POULTRY FARM BUFFER
- GAS PIPELINE CORRIDOR
- TREES TO BE RETAINED (SUBJECT TO SURVEY)
- REMNANT VEGETATION TO BE RETAINED SUBJECT TO ENGINEERING AND DETAILED DESIGN

NOTE: Lots within 100m of classified vegetation identified by Bushfire Management Plan (BMP), require a detailed BAL assessment at Building License stage.

PLAN 1 - SPIRES ESTATE STRUCTURE PLAN (PHASE 2)

Various Lots, Fifty & Eighty Road, BALDIVIS

Aerial supplied by: Nearmap
Aerial Date Stamp: N/A
Survey supplied by: N/A
Plan Number: NPS1022 - 005
Revision Number:
Drawn By: JP
Client: Spatial Property Group

0 80 160 240 320 400 480m

Scale: 1:4000 @A3 | Date Issued: 05.04.2023 | ©Niche Planning Studio

DISCLAIMER:
Town Planning compliance is subject to approval from the Tamala Park Regional Council and a suitable town planner will need to be appointed.
All Dimensions, Areas and Calculations are subject to Detailed Survey and Design before Town Planning Permit application.
Built Form is illustrative only and subject to Architectural Design and approval from an RAIA qualified architect, This plan has been prepared for illustrative purposes only and should not be used as a means to judge any properties value or yield potential.

NICHE STUDIO

2. Bushfire assessment results

2.1 Assessment inputs

2.1.1 Vegetation Classification

JBS&G assessed classified vegetation and exclusions within the project area and surrounding 150 m through on-ground verification on 21 June 2023.

Vegetation classifications have been assigned in accordance with *AS 3959—2018 Construction of Buildings in Bushfire-Prone Areas* (AS 3959; SA 2018) and the *Visual Guide for Bushfire Risk Assessment in Western Australia* (DoP 2016). Georeferenced site photos and a description of the vegetation classifications and exclusions are contained in Appendix A. Vegetation classification results are outlined in **Table 1** and **Figure 2** for existing pre-development conditions; and **Table 2** and **Figure 3** for anticipated post-development conditions.

The current pre-development extent of classified vegetation and exclusions is described below and depicted in **Figure 2**:

- Class A forest comprising a multi-tiered fuel structure with a eucalyptus overstorey, shrub midstorey and grassy understorey:
    - retained to the east of Baldivis Road within the Tramway Reserve
    - retained to the west of Everest Way within Lot 1402
    - retained within the eastern verge of Everest Way and small, isolated areas of Lot 2 to the north
    - retained within the western portion of the project area
- Class B woodland comprising sparse overstorey trees over a grassy understorey within the project area and adjacent portions of Lots 1 and 4 to the north and south respectively
- Class G grassland within and adjacent to the project area in numerous locations, comprising unmanaged grass greater than 100 mm in height at maturity.

Existing non-vegetated land (e.g. buildings, roads, driveways, access tracks, footpaths, etc), as well as any existing land managed in a low threat state (e.g. managed gardens, POS, urban street verges, bushfire staging buffers, etc), were assessed to be excluded from classification under Clauses 2.2.3.2 (e) and (f) of AS 3959.

Post-development conditions, as depicted in **Figure 3** will require modification of all remaining on-site vegetation to a non-vegetated/low threat managed state to achieve exclusion under Clause 2.2.3.2 of AS3959. This includes areas of proposed residential development, roads and landscaping throughout on-site POS and streetscapes.

2.1.2 Effective Slope

JBS&G assessed effective slope under classified vegetation within the assessment area through on ground verification on 21 June 2023 in accordance with AS 3959. Results were cross referenced with DPIRD 2 m contour data. Effective slope results are outlined in **Table 1** and **Figure 2** for existing pre-development conditions; and **Table 2** and **Figure 3** for anticipated post-development conditions. Results indicate that effective slope within and surrounding the project area is predominantly flat/upslope (0 degrees).

2.1.3 Pre-development inputs

A summary of the assessed pre-development classified vegetation, exclusions and effective slope within the project area and adjacent 150 m are listed in **Table 1** and illustrated in **Figure 2**.

Table 1: Summary of pre-development vegetation classifications/exclusions and effective slope

Vegetation plot	Vegetation classification	Effective slope	Comments
1	Class A Forest	Flat/upslope (0°)	Forest vegetation consisting of overstorey trees 10–30 m high, a midstorey and a grassy understorey
2	Class B Woodland	Flat/upslope (0°)	Sparse overstorey trees with a grassy understorey
3	Class G Grassland	Flat/upslope (0°)	Grassland greater than 100 mm in height at maturity
4	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])	N/A	Existing non-vegetated land/low threat managed areas including existing residential areas, driveways, roads, footpaths, access tracks, bushfire staging buffers, managed POS, etc

2.1.4 Post-development inputs

A summary of the expected post-development classified vegetation, exclusions and effective slope within the assessment area and adjacent 150 m are listed in **Table 2** and depicted in **Figure 3**.

The post-development vegetation classifications for all land external to the Spires Estate Structure Plan are expected to remain the same as pre-development conditions. As previously mentioned, post-development conditions will require modification of all remaining on-site vegetation to a non-vegetated/low threat managed state to achieve exclusion under Clause 2.2.3.2 of AS 3959 to facilitate proposed urban residential development.

Table 2: Summary of post-development vegetation classifications, exclusions and effective slope

Vegetation plot	Vegetation classification	Effective slope	Comments
1	Class A Forest	Flat/upslope (0°)	Forest vegetation consisting of overstorey trees 10–30 m high, a midstorey and a grassy understorey
2	Class B Woodland	Flat/upslope (0°)	Sparse overstorey trees with a grassy understorey
3	Class G Grassland	Flat/upslope (0°)	Grassland greater than 100 mm in height at maturity
4	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])	N/A	Existing non-vegetated land/low threat managed areas including existing residential areas, driveways, roads, footpaths, access tracks, bushfire staging buffers, managed POS, etc
5	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])	N/A	Areas to be modified to a non-vegetated/low threat state including proposed development within the project area (i.e. residential lots, roads, footpaths, driveways, managed gardens, POS and streetscapes)

Legend

- Project area
- 100m assessment area
- 150m assessment area
- Cadastral boundary

Vegetation classification

- Class A Forest
- Class B Woodland
- Class G Grassland
- Clause 2.2.3.2 (e) & (f)
- Photo point directions
- Topographic contours (mAHD)
- Roads

JBS&G

Job No: 65079	
Client: Spatial Property Group	
Version: A	Date: 21-Sep-2023
Drawn By: jcrute	Checked By: ZC

Scale 1:2,200 at A3

0 25 50
metres

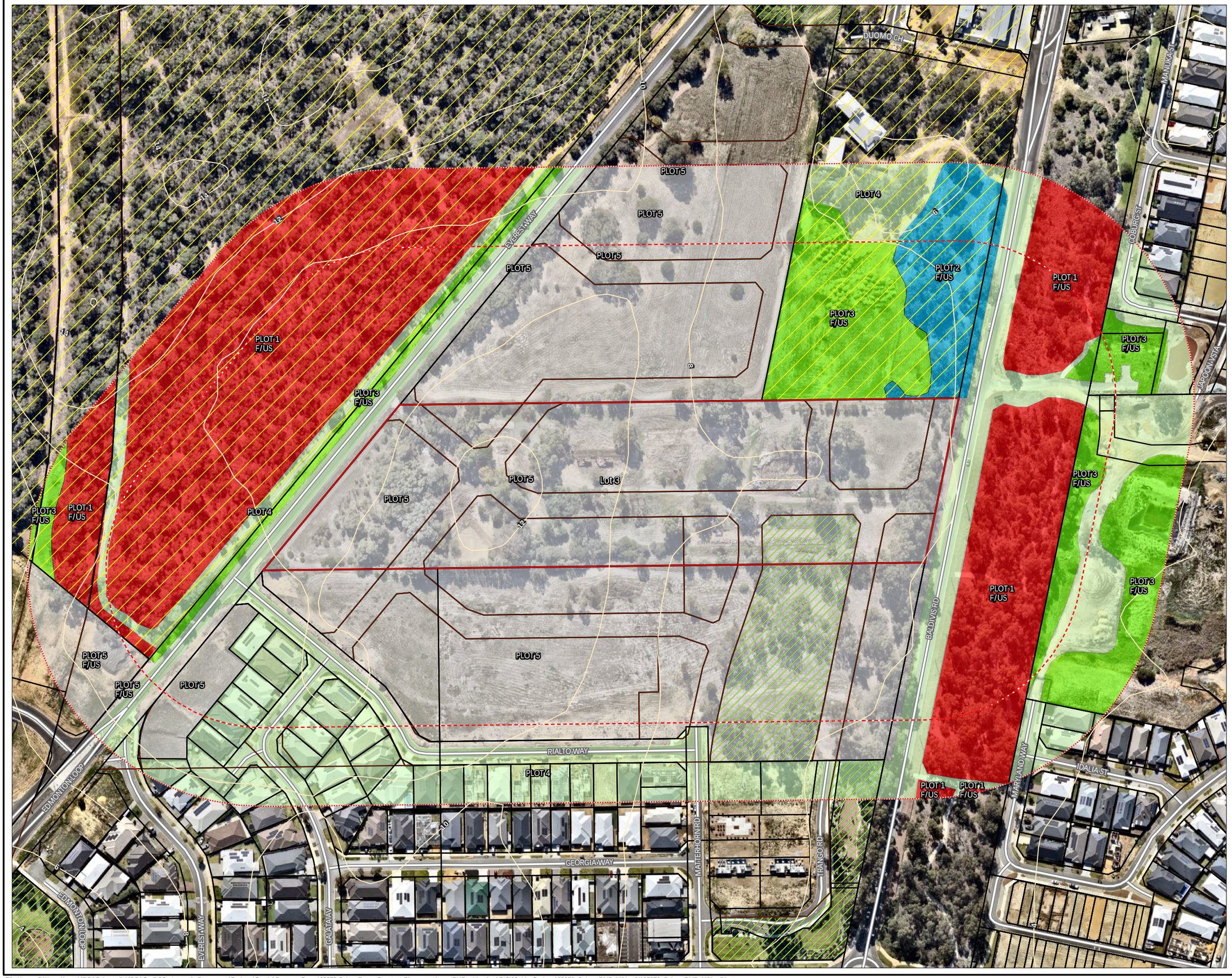
Coord. Sys. GDA2020 MGA Zone 50

Spires Estate, Lot 3
Baldivis Road,
Baldivis WA

PRE-DEVELOPMENT VEGETATION CLASSIFICATION AND EFFECTIVE SLOPE

FIGURE 2

File Name: C:\Users\jcrute\JBS&G Australia\JBS&G - DCS - Internal - Documents\Projects\Spatial Property Group\65079 Spires Estate Structure Plan amendment BMP addendum\GIS\02_MapProjects\65079_Spires_BMP_M01_v01\65079_Spires_BMP_M01_v01.aprx
Image Reference: www.nearmap.com© - Imagery Date: 29. April 2023.



Legend

- Project area
- 100m assessment area
- 150m assessment area
- Cadastral boundary
- Proposed development
- Proposed POS
- Future subdivisions
- Topographic contours (mAHD)
- Roads

JBS&G

Job No: 65079	
Client: Spatial Property Group	
Version: A	Date: 21-Sep-2023
Drawn By: jcrute	Checked By: ZC

Scale 1:2,200 at A3

0 25 50
metres

Coord. Sys. GDA2020 MGA Zone 50

Spires Estate, Lot 3
Baldivis Road,
Baldivis WA

POST-DEVELOPMENT VEGETATION CLASSIFICATION AND EFFECTIVE SLOPE

FIGURE 3

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Image Reference: www.nearmap.com© - Imagery Date: 29. April 2023.

2.2 Assessment outputs

2.2.1 Pre-development Bushfire Hazard Level (BHL) assessment

The pre-development classified vegetation extent has been assigned various Bushfire Hazard Levels (BHLs) in accordance with methodology detailed in Appendix 2 of the Guidelines, as outlined in Table 4.

Table 3: BHL assessment results

Bushfire hazard level	Characteristics*
Extreme	• Class A Forest • Class B Woodland (05) • Class D Scrub • Any classified vegetation with a greater than 10° slope.
Moderate	• Class B Low Woodland (07) • Class C Shrubland • Class E Mallee/Mulga • Class G Grassland, including sown pasture and crops • Class G Grassland: Open woodland (06), Low open woodland (08), Open shrubland (09) • Vegetation that has a low hazard level but is within 100 metres of vegetation classified as a moderate or extreme hazard, is to adopt a moderate hazard level.
Low	• Low threat vegetation may include areas of maintained lawns, golf courses, public recreation reserves and parklands, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and windbreaks • Managed grassland in a minimal fuel condition (insufficient fuel is available to significantly increase the severity of the bushfire attack). For example, short-cropped grass to a nominal height of 100 millimetre • Non-vegetated areas including waterways, roads, footpaths, buildings and rock outcrops.
*Vegetation classifications from AS 3959-2018 Table 2.3.	

JBS&G has mapped the pre-development BHLs within the project area and surrounding 150 m. The BHLs have been assessed on the basis of the vegetation summarised in Section 2.1.3 (i.e. the current pre-development extent of classified vegetation within and surrounding the project area).

The pre-development BHL assessment (refer to **Figure 4**) indicates that based on the existing vegetation extent, the project area contains land with Moderate and Extreme BHLs. Whilst the majority of the project area is rated with a pre-development Extreme BHL, the on-site vegetation is temporary and subject to modification to a non-vegetated/low threat managed state as part of proposed development. Therefore, the post-development BHL will be significantly reduced following proposed development. This is also the case for abutting sections of the proposed Structure Plan Amendment, north and south of the project area.

Classified vegetation to the east and west of the project area (opposite Baldivis Road and Everest Way respectively) has an Extreme BHL rating due to the Class A forest classifications in these areas, as does the smaller sections of Class A forest and Class B woodland north and south of the project area.

2.2.2 Post-development Bushfire Attack Level (BAL) contour assessment

A post-development Bushfire Attack Level (BAL) contour assessment has been undertaken for the project area in accordance with Method 1 of AS 3959. The Method 1 procedure incorporates the following factors:

- state-adopted Fire Danger Index (FDI) rating of 80
- vegetation classification
- effective slope
- distance maintained between proposed development areas and the classified vegetation.

The BAL rating gives an indication of the level of bushfire attack (i.e. the radiant heat flux) that may be received by future development and subsequently informs the standard of building construction and/or setbacks required for proposed habitable development to potentially withstand such impacts and/or deliver compliance with the bushfire protection criteria of the Guidelines.

The BAL contours are based on:

- the vegetation classifications and effective slope observed during site inspection on 21 June 2023
- consideration of the proposed on-site clearing extent
- consideration of proposed low threat POS areas
- resultant separation distances achieved in line with the Structure Plan Amendment layout.

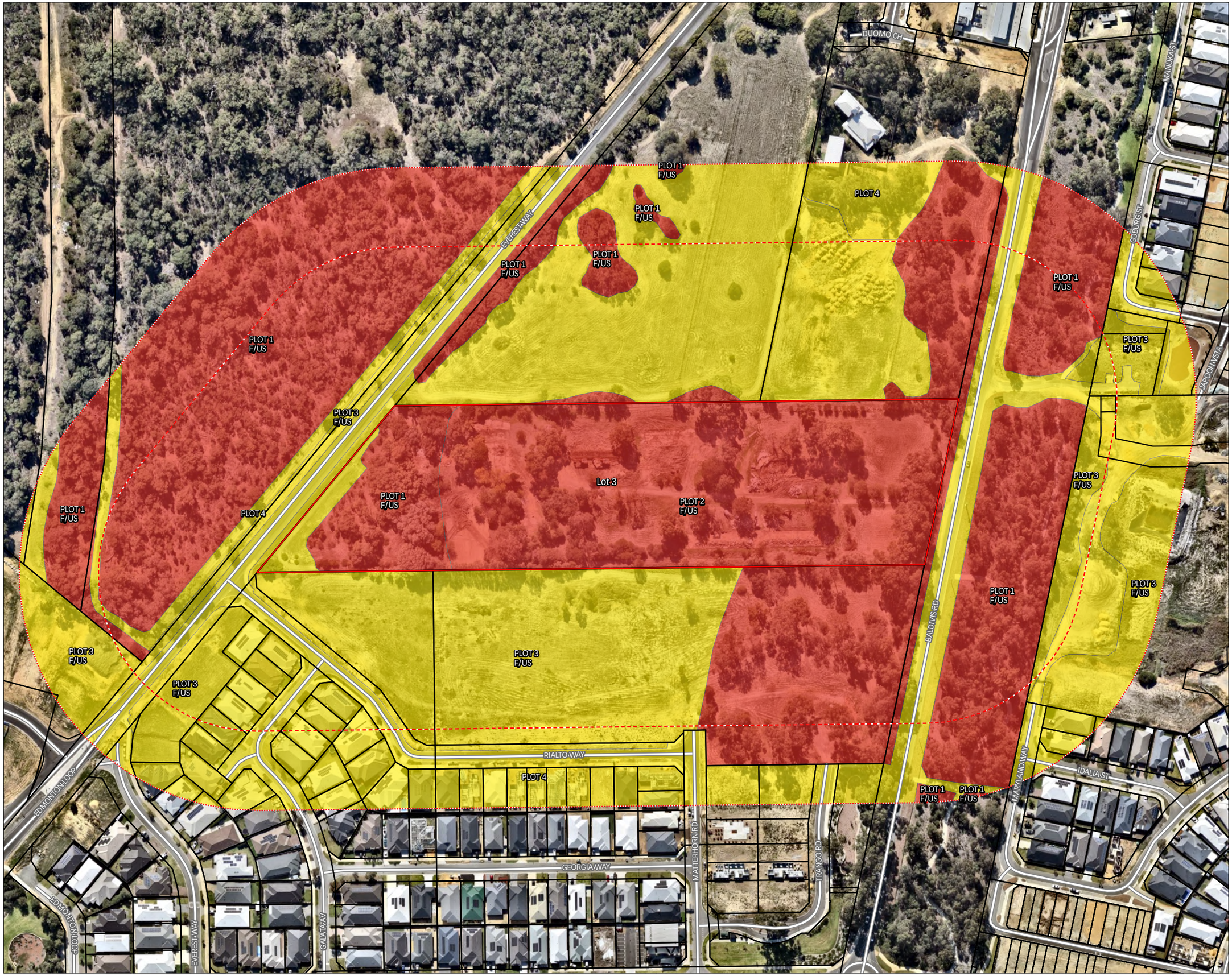
Results of the BAL contour assessment are detailed in **Table 4** and illustrated in **Figure 5**. The anticipated worst case BAL impact to future habitable development within the project area is BAL–FZ. Since the affecting vegetation to the northeast of the project area is considered temporary (refer to indicative development layout shown in **Figure 1**), this impact can be managed through the subdivision stage through the conditioning of temporary quarantining of lots until such time that BAL-29 or lower has been achieved for the relevant areas

Table 4: BAL contour assessment results

Method 1 BAL determination					
Vegetation plot	**Vegetation classification**	**Effective slope**	**Separation distance to lot boundary**	**Highest BAL to lot boundary**	**Modified BAL (with temporary quarantining of lots (see Figure 5)**
1	Class A Forest	Flat/upslope (0°)	24 m	BAL–29	N/A
2	Class B Woodland	Flat/upslope (0°)	0 m	BAL–FZ	BAL–29 (refer to Section 2.2.3 for temporary quarantining measures)
3	Class G Grassland	Flat/upslope (0°)	0 m	BAL–FZ	BAL–29 (refer to Section 2.2.3 for temporary quarantining measures)
4	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])	N/A	N/A	N/A	N/A
5	Area to be modified to a low threat state (Exclusion 2.2.3.2)	N/A	N/A	N/A	N/A

2.2.3 Temporary quarantining strategy

There is temporary BAL-40/FZ impact to the project area (as depicted in **Figure 5**) due to the direct interface with classified vegetation contained within Lot 9001 to the northeast. The abutting vegetation within Lot 9001 is considered temporary as this lot is earmarked for future development (as per **Figure 1**) that will result in removal of the vegetation and associated BAL impacts. On this basis, it is considered appropriate that the portions of the project area affected by temporary BAL-40/FZ impact can be appropriately conditioned at the subdivision approval stage to apply temporary quarantining of the affected lots until removal of the hazard and delivery of BAL-29 or lower. The area of temporary quarantining within the project area will be 14 m from the abutting Class B woodland vegetation and 8 m from the abutting Class G grassland vegetation, as depicted by the temporary quarantining area in **Figure 5**.



Legend

- Project area
- 100m assessment area
- 150m assessment area
- Cadastral boundary

Bushfire hazard level

- Extreme
- Moderate
- Roads

JBS&G

Job No: 65079

Client: Spatial Property Group

Version: A	Date: 21-Sep-2023
Drawn By: jcrute	Checked By: ZC

Scale 1:2,200 at A3

0 25 50
metres

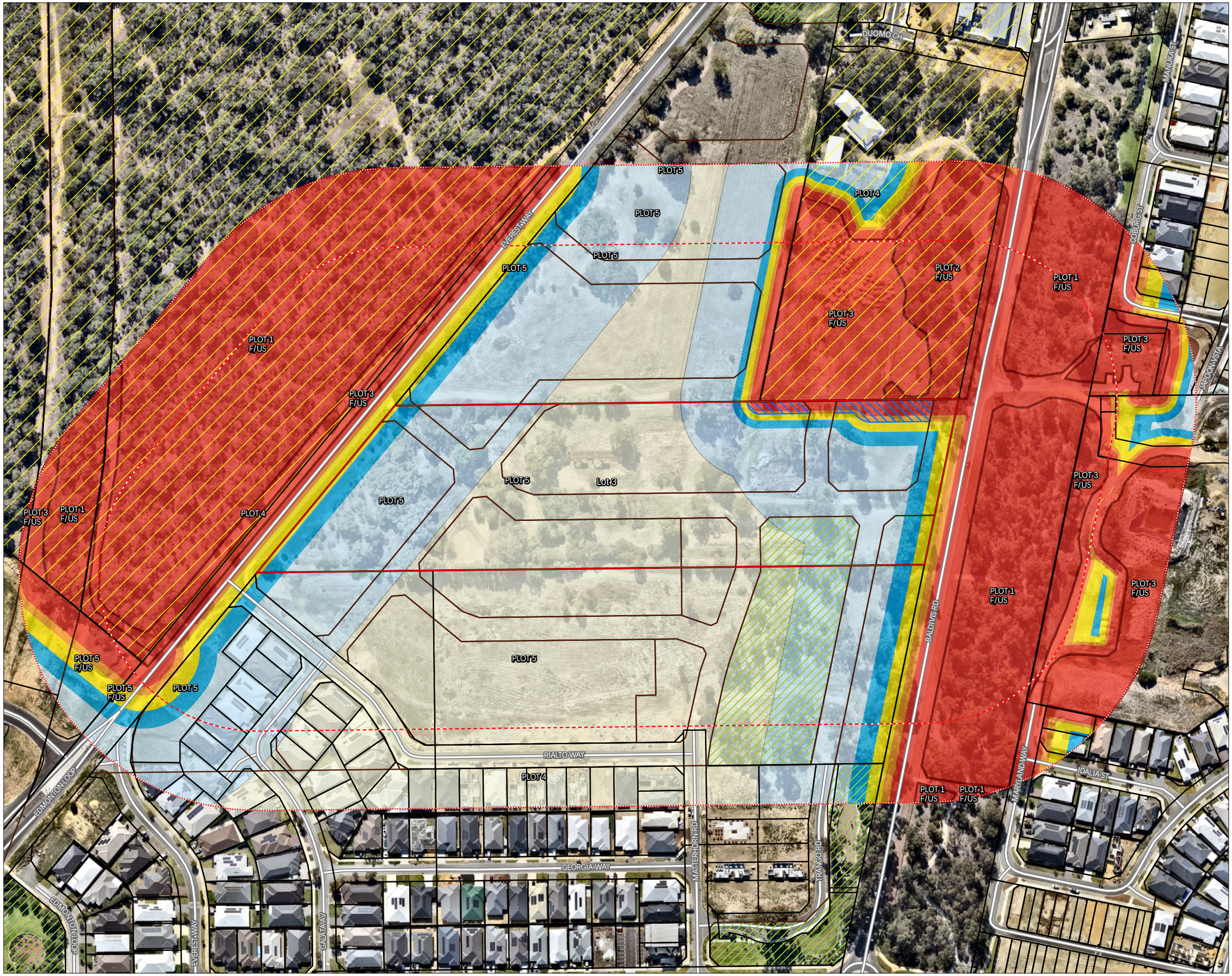
Coord. Sys. GDA2020 MGA Zone 50

Spires Estate, Lot 3
Baldivis Road,
Baldivis WA

PRE-DEVELOPMENT BUSHFIRE HAZARD LEVEL ASSESSMENT

FIGURE 4

File Name: C:\Users\jcrute\JBS&G Australia\JBS&G - DCS - Internal - Documents\Projects\Spatial Property Group\65079 Spires Estate Structure Plan amendment BMP addendum\GIS\02_MapProjects\65079_Spires_BMP_M01_v01\65079_Spires_BMP_M01_v01.aprx
Image Reference: www.nearmap.com© - Imagery Date: 29. April 2023.



Legend

- Project area
- 100m assessment area
- 150m assessment area
- Cadastral boundary
- Proposed development
- Proposed POS
- Future subdivisions
- Classified vegetation
- Temporary quarantining area

BAL contours

- BAL FZ
- BAL 40
- BAL 29
- BAL 19
- BAL 12.5
- BAL Low

Roads

JBS&G

Job No: 65079	
Client: Spatial Property Group	
Version: A	Date: 21-Sep-2023
Drawn By: jcrute	Checked By: ZC

Scale 1:2,200 at A3

0 25 50
metres

Coord. Sys. GDA2020 MGA Zone 50

Spires Estate, Lot 3
Baldivis Road,
Baldivis WA

BAL CONTOUR MAP

FIGURE 5

File Name: C:\Users\jcrute\JBS&G Australia\JBS&G - DCS - Internal - Documents\Projects\Spatial Property Group\65079 Spires Estate Structure Plan amendment BMP addendum\GIS\02_MapProjects\65079_Spires_BMP_M01_v01\65079_Spires_BMP_M01_v01.aprx
Image Reference: www.nearmap.com© - Imagery Date: 29. April 2023.

3. Assessment against bushfire protection criteria

3.1 Compliance with Elements 1-4

Demonstration that the proposed development can comply with relevant acceptable solutions of Elements 1–4 of the bushfire protection criteria of the Guidelines (Version 1.4) is outlined in **Table 5**.

Table 5: Compliance with the bushfire protection criteria of the Guidelines (Elements 1–4)

Bushfire protection criteria	Performance Principle	Method of compliance Acceptable solutions	Proposed bushfire management strategies	Compliance achievable at future planning stages
Element 1: Location	**Performance Principle P1** The strategic planning proposal, subdivision and development application is located in an area where the bushfire hazard assessment is or will, on completion, be moderate or low, or a BAL–29 or below, and the risk can be managed. For unavoidable development in areas where BAL–40 or BAL–FZ applies, demonstrating that the risk can be managed to the satisfaction of the decision-maker.	**A1.1 Development location** The strategic planning proposal, subdivision and development application is located in an area that is or will, on completion, be subject to either a moderate or low bushfire hazard level, or BAL–29 or below.	The pre-development BHL assessment (**Figure 4**) identifies that the project area currently contains land with Moderate and Extreme bushfire hazard levels. However, on completion of development, vegetation within the project area is expected to be cleared and/or modified and managed to a low threat state, as are adjacent portions of the Structure Plan Amendment area to the north and south (**Figure 3**). The post-development BAL contour assessment (see **Figure 5** and **Table 4**) demonstrates that the project area is largely capable of achieving BAL-29 or lower, aside from a small section of BAL-40/FZ intrusion in the northeast of the project area. Implementation of the temporary quarantining strategy at the subdivision stage, as stated in 2.2.3, will ensure that no development occurs within areas of BAL-40/FZ and compliance with A1.1 is maintained.	✓
Element 2: Siting and design	**Performance Principle P2** The siting and design of the strategic planning proposal, subdivision or development application, including roads, paths and landscaping, is appropriate to the level of bushfire threat that applies to the site. The proposal incorporates a defendable space and significantly reduces the heat intensities at the building surface thereby minimising the bushfire risk	**A2.1 Asset Protection Zone** Every habitable building is surrounded by, and every proposed lot can achieve, an APZ depicted on submitted plans, which meets the requirements set out in Schedule 1.	Asset Protection Zones (APZs) required for future habitable development to achieve BAL-29 are to be implemented for all relevant lots where required. The required APZs will be identified at future planning stages based on future subdivision/development design and following a subdivision stage BAL contour assessment. The area of temporary quarantining depicted in **Figure 5** represents a potential APZ setback that may need to be	✓

Bushfire protection criteria	Performance Principle	Method of compliance Acceptable solutions	Proposed bushfire management strategies	Compliance achievable at future planning stages
	to people, property and infrastructure, including compliance with AS 3959 if appropriate.		employed until such time that the adjacent temporary vegetation is removed. APZs are to be implemented and maintained in accordance with Schedule 1 of the Guidelines **(Appendix B**).	
Element 3: Vehicular access	**Performance Principle P3i** The design and capacity of vehicular access and egress is to provide for the community to evacuate to a suitable destination before a bushfire arrives at the site, allowing emergency services personnel to attend the site and/or hazard vegetation.	**A3.1 Public roads** *The minimum requirements under this acceptable solution are applicable to all proposed and existing public roads.* Public roads are to meet the minimum technical requirements in Table 6, Column 1. The trafficable (carriageway/pavement) width is to be in accordance with the relevant class of road in the Local Government Guidelines for Subdivisional Development (IPWEA Subdivision Guidelines), Liveable Neighbourhoods, Austroad standards and/or any applicable standards for the local government area.	All proposed public roads will be constructed to the technical requirements of the Guidelines (see **Appendix C**) and in accordance with relevant federal, State and local government requirements.	✓
		A3.2a Multiple access routes Public road access is to be provided in two different directions to at least two different suitable destinations with an all-weather surface (two-way access). If the public road access to the subject site is via a no-through road which cannot be avoided due to demonstrated site constraints, the road access is to be a maximum of 200 metres from the subject lot(s) boundary to an intersection where two-way access is provided. The no-through road may exceed 200 metres if it is demonstrated that an alternative	The project area forms an extension to the existing approved Spires Estate Structure Plan area and based on indicative development design, completion of the development will provide connections to the existing and proposed public road network as follows: • access west through to Everest Way • access south through future roads to Matterhorn Road and Trango Road • access north through future roads to Duomo Chase, Glacier Parade and Fifty Road. The above connections will provide multiple access routes to suitable destinations, including Rockingham to the west and Baldivis to the south. Multiple access routes will also	✓

Bushfire protection criteria	Performance Principle	Method of compliance Acceptable solutions	Proposed bushfire management strategies	Compliance achievable at future planning stages
		access, including an emergency access way, cannot be provided due to site constraints and the following requirements are met: • the no-through road travels towards a suitable destination; and • the balance of the no-through road, that is greater than 200 metres from the subject site, is wholly within BAL-LOW, or is within a residential built-out area – Figure 23.	need to be provided for individual stages during staging of development, which will be determined at the subdivision and clearance stages of development.	
		A3.2b Emergency access way *Where it is demonstrated that A3.2a cannot be achieved due to site constraints, or where an alternative design option does not exist, an emergency access way can be considered as an acceptable solution.* An emergency access way is to meet all the following requirements: • requirements in Table 6, Column 2; • provides a through connection to a public road; • be no more than 500 metres in length; and • must be signposted and if gated, gates must open the whole trafficable width and remain unlocked.	No permanent EAWs are required; however, if development and vehicle access construction is to be staged, any temporary EAWs required as part of development staging are to be constructed to the technical requirements of the Guidelines (see **Appendix C**).	✓
		A3.3 Through-roads All public roads should be through-roads. No-through roads should be avoided and should only be considered as an acceptable solution where:	All proposed public roads will be through roads. Any temporary no-through roads required as part of development staging will be constructed to the technical requirements of the Guidelines (see **Appendix C**).	✓

Bushfire protection criteria	Performance Principle	Method of compliance Acceptable solutions	Proposed bushfire management strategies	Compliance achievable at future planning stages
		• it is demonstrated that no alternative road layout exists due to site constraints; and • the no-through road is a maximum length of 200 metres to an intersection providing two-way access, unless it satisfies the exemption provisions in A3.2a of this table. A no-through road is to meet all the following requirements: • requirements of a public road (Table 6, Column 1); and • turn-around area as shown in Figure 24.		
	Performance Principle P3ii The design of vehicular access and egress provides: • access and egress for emergency service vehicles while allowing the community to evacuate; • a defendable space for emergency services personnel on the interface • between classified vegetation and development site; and • hazard separation between classified vegetation and the subject site to reduce the potential radiant heat that may impact a lot(s).	**A3.4a Perimeter roads** A perimeter road is a public road and should be provided for greenfield or infill development where 10 or more lots are being proposed (including as part of a staged subdivision) with the aim of: • separating areas of classified vegetation under AS3959, which adjoin the subject site, from the proposed lot(s); and • removing the need for battle-axe lots that back onto areas of classified vegetation. A perimeter road is to meet the requirements contained in Table 6, Column 1. A perimeter road may not be required where: • the adjoining classified vegetation is Class G Grassland;	Based on indicative development design, perimeter roads have, or will be provided at all external development interfaces to provide separation between adjoining classified vegetation hazards and a defendable space for firefighting activities. Existing Baldivis Road and Eighty Road provide perimeter access to vegetation hazards along the western and eastern interfaces respectively.	✓

Bushfire protection criteria	Performance Principle	Method of compliance Acceptable solutions	Proposed bushfire management strategies	Compliance achievable at future planning stages
		• lots are zoned for rural living or equivalent; • it is demonstrated that it cannot be provided due to site constraints; or • all lots have frontage to an existing public road.		
	Performance Principle P3iii Vehicular access is provided which allows: • access and egress for emergency service vehicles; • defendable space for emergency services • personnel on the interface between classified vegetation and development; and • hazard separation between classified vegetation and the site to reduce the potential radiant heat that may impact a lot(s).	**A3.4b Fire service access route** *Where proposed lots adjoin classified vegetation under AS3959, and a perimeter road is not required in accordance with A3.4a, a fire service access route can be considered as an acceptable solution to provide firefighter access, where access is not available, to the classified vegetation.* A fire service access route is to meet all the following requirements: • requirements in Table 6, Column 3; • be through-routes with no dead-ends; • linked to the internal road system at regular intervals, every 500 metres; • must be signposted; • no further than 500 metres from a public road; • if gated, gates must open the required horizontal clearance and can be locked by the local government and/or emergency services, if keys are provided for each gate; and • turn-around areas designed to accommodate type 3.4 fire appliances	As discussed under A3.4a, the proposed development (based on indicative development design) is expected to provide perimeter roads at all external development interfaces. In this regard, fire service access routes (FSARs) are not considered to be required for the proposed development.	N/A

Bushfire protection criteria	Performance Principle	Method of compliance Acceptable solutions	Proposed bushfire management strategies	Compliance achievable at future planning stages
		and to enable them to turn around safely every 500 metres.		
	Performance Principle P3iv Vehicular access is provided which allows emergency service vehicles to directly access all habitable buildings and water supplies and exit the lot without entrapment.	**A3.5 Battle-axe access legs** *Where it is demonstrated that a battle-axe cannot be avoided due to site constraints, it can be considered as an acceptable solution.* There are no battle-axe technical requirements where the point the battle-axe access leg joins the effective area of the lot, is less than 50 metres from a public road in a reticulated area. In circumstances where the above condition is not met, or the battle-axe is in a non-reticulated water area, the battle-axe is to meet all the following requirements: • requirements in Table 6, Column 4; and • passing bays every 200 metres with a minimum length of 20 metres and a minimum additional trafficable width of two metres (i.e. the combined trafficable width of the passing bay and constructed private driveway to be a minimum six metres).	A3.5 is relevant to the subdivision stage of planning.	N/A
		A3.6 Private driveways There are no private driveway technical requirements where the private driveway is: • within a lot serviced by reticulated water; • no greater than 70 metres in length between the most distant external part of the development site and the public road measured as a hose lay; and	A3.6 is relevant to the DA stage of planning.	N/A

Bushfire protection criteria	Performance Principle	Method of compliance Acceptable solutions	Proposed bushfire management strategies	Compliance achievable at future planning stages
		• accessed by a public road where the road speed limit is not greater than 70 km/h. In circumstances where all of the above conditions are not met, or the private driveway is in a non-reticulated water area, the private driveway is to meet all the following requirements: • requirements in Table 6, Column 4; • passing bays every 200 metres with a minimum length of 20 metres and a minimum • additional trafficable width of two metres (i.e. the combined trafficable width of the passing bay and constructed private driveway to be a minimum six metres); and • turn-around area as shown in Figure 28 and within 30 metres of the habitable building.		
Element 4: Water	No performance principle applies	**A4.1 Identification of future water supply** Evidence that a reticulated or sufficient non-reticulated water supply for bushfire fighting can be provided at the subdivision and/or development application stage, in accordance with the specifications of the relevant water supply authority or the requirements of Schedule 2. Where the provision of a strategic water tank(s) is required a suitable area within a road reserve or a dedicated lot the location should be identified, should be identified on the structure plan, to the satisfaction of the local government.	A reticulated water supply will be provided for proposed development in accordance with the specifications of the relevant water supply authority through extension of existing services from surrounding development areas.	✓

Bushfire protection criteria	Performance Principle	Method of compliance Acceptable solutions	Proposed bushfire management strategies	Compliance achievable at future planning stages
	Performance Principle P4 Provide a permanent water supply that is: • sufficient and available for firefighting purposes; • constructed from non-combustible materials (e.g. steel), or able to maintain its integrity throughout a bushfire; and • accessible, with legal access for maintenance and re-filling by tankers and emergency service vehicles.	**A4.2 Provision of water for firefighting purposes** Where a reticulated water supply is existing or proposed, hydrant connection(s) should be provided in accordance with the specifications of the relevant water supply authority. Where these specifications cannot be met, then the following applies: • The provision of a water tank(s), in accordance with the requirements of Schedule 2; and • Where the provision of a strategic water tank(s) is applicable, then the following requirements apply: – land to be ceded free of cost to the local government for the placement of the tank(s); – the lot or road reserve where the tank is to be located is identified on the plan of subdivision; – tank capacity, construction, and fittings, provided in accordance with the requirements of Schedule 2; and – a strategic water tank is to be located no more than 10 minutes from the subject site (at legal road speeds). Where a subdivision includes an existing habitable building(s) that is to be retained, a water supply should be provided to this existing habitable building(s), in accordance with the requirements listed above.	A4.2 is relevant to the subdivision and DA stage of planning.	N/A

4. Responsibilities for implementation and management of the bushfire measures

This BMP addendum has been prepared as a strategic guide to demonstrate how development compliance will be delivered at future planning stages in accordance with the Guidelines. Aside from the preparation of future BMPs/addendums to accompany future subdivision/development applications where appropriate, there are no further items to implement, enforce or review at this strategic stage of the planning process.

Future BMPs/addendums prepared to accompany future subdivision/development applications are to meet the relevant commitments outlined in this strategic level BMP addendum, address the relevant requirements of SPP 3.7 (i.e. Policy Measures 6.4 and 6.5 respectively) and demonstrate in detail how the proposed development will comply with the relevant acceptable solutions of the Guidelines. Future BMPs/addendums prepared to accompany future subdivision/development applications are to include the following detailed information:

- confirmation of final lot layout in accordance with a plan of subdivision
- confirmation of the anticipated post-development classified vegetation extent, exclusions, effective slope and separation distances
- confirmation of areas to be modified to a non-vegetated/low threat managed state as part of proposed development
- confirmation of the anticipated low threat POS areas through support from a POS landscape concept or plan
- confirmation of how BAL management will be addressed during development staging, including management of temporary on-site bushfire hazards resulting from staged clearing (i.e. provision of low threat staging buffers or temporary quarantining of lots where required)
- confirmation of a temporary quarantining strategy that deals with the temporary classified vegetation identified to the northeast of the project area and resulting BAL-40/FZ impact
- confirmation of how vehicular access provisions will be addressed during development staging, including demonstration that a minimum of two access routes will be achieved for each stage of development (i.e. provision of public roads in advance and/or temporary compliant access provisions such as no-through roads and EAWs)
- confirmation of water supply provisions in relation to reticulated water
- provisions for notification on Title for any proposed lots situated within a designated bushfire prone area containing a rating of BAL-12.5 or greater
- compliance requirements with the annual City of Rockingham Fire Control Notice (see Appendix D)
- assessment against the acceptable solutions of Elements 1–4 of the bushfire protection criteria of the Guidelines
- proposed audit and compliance program outlining all measures requiring implementation prior to lot title and the appropriate timing and responsibilities for implementation.

Based on the information contained in this BMP, JBS&G considers the bushfire hazards within and adjacent to the project area and the associated bushfire risks to the proposed development are readily manageable through adoption of standard acceptable solution management responses outlined in the Guidelines. JBS&G considers that the project area can be developed with a manageable level of bushfire risk whilst maintaining full compliance with SPP3.7 and the Guidelines, which will be demonstrated through future BMPs/addendums prepared to accompany future subdivision/development applications.

5. References

Department of Fire and Emergency Services (DFES) 2021, *Map of Bush Fire Prone Areas*, [Online], Government of Western Australia, available from: https://maps.slip.wa.gov.au/landgate/bushfireprone/, [20/06/2023].

Department of Planning (DoP) 2016, *Visual guide for bushfire risk assessment in Western Australia*, Department of Planning, Perth.

Standards Australia (SA) 2018, Australian Standard *AS 3959–2018 Construction of Buildings in Bushfire-prone Areas*, Standards Australia, Sydney.

Strategen 2014, *Fire Management Plan: Spires Estate Local Structure Plan*, report prepared for Spatial Property Group, March 2014.

Strategen 2018, *Bushfire Management Plan Addendum: Spires Estate, Baldivis*, report prepared for Spatial Property Group, March 2018.

Western Australian Planning Commission (WAPC) 2015, *State Planning Policy 3.7 Planning in Bushfire Prone Areas*, Western Australian Planning Commission, Perth.

Western Australian Planning Commission (WAPC) 2021, *Guidelines for Planning in Bushfire Prone Areas*, Version 1.4 December 2021, Western Australian Planning Commission, Perth.

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Appendix A Pre-development vegetation plot photos and descriptions

Plot 1	
Vegetation classification	Class A Forest

Description / justification

Forest vegetation consisting of overstorey trees 10–30 m high, a midstorey and a grassy understorey

Photo ID: 1a

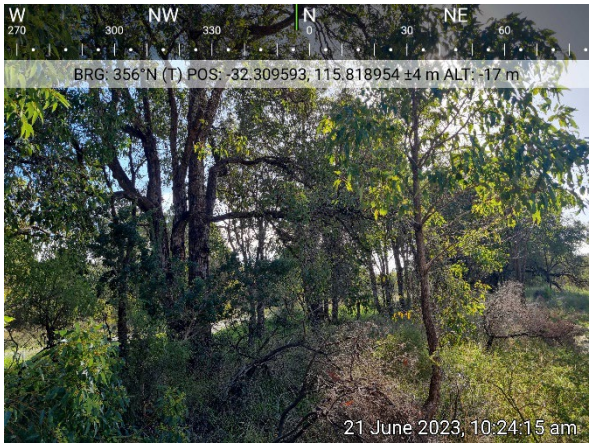
Photo ID: 1b

Photo ID: 1c

Photo ID: 1d

Photo ID: 1e

Photo ID: 1f

Plot 1	
 **Photo ID:** 1g	 **Photo ID:** 1h
 Photo ID: 1i	 **Photo ID:** 1j
 Photo ID: 1k	 **Photo ID:** 1l

Plot 1	
 Photo ID: 1m	

Plot 2	
Vegetation classification	Class B Woodland

Description / justification

Sparse overstorey trees with a grassy understorey

Photo ID: 2a

Photo ID: 2b

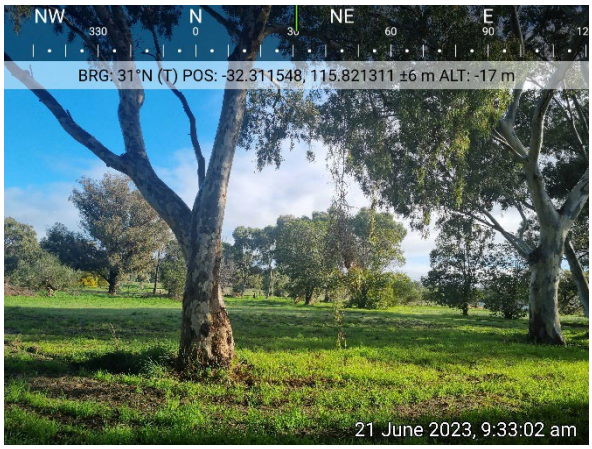
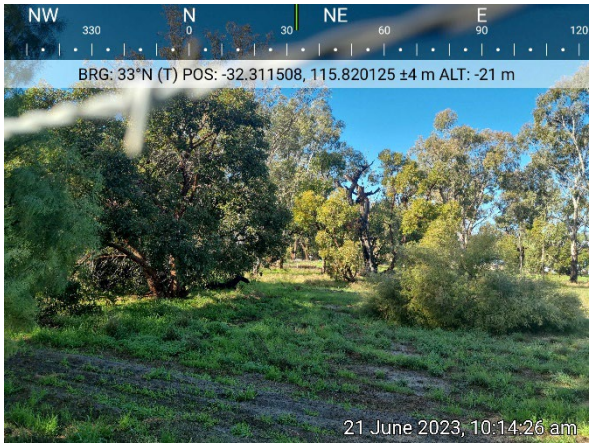


Photo ID: 2c

Photo ID: 2d

Photo ID: 2e

Photo ID: 2f

Plot 2	
 **Photo ID:** 2g	 **Photo ID:** 2h
 Photo ID: 2i	 **Photo ID:** 2j
 Photo ID: 2k	

Plot 3	
Vegetation classification	Class G Grassland

Description / justification

Grassland greater than 100 mm in height at maturity

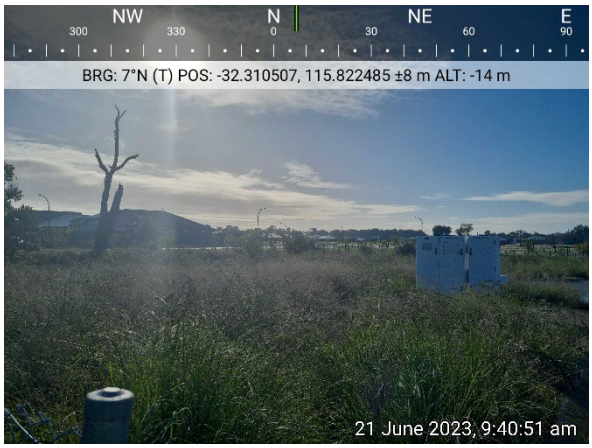


Photo ID: 3a

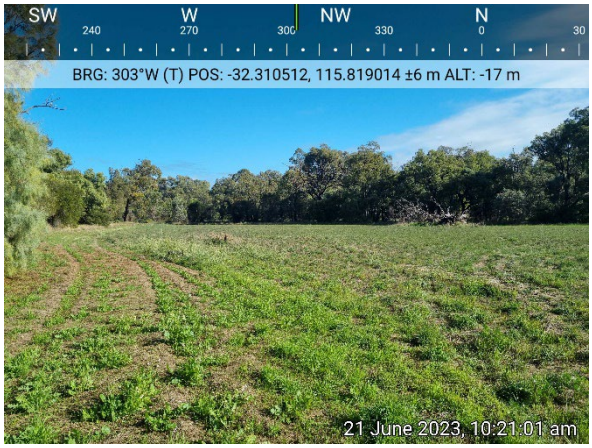
Photo ID: 3b

Photo ID: 3c

Photo ID: 3d

Photo ID: 3e

Photo ID: 3f

Plot 3	
Photo ID: 3g	**Photo ID:** 3h
 **Photo ID:** 3i	**Photo ID:** 3j
Photo ID: 3k	**Photo ID:** 3l

Plot 3	
Photo ID: 3m	**Photo ID:** 3n

Plot 4	
Vegetation classification	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])

Description / justification

Existing non-vegetated land/low threat managed areas including existing residential areas, driveways, roads, footpaths, access tracks, bushfire staging buffers, managed POS, etc

Photo ID: 4a

Photo ID: 4b

Photo ID: 4c

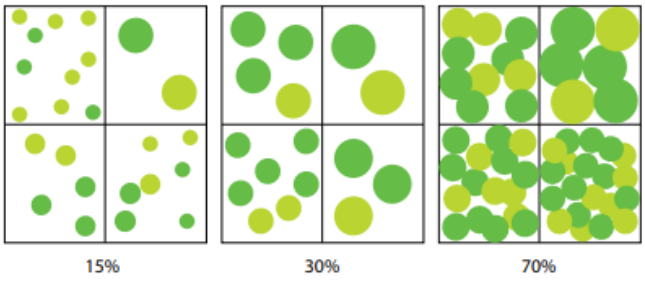
Photo ID: 4d

Photo ID: 4e

Photo ID: 4f

Plot 4	
 Photo ID: 4g	 **Photo ID:** 4h
 Photo ID: 4i	 **Photo ID:** 4j
 Photo ID: 4k	

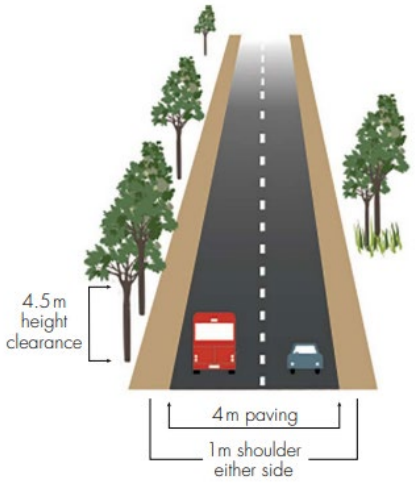
Appendix B APZ Standards (Schedule 1 of the Guidelines)

Schedule 1: Standards for Asset Protection Zones	
Object	**Requirement**
Fences within the APZ	Should be constructed from non-combustible materials (for example, iron, brick, limestone, metal post and wire, or bushfire-resisting timber referenced in Appendix F of AS 3959).
Fine fuel load (Combustible, dead vegetation matter <6 millimetres in thickness)	Should be managed and removed on a regular basis to maintain a low threat state. Should be maintained at <2 tonnes per hectare (on average). Mulches should be non-combustible such as stone, gravel or crushed mineral earth or wood mulch >6 millimetres in thickness.
Trees* (>6 metres in height)	Trunks at maturity should be a minimum distance of six metres from all elevations of the building. Branches at maturity should not touch or overhang a building or powerline. Lower branches and loose bark should be removed to a height of two metres above the ground and/or surface vegetation. Canopy cover within the APZ should be <15 per cent of the total APZ area. Tree canopies at maturity should be at least five metres apart to avoid forming a continuous canopy. Stands of existing mature trees with interlocking canopies may be treated as an individual canopy provided that the total canopy cover within the APZ will not exceed 15 per cent and are not connected to the tree canopy outside the APZ. **Figure 19:** Tree canopy cover – ranging from 15 to 70 per cent at maturity 
Shrub* and scrub* (0.5 metres to six metres in height). Shrub and scrub >6 metres in height are to be treated as trees.	Should not be located under trees or within three metres of buildings. Should not be planted in clumps >5 square metres in area. Clumps should be separated from each other and any exposed window or door by at least 10 metres.
Ground covers* (<0.5 metres in height. Ground covers >0.5 metres in height are to be treated as shrubs)	Can be planted under trees but must be maintained to remove dead plant material, as prescribed in 'Fine fuel load' above. Can be located within two metres of a structure, but three metres from windows or doors if >100 millimetres in height.
Grass	Grass should be maintained at a height of 100 millimetres or less, at all times. Wherever possible, perennial grasses should be used and well-hydrated with regular application of wetting agents and efficient irrigation.

Schedule 1: Standards for Asset Protection Zones	
Defendable space	Within three metres of each wall or supporting post of a habitable building, the area is kept free from vegetation, but can include ground covers, grass and non-combustible mulches as prescribed above.
LP Gas Cylinders	Should be located on the side of a building furthest from the likely direction of a bushfire or on the side of a building where surrounding classified vegetation is upslope, at least one metre from vulnerable parts of a building. The pressure relief valve should point away from the house. No flammable material within six metres from the front of the valve. Must sit on a firm, level and non-combustible base and be secured to a solid structure.

Source: *Guidelines for Planning in Bushfire Prone Areas (WAPC 2021)*

Appendix C Vehicular access technical standards of the Guidelines

Acceptable Solution A3.1 – Public Roads
Explanatory Note E3.1
These Guidelines do not prescribe values for the trafficable (carriageway/pavement) width of public roads as they should be in accordance with the class of road as specified in the IPWEA Subdivision Guidelines, Liveable Neighbourhoods, Austroad Standards and/or any applicable standard in the local government area. The IPWEA Subdivision Guidelines, Liveable Neighbourhoods, Austroad Standards do not prescribe a horizontal clearance. However, it is recommended that a traversable verge is provided to allow for emergency services vehicles to stop and operate on the side of the public road, specifically where the public road may traverse large areas of classified vegetation. Where local government roads are proposed to be widened by the proponent, they must obtain approval from the local government.    Figure 20: Example of a public road

Source: *Guidelines for Planning in Bushfire Prone Areas (WAPC 2021)*

Acceptable Solution A3.2a – Multiple access routes
Explanatory Note E3.2a

Two-way public road access is public road access from a lot in at least two different directions to two suitable destinations, and provides residents and the community, as well as emergency services, with access and egress from both the subdivision and individual habitable buildings/development in the event of a bushfire emergency. A single road provides no alternative route if the access becomes congested or is unable to be traversed due to smoke and/or fallen trees during a bushfire.

Two-way public road access applies to access/egress routes leading into a subdivision, as well as those within a subdivision. A road that loops back onto itself does not constitute the option of two different directions.

Two-way public road access should always be the first option. Where the site is not able to achieve two-way access within 200 metres of the lot boundary, due to demonstrated site or environmental constraints, the proponent should identify options for an emergency access way from the subject site to a suitable destination. Where an emergency access way cannot be provided, the proponent should demonstrate compliance with the performance principle.

Subject sites or proposed lots greater than 200 metres from an intersection, which provides two-way access, do not satisfy the requirement for two-way access unless they meet the provisions which allow for no-through roads greater than 200 metres in A3.2a.

To demonstrate compliance with the performance principle for two-way access, the bushfire planning practitioner may have regard to:

- the extent of the bushfire hazard, location and vegetation classification, the likelihood, potential severity and impact of bushfire to the subject site and the road network;
- time between fire detection and the onset of conditions in comparison to travel time for the community to evacuate to a suitable destination;
- available access route(s) travelling towards a suitable destination; and
- turn-around area for a fire appliance for no-through roads.

Figure 21: Example of compliant and non-compliant two-way

Source: *Guidelines for Planning in Bushfire Prone Areas (WAPC 2021)*

Acceptable Solution A3.2b – Emergency access way
Explanatory Note E3.2b
An emergency access way is not a preferred alternative to through public road access and should only be considered acceptable where it has been demonstrated that it will provide the safety and performance needs of emergency services and the community, including consideration for future needs, and that public road access to satisfy A3.2a cannot be achieved due to site constraints, such as an established road network with no opportunity to provide a public road for secondary access. Acceptance of an emergency access way should also consider the ability to accommodate reasonable worst-case vehicle volumes. The principle function of the emergency access way is to provide a contingency (second) community evacuation route and simultaneously provide access for emergency services, in the event of a bushfire emergency. Where an emergency access way traverses classified vegetation, which has the potential to create a bushfire hazard, an emergency access way performs the secondary function of providing access by emergency services to this vegetation. Emergency access ways should connect to a public road to allow alternative two-way through access. An emergency access way should not exceed 500 metres in length as they may not be as safe for road-use due to not being designed or constructed to the full requirements of a public road and may present uncertainties to emergency service personnel and the public as they are not part of the daily road network and not identified on Maps. **Permanent public emergency access way** An emergency access way can be provided as either a public easement in gross or a right-of-way. In both approaches, the management of the emergency access way is by the local government as the grantee of the easement or management body of the right-of-way. The proponent must obtain written consent from the local government that the local government will accept care, control and management of the easement or right-of-way; this must be provided to the decision-maker prior to granting planning approval. The approach taken is at the discretion of the decision-maker and/ or the local government and is also dependent on whether the land is to remain in private ownership or be ceded to the Crown. Consultation with Land Use Management at the Department of Planning, Lands and Heritage should also be considered if the land is to be ceded to the Crown or if the local government is uncertain of which approach to take. If the emergency access way is provided as an easement, it should be provided as a public easement in gross under sections 195 and 196 of the Land Administration Act 1997 in favour of the local government and/or public authority, to ensure accessibility for emergency services and the public at all times. To be provided as a right-of-way the emergency access way should be vested in the Crown under section 152 of the Planning and Development Act 2005 as a right-of-way and such land to be ceded free of cost and without any payment or compensation by the Crown. If gates are used to control traffic flow during non-emergency periods, these will be managed by the local government and must not be locked. Gates should be double gates wide enough to access the full pavement width and accommodate Type 3.4 fire appliances with the design and construction to be approved by the relevant local government. **Temporary public emergency access way** A temporary emergency access way may be proposed to facilitate the staging arrangements of a subdivision. The provision of two public roads may not be possible in the first stage of the subdivision and an emergency access way can be provided as an interim access route until the second public road is developed and gazetted in a subsequent stage of the subdivision (see figure 22). The emergency access way should be provided in the same manner as a permanent emergency access way, but it should be removed from the certificate of title once the public road

Acceptable Solution A3.2b – Emergency access way

Explanatory Note E3.2b

is developed and gazetted. Where an emergency access way is proposed as an alternative to a public road, the Bushfire Management Plan should provide thorough justification for its use.

Restricted public emergency access way

There may be some instances where a restricted emergency access way is proposed as a performance principle based solution where access is only available to the public in the event of a bushfire emergency. This option can only be considered where the local government or Main Roads WA have advised that vehicular access on the emergency access way is not allowed during non-emergency periods, as it provides an additional thoroughfare and entry point on a local or State road. In this scenario, the emergency access way can be provided as an easement under section 195 of the Land Administration Act 1997, as public access in the event of a bushfire emergency or vested in the Crown as a reserve under section 152 of the Planning and Development Act 2005. Such land is to be ceded free of cost without any payment or compensation by the Crown. The proponent must obtain written consent from the local government that the local government will accept care, control and management of the proposed reserve and agree to the terms of the Management Order Conditions (if applicable); this must be provided to the decision-maker prior to granting planning approval.

The purpose of the reserve should be for a public purpose specified in the condition related to the subdivision, for example for emergency access only, or for emergency access and recreation. A reserve for emergency access and recreation can optimise the land-use as a dual purpose where it provides vehicular access in the event of a bushfire emergency, but can be accessed by the public (on foot) on a day-to-day basis as a recreation link. Appropriate signage can ensure the general public is aware of the purpose of the reserve. The approach taken is at the discretion of the decision-maker and/or local government.

Right-of-carriageway emergency access way

There may be some instances where a right-of-carriageway easement is proposed as a performance principle-based solution. This may be where particular landowner(s) and emergency services, but not the public, require access over a neighbouring lot(s). A right-of-carriageway easement should be provided under section 195 of the Land Administration Act 1997. The easement is to provide alternative access for the particular landowner(s) in the event of a bushfire emergency and not for use by the public. In this scenario, support will be necessary from the adjoining lot owner(s). The easement is to be granted to the local government and it is to agree with the landowner on the arrangements of the management of the easement area by deed. These management arrangements will be at the discretion of the local government. If gated, the easement area can be locked to restrict day-to-day vehicular access.

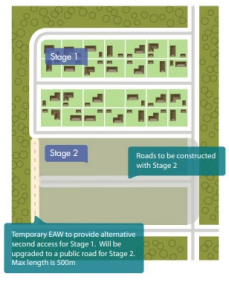


Figure 22: Example of an emergency access way

Source: *Guidelines for Planning in Bushfire Prone Areas (WAPC 2021)*

Acceptable Solution A3.3 – Through roads

Explanatory Note E3.3

In bushfire prone areas, a proposed structure plan or subdivision that incorporates no-through roads should be avoided because they do not provide a connected and legible design that allows for easy access and egress by the community, residents and emergency services in the event of a bushfire. No-through roads also reduce the options available for access and egress in the event of a bushfire emergency.

There will however be situations where a subject site is accessed via an existing or proposed no-through road and alternative access cannot be provided. In these situations, the proponent should demonstrate to the decision-maker, that all efforts have been made with the local government and/or adjoining landowners to secure alternative public road access or an emergency access way and that a redesign has been explored. The bushfire planning practitioner may need to develop a performance principle-based solution or address the non-compliance and demonstrate to the decisionmaker why discretion should be exercised in accordance with section 2.6 of these Guidelines.

No-through roads will only be considered an acceptable solution where it is demonstrated by the proponent, to the satisfaction of the decision maker, that a no through-road cannot be avoided due to site constraints. For example, the internal road design of a structure plan or subdivision where site constraints, such as a water body or Bush Forever, prevent the ability to create a through-road and a no through road may be a more appropriate road layout.

No-through roads should be a maximum of 200 metres from the lot(s) boundary to an intersection where two-way access is provided and may only exceed 200 metres if it meets the provisions which allow for no-through roads greater than 200 metres in A3.2a.

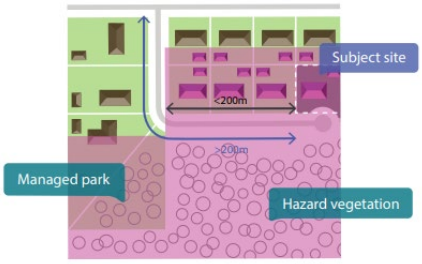


Figure 23: Example of a site on a no-through road greater than 200 metres from the intersection, but within 200 metres of BAL-LOW

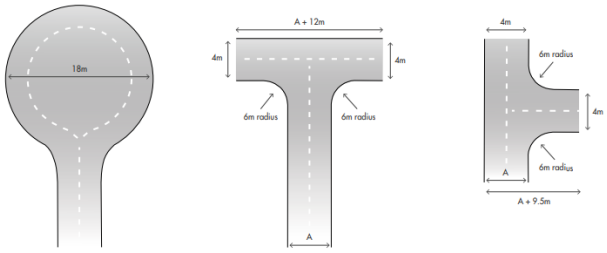


Figure 24: Turn-around area dimensions for a no-through road

Source: *Guidelines for Planning in Bushfire Prone Areas (WAPC 2021)*

Acceptable Solution A3.4a – Perimeter roads

Explanatory Note E3.4a

Where a planning proposal includes the creation of 10 or more lots adjacent to each other, which adjoin classified vegetation under AS 3959 with the exception of Class G Grassland, as part of a greenfield development or large urban infill site, hazard separation and defendable space should be provided in the form of a perimeter road. Greenfield is 'undeveloped or minimally developed areas that have been identified for urban development'; and urban infill is 'the redevelopment of existing urban areas at a higher density than currently exists'. The creation of 10 or more lots includes cumulative subdivision applications where the subdivision application may be part of a staged subdivision.

A perimeter road should be in accordance with the class of road as specified in the IPWEA Subdivision Guidelines, Liveable Neighbourhoods, Austroad Standards and/or any applicable standard in the local government area as per the requirements of a public road in Table 6, Column 1.

As the road is likely to function as a key neighbourhood distributor, or similar, consideration should be given to the provision of additional width to allow for emergency services vehicles to stop and operate on the side of the perimeter road, whilst simultaneously proving for the evacuation of the community (Figure 20).

When designing a strategic planning proposal and/or subdivision, creating a large setback between classified vegetation and proposed lots with a perimeter road, and orientating habitable buildings to front onto (rather than back onto) areas of vegetation has many benefits, including:

- passive surveillance;
- defendable space for firefighting and emergency management purposes;
- reducing the potential radiant heat that may impact a habitable building in a bushfire event;
- reducing the need for battle-axe lots; and
- unconstrained public access/egress for the community in the event of a bushfire.

In developments where no perimeter road exists, property defence in a bushfire event is difficult and can be impossible. Where proposed lots have frontage to an existing public road and abut the hazard at the rear or side, it may be an undesirable planning outcome to create lots which front the existing public road and back onto a perimeter road. In this instance, consideration should be given to a fire service access route. Refer to E3.4b below.

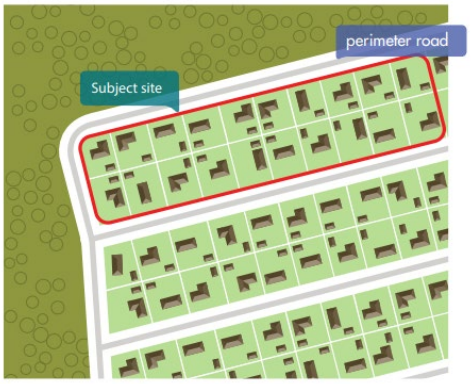


Figure 25: Example of a perimeter road

Source: *Guidelines for Planning in Bushfire Prone Areas (WAPC 2021)*

Technical requirement	1	2	3	4
	Public road	Emergency access way[1]	Fire service access route[1]	Battle-axe and private driveways[2]
Minimum trafficable surface (m)	In accordance with A3.1	6	6	4
Minimum horizontal clearance (m)	N/A	6	6	6
Minimum vertical clearance (m)	4.5	4.5	4.5	4.5
Minimum weight capacity (t)	15	15	15	15
Maximum grade unsealed road[3]	As outlined in the IPWEA Subdivision Guidelines	1:10 (10%, 6°)	1:10 (10%, 6°)	1:10 (10%, 6°)
Maximum grade sealed road[3]		1:7 (14.3%, 8°)	1:7 (14.3%, 8°)	1:7 (14.3%, 8°)
Maximum average grade sealed road		1:10 (10%, 6°)	1:10 (10%, 6°)	1:10 (10%, 6°)
Minimum inner radius of road curves (m)		8.5	8.5	8.5

[1] To have crossfalls between 3 and 6%

[2] Where driveways and battle-axe legs are not required to comply with the widths in A3.5 or A3.6, they are to comply with the Residential Design Codes and Development Control Policy 2.2 Residential Subdivision

[3] Dips must have no more than a 1 in 8 (12.5% -7.1 degree) entry and exit angle.

Appendix D City of Rockingham Fire Control Notice

Fire Control Notice 2023 – 2024

Your property must comply on 1 December 2023 and be maintained through to 31 May 2024

First and final notice to owners and/or occupiers of all land within the City of Rockingham

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Penalty of up to $5,000 for non-compliance

rockingham.wa.gov.au

city of Rockingham

where the coast comes to life

As a measure to assist in the control of bushfires and pursuant to the powers contained in ***Section 33 of the Bush Fires Act 1954***, you have a legal requirement to carry out fire prevention works on your property. Your property must comply on 1 December 2023 and be maintained through to 31 May 2024.

"Take notice that pursuant to ***Section 33 (4) of the Bush Fires Act 1954***, where the owner and/or occupier of the land fails or neglects to comply with the requisitions of this Notice within the specified times, the City of Rockingham may by its officers and with such servants, workmen and contractors, vehicles and machinery as the officers deem fit, enter upon the land and carry out the requisitions of this Notice which have not been complied with and pursuant to ***Section 33 (5) of the Bush Fires Act 1954***, the amount of any costs and expenses incurred may be recovered from you as the owner and/or occupier of the land."

Compliance inspections will commence on 1 December 2023. Failure to comply with the City's Fire Control Notice may result in a penalty of up to $5,000, with additional contractor and administration costs to carry out fire prevention works on your property.

All land with an area of 4047m^2 or more (more than one acre)

Owners/Occupiers of developed and vacant land are required to:

- install and maintain mineral earth firebreaks as per firebreak specifications
- ensure driveways and access ways to all buildings are maintained at a minimum of three (3) metres in width and a vertical clearance height of four (4) metres, with all over hanging vegetation trimmed back to clear access.

All land with an area of less than 4047m^2 (less than one acre)

Owners/Occupiers of vacant land are required to:

- remove accumulated fuel such as leaf litter, twigs, dead bush and dead trees capable of carrying a running fire
- have the entire vacant land clear of weed or long grasses by slashing, mowing or other means to a height no greater than 50 mm and maintained in this state.

Owners/Occupiers of developed land are required to:

- ensure driveways and access ways to all buildings are maintained at a minimum of three (3) metres in width and a vertical clearance height of four (4) metres, with all over hanging vegetation trimmed back to clear access.

Firebreak Specifications

- must be not less than three (3) metres wide immediately inside and along all boundaries (including on boundaries adjacent to roads, rail and drain reserves and all public open space reserves)
- must be not more than four (4) metres wide (further width extensions may be considered upon written application for approval to the City)
- may have a corner turning radius of up to ten (10) metres
- must have a vertical clearance height of four (4) metres, with all over hanging vegetation trimmed back clear of the firebreak
- must be a mineral earth firebreak with a continuous trafficable surface for a 4WD vehicle, clear of any obstructions and must not terminate in a cul-de-sac (dead end)
- maintained and living lawns are acceptable in conjunction with, or in lieu of mineral earth firebreaks, provided that the same width and height requirements for a firebreak are maintained.

Firebreaks are intended to minimise the spread or extension of a bushfire and provide safe access on your property for emergency vehicles (ensuring fire does not travel under the vehicles or underfoot).

Bushfire Management Plan

Previously known as a Fire Management Plan. All properties that are subject to a Bushfire Management Plan as a result of a subdivision or development application or an approved treatment plan, must comply with the requirements of such plans in their entirety.

Additional Works

In addition to the requirements of this Notice, regardless of land size and location, you may be required to carry out further fire prevention works to reduce hazards considered necessary by an Authorised Officer. Any further requirement would be specified by way of a "work order" forwarded to the address of the owner(s) and/or occupier(s).

Some examples of these could be:

- ensure roofs, gutters and walls of all buildings on the land are free of flammable matter
- remove accumulated fuel such as leaf litter, twigs, dead bush and dead trees capable of carrying a running fire
- reduce unmanaged grasses/weeds by slashing, mowing or other means
- reduce long grasses in areas not being grazed or cultivated by slashing, mowing, bailing or by other means
- reduce vegetation to a low threat state from the outer edge of the firebreak through to the property boundary (e.g. no long grass or overhanging branches)
- assets identified in the City's **Bushfire Risk Management Plan 2018 - 2022** or any land identified with a treatment plan to reduce risk to assets.

Any owner and/or occupier who engages a contractor to undertake works on their behalf is responsible for ensuring that the completed works meet the requirements of this Fire Control Notice.

Any Fire Control Notice previously published by the City of Rockingham in the Government Gazette or in any locally circulated newsprint is hereby revoked.

Variation to the Fire Control Notice

To request authorisation to use other methods of fire prevention on your land outside of this notice, please apply in writing together with an 'Application to Vary Location and Type of Firebreaks' form (available on the City's website rockingham.wa.gov.au). Submit completed forms to the City of Rockingham no later than 31 October 2023.

A submission for a variation is required annually for the duration of that year's Fire Control Notice period.

If you require further information or would like to talk with a Fire Control Officer, please call **9528 0333** or email **firecontrol@rockingham.wa.gov.au**

APPENDIX 6: SITE CONTAMINATION REPORT

Lot 3 Baldivis Road, Baldivis

Detailed Site Investigation

Western Environmental Pty Ltd
(08) 6162 8980
PO Box 437, Leederville, WA 6903
enquiries@westenv.com.au
westenv.com.au

Lot 3 Baldivis Road, Baldivis

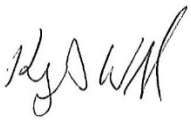
Detailed Site Investigation

Report No:
P22.142-RPT-DSI_0
Issue Date:
11-Oct-2023
Status
FINAL

Prepared for:
Spatial Property Group
Unit 5, Level 2, 896 Canning Highway,
Applecross WA 6153

Prepared by
Western Environmental Pty Ltd
Unit 5, 162 Colin Street
West Perth WA 6005
westenv.com.au

Internal Review

Author	Reviewed by	Approved by
		
Robin Anderson Principal Environmental Scientist	**Kylie Skippings** Senior Principal Environmental Engineer	**Robin Anderson** Principal Environmental Scientist
2-Oct-2023	**4-Oct-2023**	**6-Oct-2023**

Distribution Record

Copies	Document ID / Version	Date	Received by
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Scope of Services

This environmental report ("this report") has been prepared for the sole benefit and exclusive use of the Client for the purpose for which it was prepared in accordance with the agreement between the Client and WEPL ("the Agreement"). However, in addressing the requirements of the Contaminated Sites Act 2003, an Accredited Contaminated Sites Auditor may be engaged by the Client to undertake review of this report, prior to its submission to the DWER. The report shall be made available and can be relied upon for the purposes of the Contaminated Sites Act.

WEPL disclaims any and all liability with respect to any use of or reliance upon this report for any other purpose whatsoever.

In particular, it should be noted that this report is based on a scope of services defined by the Client, and is limited by budgetary and time constraints, the information supplied by the Client (and its agents) and, in some circumstances, access and/or site disturbance constraints.

The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in this report, or the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

Reliance on Data

In preparing this report, WEPL has relied on data, surveys, analyses, designs, plans and other information provided by the Client (or its agents), other individuals and organisations ("the data").

Except as otherwise stated in this report, WEPL has not verified the accuracy or completeness of the data. WEPL does not represent or warrant that the data is true or accurate, and disclaims any and all responsibility or liability with respect to the use of the data.

To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data.

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The conclusions must also be considered in light of the agreed scope of services (including any constraints or limitation therein) and the methods used to carry out those services, both of which are as stated or referred to in this report.

Environmental Conclusions

In accordance with the scope of services, WEPL has conducted environmental field monitoring and/or testing in the preparation of this report. The nature and extent of monitoring and/or testing conducted is described in this report.

On all sites, varying degrees of non-uniformity of vertical and horizontal conditions in media (soil, water, air, waste or other media as described in the report) are encountered. Hence no monitoring, common testing or sampling technique can eliminate the possibility that monitoring or testing results/samples are not totally representative of media conditions encountered. The conclusions are based on the data and the environmental field monitoring and/or testing actually undertaken, and are therefore merely indicative of the environmental condition of the site at the time of preparing this report, including the presence or otherwise of contaminants or emissions. It should be recognised that site conditions, including the extent and concentration of contaminants, can change.

Within the limitations imposed by the scope of services, the monitoring, testing, sampling and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. To the maximum extent permitted by law, no other warranty, express or implied, is made.

Report for Benefit of Client

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Other parties should not rely on this report or the accuracy or completeness of any conclusions contained in this report, and should make their own enquiries and obtain independent advice in relation to such matters.

If an Auditor is engaged by the Client to undertake review of this report, it shall be made available subject to the terms and conditions of the agreement between the Client and WEPL and the caveats in this statement.

Other Limitations

This report is intended to be read in its entirety, and sections or parts of this report should therefore not be read and relied on out of context.

WEPL will not be liable to update or revise this report to take into account any events or circumstances or facts becoming apparent after the date of this report.

Executive Summary

Introduction

Western Environmental Pty Ltd (WEPL) was commissioned by Spatial Property Group (the Client) to complete a Detailed Site Investigation (DSI) for Lot 3 (No. 392) Baldivis Road, Baldivis, Western Australia (the Site). The Site is located approximately 44 km south of Perth within the City of Rockingham (CoR). The Site location is shown on Figure 1. The Site has not been reported to or classified by the Department of Water and Environmental Regulation (DWER) as a potentially contaminated site under the provisions of the *Contaminated Sites Act 2003 (The CS Act)*.

The Client proposes to redevelop the Site for residential and public open space (POS) purposes and associated road reserves and an initial concept layout plan of the proposed subdivision is included in Appendix A. In response to an anticipated future subdivision condition related to site contamination, a staged investigation process has been initiated for the Site. A Preliminary Site Investigation (PSI) was completed in November 2022 (WEPL, 2022a) to assess past contaminating activities or land uses and identify other environmental issues which could pose a constraint to the proposed development. The PSI identified the Site has historically been subject to two main potentially contaminating land uses comprising:

- Strip cultivation from the early 1970s to the mid 1980s.
- Poultry farming from the mid 1980s to 2021.

Multiple potential areas of concern (PAoCs) were identified as associated with the strip cultivation and poultry farming land uses and potential off-site sources of migratory groundwater contamination (market gardening) were identified up-gradient from the site. The PSI was reviewed by the appointed contaminated sites auditor (CSA), Ms Vanessa Bryant in November 2022.

A Sampling and Analysis Quality Plan (SAQP) was prepared to guide the soil and groundwater investigations proposed to assess the contamination status of the Site (WEPL, 2022b) and was reviewed by the appointed CSA in November 2022. This DSI report documents the implementation of, and results from, the soil and groundwater investigations undertaken at the site to determine the suitability of the site for the proposed residential development.

The infrastructure present on the site at the time the PSI and SAQP were prepared (a residential house, offices, sheds and infrastructure associated with the poultry operations) have since been demolished and removed from Site in early 2023.

Objective

Overall, the DSI was intended to determine if contaminants are present in soil or groundwater at concentrations with the potential to pose an unacceptable risk to the environment or human health. This information is then used to inform an assessment of the suitability of the site for the proposed residential land use or make recommendations for management actions that may be required to make the site suitable.

Scope of Work

The scope of work undertaken during the DSI included an intrusive soil investigation involving the installation of 34 test pits and submission of samples for analysis for identified Contaminant of Potential Concern (CoPC). Sub-samples of soils from each test pit were also sieved to determine the presence/ absence of asbestos containing material (ACM) within the retained portion. A surface ACM assessment was implemented comprising an emu-pick/ visual inspection across 52 discrete 10 x 10m grids over former building footprints, in accordance with the relevant Department of Health (DoH) guidelines (2021), as well as field screening of soil from one shallow test pit in the centre of each grid to assess the presence of subsurface ACM.

An intrusive groundwater investigation involving the installation of a network of four monitoring wells, one groundwater monitoring event and the submission of four primary samples and five QA/ QC samples to a NATA accredited laboratory for analysis, was also completed.

Results

With the exception of heptachlor epoxide in soil, all reported concentrations of all contaminants in soil (including asbestos) and groundwater were below all assessment levels relevant to the protection of human health. The concentration of heptachlor expoxide at one test pit location exceeded the adopted United States Environmental Protection Agency residential criteria in the absence of an applicable Australian Guideline value. However, a review of US based pesticide assessment levels compared to Australian levels and future concentrations based on the representative half-life of the compound confirmed there was no unacceptable risk. It can therefore be reasonably concluded that there is no potentially unacceptable risk posed to current or future human receptors currently or under the proposed residential land use.

Elevated concentrations of metals were reported in some shallow samples collected from adjacent to the laying sheds during the PSI. However, all of the samples with elevated concentrations were collected prior to the completion of demolition works when poultry excrement was accumulated below the elevated base of the laying sheds. All samples collected after demolition had been completed (which included removal/ disposal of the excrement) were below all relevant assessment levels. It is therefore likely that the elevated concentrations were limited to the shallow soil profile and this was incidentally removed/ remediated during the site demolition works. As such there is no longer any metals present in soils around the former laying sheds on-site that would pose a risk to the environment

The sediment sample collected from a contained drainage sump was the only sample collected during the DSI that reported an exceedance of the adopted ecological investigation level (EIL) for Zn. This is a small, localised and contained impact with the reported concentration (466 mg/kg) only marginally exceeding the

adopted assessment level. Furthermore, the concrete sump will need to be removed to facilitate site development works and is not thought to be a potential source of contamination that requires further consideration.

One sample collected during the PSI (S02_0.15) from Laying Shed 3 reported an elevated concentration of TRH F3 that exceeded the EIL. This is expected to be largely from organic matter associated with the poultry excrement and enriched shallow soils present at the time of the PSI. No other sources of TRH were identified on-site and the impact identified is extremely localised. As such, the minor occurrence of TRH in soil around Laying Shed 3 is not thought to be a potential source of contamination that requires further consideration.

The single sample that reported the elevated concentration of benzo(a)pyrene (BaP) during the PSI (S06_0.15) was also collected from Laying Shed 3 and exceeded the EIL. While the source of B[a]P and other PAH compounds across the Site is not confirmed, it is possibly associated with wood impregnation/preservation with creosote, given the construction of buildings (which include treated timber components). As the presence of BaP is not associated with high organic content of soils from poultry excrement, its potential as a source of contamination for environmental harm was considered further in the risk assessment.

Potential risk to the environment from groundwater were limited to concentrations of zinc (Zn), copper (Cu), total nitrogen (TN) and nitrate +nitrite (NOx) that were reported above the relevant assessment levels at one or more monitoring locations. Cu is a common feed additive that has bactericidal properties which positively impacts feed efficiency and growth rate. The elevated concentrations in groundwater are therefore likely to have originated from poultry excrement which subsequently leached to groundwater, noting that the excrement has been removed from Site.

The concentration of Cu at well GW02 (0.002 mg/L) exceeded the freshwater 95% species protection level assessment level (FW (95%)) (0.0014 mg/L), though the remaining three wells reported all concentrations below the laboratory LoR (<0.001 mg/L). On this basis the extent of copper impact to groundwater is limited to the vicinity of well GW02 only. Cu It should be noted that are currently no freshwater ecosystem on the site, nor are there planned to be any in the future as part of the proposed development. Furthermore, the data from well GW01 confirms that the concentration of Cu in groundwater migrating off-site does not pose a risk to off-site receptors. On this basis it can be reasonably concluded that there is no unacceptable risk to any current or future on-site or off-site receptors.

The concentration of Zn at well GW01 (0.016 mg/L) exceeded the FW (95%) assessment level (0.008 mg/L), though the remaining three wells reported all concentrations below the laboratory LoR (<0.005 mg/L). As well GW01 is located at the down-gradient site boundary, the data indicates that the site is adding to the contaminant load of Zn in groundwater. Zn is a common poultry feed additive to aid growth, maintenance and other functions such as bone development, feather development, enzyme structure and function. Given the elevated concentrations of Zn in shallow soil samples collected during the PSI, it would appear likely that high concentrations of Zn in poultry excrement leaching to groundwater is the likely source. Elevated Zn was only present in well GW01 which is located down-gradient of the two rearing sheds near the western Site

boundary. The potential for Zn as a source of contamination for environmental harm was considered further in the risk assessment.

The available data indicates that the poultry farm land use has been adding to the nitrogen load in groundwater given that up-gradient well GW04 reported nutrient concentrations at least one order of magnitude below the remaining three wells. The maximum concentrations of TN and NO3 were reported at well GW02 which is directly down-gradient from three former laying sheds (Laying Sheds 1, 3 and 4) and less than 10 m from Laying Shed 4. The concentrations at well GW03 which is located over 50 m down-gradient of only one former laying shed (Laying Shed 2) were elevated compared to up-gradient well GW02 but lower than well GW03. This distribution indicates that the increased number of chickens up-gradient from well GW02 is likely to have resulted in a greater volume of excrement that will have contributed to elevated nutrient concentrations in groundwater. The potential for nutrients as a source of contamination for environmental harm was considered further in the risk assessment.

Risk Assessment

The consequence of a complete source-pathway-receptor (SPR) linkage for:

- BaP in soil was classified as 'Negligible' given the general lack of sensitivity of the current and potential on-site ecological receptors as they will not be supporting any significant ecosystem functions. The limited extent of the impacted soil will also mean that any exposure is limited to a very small population.

- Both nutrients and Zn in groundwater was classified as 'Minor'. Given the ongoing source of both contaminants in groundwater (poultry excrement) have been removed from Site, any impacts associated with the discharge of groundwater to the freshwater ecosystems would be expected to be a short-term impact only as the concentrations naturally decrease over time. However, as the three wetland receptors are classified as CCW, the 'Negligible' classification is not considered appropriate.

The likelihood of the SPR linkage being completed was classified as:

- 'Rare' for soil as the limited extent of the impacted soil means the exposure pathway will need to be completed within a very small portion of the site which limits the likelihood of it occurring.

- 'Rare' for groundwater as the concentrations of both contaminants are expected to reduce as distance from the site increases. Indicative calculations provided indicating that if the distance from source to concentration gradient remans consistent, the nutrient concentrations in groundwater would be expected to fall below the relevant assessment levels within 500 m of the site, which is 500 m before it reaches the closest environmental receptor which is over 1 km from the site. The original impact area for Zn in groundwater is a much smaller portion of the site compared to nutrients, being limited to down-gradient of the two smaller rearing sheds. As such, the maximum concentration is only two times the assessment level, as opposed to at least 15 times for nutrients.

Therefore dispersion and dilution would be expected to reduce Zn concentrations well below the adopted assessment level by the time groundwater migrates 1 km to the closest aquatic receptor.

Conclusions and Recommendations

The results of the laboratory data from the current investigation confirmed that:

- The contaminant concentrations identified in soil and groundwater do not pose an unacceptable risk to human receptors either currently or under the proposed future residential development.
- A concrete sump on-site contains a minor amount of sediment with Zn present above the EIL-A. It does not pose an exposure risk but the excavation and disposal of the sump and material contained within should be managed during future site works.
- The contaminant concentrations of BaP in soil had the potential to pose a theoretical risk to on-site and off-site ecological receptors.
- The contaminant concentrations of nutrients and Zn in groundwater had the potential to pose a theoretical risk to aquatic receptors.

With respect to soil, the on-site ecological receptors with the potential to be impacted are not environmentally sensitive or supporting of significant ecosystem functions/ values. This is likely to become even more so in the future as the site is cleared for development, reducing the native fauna habitat values of the Site.

There are currently no aquatic receptors on-site with the potential to be adversely affected by the reported concentrations of nutrients and Zn in groundwater, nor are there likely to be following the proposed residential development. Therefore, the only receptors potentially at risk from impacted groundwater are two CCW located over 1 km from the Site and a third CCW located over 2 km from the Site.

A qualitative risk assessment was completed with consideration of the likelihood of the source-pathway-receptor-linkages being complete along with the consequences if it were to be complete. The potential linkage for all potential linkages was assigned an overall risk classification of ‘Very low’ with a consequence of 'Negligible' or 'Minor' and a likelihood of 'Rare'. On this basis there is not considered to be an unacceptable risk to the environment, currently or I the future, and no further assessment, remedial action or management measures need to be implemented to reduce the risk.

Contamination in the CS Act is defined ‘in relation to land, water or a site, means having a substance present in or on that land, water or site at above background concentrations that presents, or has the potential to present, a risk of harm to human health, the environment or any environmental value.’ Based on the data obtained during the current investigation and the outcome of the risk assessment, it can be reasonably concluded that the site does not meet this definition of contamination and is suitable for the proposed residential development.

It is recommended that this investigation and associated Voluntary Auditors Report (VAR) be submitted to the Western Australian Planning Commission (WAPC) with the future subdivision application to prevent a Condition related to potential Site contamination being added to the subdivision approval.

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1. Introduction

Western Environmental Pty Ltd (WEPL) was commissioned by Spatial Property Group (the Client) to complete a Detailed Site Investigation (DSI) for Lot 3 (No. 392) Baldivis Road, Baldivis, Western Australia (the Site). The Site is located approximately 44 km south of Perth within the City of Rockingham (CoR). The Site location is shown on Figure 1. The Site has not been reported to or classified by the Department of Water and Environmental Regulation (DWER) as a potentially contaminated site under the provisions of the *Contaminated Sites Act 2003* (The CS Act).

The Client proposes to redevelop the Site for residential and public open space (POS) purposes and associated road reserves and an initial concept layout plan of the proposed subdivision is included in Appendix A. In response to an anticipated future subdivision condition related to site contamination, a staged investigation process has been initiated for the Site. A Preliminary Site Investigation (PSI) was completed in November 2022 (WEPL, 2022a) to assess past contaminating activities or land uses and identify other environmental issues which could pose a constraint to the proposed development. The PSI identified the Site has historically been subject to two main potentially contaminating land uses comprising:

- Strip cultivation from the early 1970s to the mid-1980s.
- Poultry farming from the mid-1980s to 2021.

Multiple potential areas of concern (PAoCs) were identified as associated with the strip cultivation and poultry farming land uses and potential off-site sources of migratory groundwater contamination (market gardening) were identified up-gradient of the site. The PSI was reviewed by the appointed contaminated sites auditor (CSA), Ms Vanessa Bryant in November 2022.

A Sampling and Analysis Quality Plan (SAQP) was prepared to guide the soil and groundwater investigations proposed to assess the contamination status of the Site (WEPL, 2022b) and was reviewed by the appointed CSA in November 2022. This DSI report documents the implementation of, and results from, the soil and groundwater investigations undertaken at the site to determine the suitability of the site for the proposed residential development.

The infrastructure present on the site at the time the PSI and SAQP were prepared (a residential house, offices, sheds and infrastructure associated with the poultry operations) has been demolished and removed from Site in early 2023.

1.1 Objectives

The primary objectives of the DSI were to:

- Implement the soil and groundwater sampling regime as described in the SAQP.
- Determine the nature, extent and severity of any soil contamination within the PAoCs identified in the PSI report.
- Determine if groundwater within the Site is impacted by on-site and/or off-site activities.
- Determine if contaminants are present in soil or groundwater at concentrations with the potential to pose an unacceptable risk to the environment or human health.
- Assess the suitability of the site for the proposed residential land use or make recommendations for management actions that may be required to make the site suitable.

1.2 Scope of Work

The scope of work undertaken during the DSI included:

- An intrusive soil investigation involving:
    - The installation of 34 test pits to a maximum depth of 1.0 metres below ground level (mBGL) to determine the lateral and vertical extent, if any, of soil impact at the site resulting from the historical land uses.
    - The submission of 38 primary samples and seven quality assurance/ quality control (QA/ QC) samples to a National Association of Testing Authorities (NATA) accredited laboratory for analysis.
    - Collection and sieving of 10 L sub-samples of soils (field screening) from each test pit to determine the presence/ absence of asbestos containing material (ACM) within the retained portion.
- A surface ACM assessment comprising:
    - Establishing a network of 52 grids approximately 10 m x 10 m across former building footprints.
    - Completion of an emu-pick/ visual inspection of each grid in accordance with the relevant Department of Health (DoH) guidelines (DOH, 2021)
    - Field screening of one shallow test pit in the centre of each grid to assess the presence of subsurface ACM.

- An intrusive groundwater investigation involving:
    - The installation of a network of four monitoring wells to depths between 5.5 and 12.0 mBGL
    - One groundwater monitoring event including sampling from all four newly installed wells.
    - The submission of four primary samples and five QA/ QC samples to a NATA accredited laboratory for analysis.
- A Tier 1 risk assessment comparing the soil analytical results and field screening data against the adopted assessment levels to determine if a significant risk to the environment or human health is present.
- A review of the conceptual site model (CSM) developed during the PSI to assess the relevance of the source-pathway-receptor linkages following the Tier 1 risk assessment.
- A qualitative risk assessment to determine the magnitude of any risk identified and the suitability of the site for the proposed residential land use.
- A determination of any additional investigation, management or remediation works that may be necessary to render the site suitable for the intended residential land use.

1.3 Relevant Guidelines

The scope of work and methodology for the investigation of contaminated sites in Western Australia is guided by the DWER Contaminated Sites Guideline (CSG) document *Assessment and Management of Contaminated Sites* (DWER, 2021). DWER (2021) adopts the principles contained within the *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)* (the ASC NEPM) (NEPC, 2013a), which includes:

- *Schedule B1 - Guideline on Investigation Levels for Soil and Groundwater.*
- *Schedule B2 - Guideline on Site Characterisation.*
- *Schedule B3 - Guideline on Laboratory Analysis of Potentially Contaminated Soils.*
- *Schedule B4 - Guideline on Site-Specific Health Risk Assessment Methodology.*
- *Schedule B5a - Guideline on Ecological Risk Assessment.*
- *Schedule B5b - Guideline on Methodology to Derive Ecological Investigation Levels in Contaminated Soils.*
- *Schedule B5c - Guideline on Ecological Investigation Levels for Arsenic, Chromium (III), Copper, DDT, Lead, Naphthalene, Nickel and Zinc.*
- *Schedule B6 - Guideline on the Framework for Risk-Based Assessment of Groundwater Contamination.*
- *Schedule B7 - Guideline on derivation of health-based investigation levels.*

- *Schedule B8 - Guideline on Community Engagement and Risk Communication.*
- *Schedule B9 - Guideline on Competencies and Acceptance of Environmental Auditors and Related Professionals.*

The scope of work undertaken for this investigation is consistent with the above guidelines and the DoH document *Guidelines for the assessment, remediation and management of asbestos-contaminated sites in Western Australia* (DoH, 2021).

Other guideline series that are applicable to the investigation and assessment of contamination at the site include the Contaminated Land Guidelines published by the New South Wales Environmental Protection Authority (NSW EPA) which includes:

- *Sampling design part 1 - application* (NSW EPA, 2022a).
- *Sampling design part 2 - interpretation* (NSW EPA, 2022b).

Although the approaches and methodologies for contaminated site investigations documented in these guidelines are generally consistent with each other, the CS Act requires contaminated site investigations in Western Australia to be undertaken in a manner consistent with A*ssessment and Management of Contaminated Sites* (DWER, 2021). As DWER (2021) refers to the amended ASC NEPM, these two documents form the primary basis of this investigation.

1.4 Report Structure

The following report is generally compliant with the structure recommended in Schedule B2 of the ASC NEPM. A detailed historical review of the site and associated land uses was provided in the PSI (WEPL, 2022a) and while a summary of pertinent information is provided in Section 2 , it is not reproduced in full.

1.5 Terms

The following terms will be used in reference to fibre cement materials:

- Fibre cement material (FCM): Material that does not visually appear with a high level of confidence to be Asbestos Containing Material (ACM) or laboratory analysis has confirmed the absence of asbestos.
- ACM: Material confirmed by laboratory analysis to contain asbestos or there is a high level of certainty that asbestos is present based on visual observations.
- Non-friable or bonded asbestos: Refers to ACM where the asbestos fibres are bound to another material or are part of a matrix, for example, asbestos cement sheeting or vinyl tiles. Bonded ACM can include broken, weathered or fragmented material that retains its basic integrity.
- Fibrous asbestos (FA): Is any material containing asbestos that is wholly or in part friable (can be broken or crumbled by hand pressure), including any previously non-friable ACM that is in a severely

degraded condition such that it can be broken or crumbled by hand pressure. Friable asbestos also includes products such as pipe lagging and other loose-fill insulation and manufacturing waste.

- Asbestos fines (AF): Relate to the size of asbestos contamination present (smaller than 7 mm x 7 mm) within a soil sample. AF includes free fibres or loose fibre bundles as well as small pieces of friable and non-friable material such as asbestos cement fragments mixed within the soil.
- Suspect ACM (sACM): FCM that visually appears to be ACM but has not been subject to laboratory confirmation.

The term 'impact' is used in this report in reference to the presence of potential contaminants above background concentrations that have not been subject to an appropriate risk assessment to confirm they represent contamination, or where a risk assessment indicates the absence of risk to human health or environmental receptors. To be considered contamination, an appropriate risk assessment is required to confirm actual or potential source-pathway-receptor linkages and concentrations that pose a risk to human health or environmental receptors. Therefore only impact that is deemed likely to pose a risk to human health and/or the environment is considered 'contamination' pursuant to the definition of contamination in the CS Act.

1.6 Auditor Details

Ms Vanessa Bryant of Senversa Pty Ltd (Senversa) has been engaged as the CSA for all site investigations. The engagement has been made on a voluntary basis in anticipation of a future subdivision condition that will require an Auditor's Report.

2. Site Identification and General Information

2.1 Site Identification

The site comprises a single lot located between Eighty Road on the western boundary and Baldivis Road on the eastern boundary as shown on Figure 2. While the land immediately adjacent to the site remains consistent with rural residential land uses, residential developments are mid-construction less than 300 m from the Site in all directions.

The Site has a total area of 4.01 hectares (ha) and the legal site identification details are summarised in Table A with the current certificate of title (CT) provided in Appendix B.

Table A: Site Identification details

Lot Detail	Description
Lot/Diagram	Lot 3 on Diagram 29589
Street Address	392 Baldivis Road, Baldivis
Volume/Folio	382/138A
Owner	Vysell Pty Ltd
Total Area	4.0461 ha
Current Land Use	Currently unoccupied. Ceased operations as poultry farm in mid-2021
Proposed Future Land Use	Urban/residential development with POS
Local Government Authority	City of Rockingham
Site Coordinates GDA2020/Zone 50	Refer to Figure 1

The site is located within the local government authority area of the City of Rockingham. The site boundary co-ordinates are provided in Table 2 and are shown on Figure 1.

Table B: Site Boundary Co-Ordinates

Location	Easting	Northing
North-west corner	388713	6424523
South-west corner	388626	6424418
North-east corner	389069	6424528
South-east corner	389047	6424423

The boundary co-ordinates are reported in Geocentric Datum of Australia (GDA2020) and Map Grid of Australia (MGA) Zone 50 format.

2.2 Land Use and Zoning

2.2.1 Current Land Use and Zoning

The Site has recently ceased operation as a poultry farm during mid-2021 and is currently unoccupied. All infrastructure associated with the former operation have been removed, with these demolition works being completed in April and May 2023.

Based on the Local Planning Scheme - Zones and Reserves (DPLH-071) dataset is zoned as 'Development' under City of Rockingham (CoR) Town planning Scheme (TPS) No. 2. Figure 3 illustrates the land use and zoning at and surrounding the Site.

2.2.2 Proposed Land Use

WEPL understand that the Site is to be subdivided into 72 low density residential lots and POS area, along with associated road reserves to facilitate access. A proposed subdivision concept plan (presented within Appendix A) indicates that the proposed residential lot sizes will range from approximately 343 m^2 to 705 m^2 in area (excluding partial lots) and the POS approximately 1,914 m^2.

It should be noted that Conditional Subdivision Approval has not been granted by the WAPC as at the time of preparing this report, although it is considered that a condition will likely be provided in relation to the requirement for contamination investigations given the historical use of the Site.

2.2.3 Surrounding Land Use and Zoning

Current land uses and applicable zoning surrounding the Site have been assessed based on a review of different information sources [street directory, Google maps, CoR local planning scheme, Metropolitan Region Scheme (MRS) and are presented in Figure 3. Further information regarding the surrounding land use is provided below:

- North - immediately north of the Site are two rural/residential lots (Lots 1 and 2) also zoned 'Development' under the CoR TPS No. 2. Fifty Road runs along the northern boundaries of Lots 1 and 2 followed by Baldivis Playgroup and Baldivis Reserve (360 m from Site) zoned as 'POS' under the TPS No. 2. Further north contains existing residential developments.

- East – the Site is bounded by Baldivis Road to the east followed by further land zoned 'Development' under the CoR TPS No. 2. Areas to the north-east and south-east between Baldivis Road and the Kwinana Freeway are being developed for residential land use. The Kwinana Freeway is located approximately 830 m west of the Site followed by rural/residential properties zoned 'Rural' with the Peel Main Drain running north-south approximately 1.4 km east into Folly Pool. Beyond the Peel Main Drain and Folly Pool lie rural/residential properties.

- South - the Site is bound by a Lot 9501 and 9003 to the south, which are former rural/residential land zoned 'Development' under the CoR TPS No. 2. South of these lots exists recently developed residential housing.

- West - immediately west of the Site is remnant native vegetation on Lot 1402, which is zoned 'Development' under the CoR TPS No. 2. Further west and south-west of the Site lies former rural/agricultural property and market gardens that are currently being redeveloped for residential housing. Remnant vegetation and rural/residential properties remain from approximately 1.05 km west through to Mandurah Road, followed by Lake Cooloongup.

2.3 Previous Site Investigations

2.3.1 Preliminary Site Investigation

The purpose of the PSI was to assess the Site's suitability for the proposed land use and/or provide an outline of requirements for any further investigations or management protocols that are required to render the Site suitable for the proposed development. The key findings of the PSI were as follows:

- The Lot is currently zoned 'Development' under the CoR TPS No. 2 and covers an area of approximately 4.0461 hectares.

- The Site and surrounds appear to comprise remnant bushland in the earliest available aerial (1953). Clearing was first observed on-site prior to 1970 in conjunction with the construction of two large sheds and a smaller structure (which forms the basis of the current Office Building). Cropping across the Site is evident in the 1974 aerial ceasing by approximately 1983. The current residential house was built between 1983 and 1985. The first two Laying Sheds are evident in the 1989 aerial with the additional two Laying Sheds and additional sheds within the north-western corner of the Site constructed by 1995.

- Surrounding land has historically been utilised for rural/agricultural purposes, including rural/residential properties, grazing, orchards and market gardens. Currently the Site is surrounded by cleared land to the north and south, which will be developed into residential housing now that the poultry farm operations has ceased operation and the associated odour buffer will no longer prohibit development. West across Eighty Road lies an area of remnant vegetation followed by further residential development. Similarly, immediately east of Baldivis Road lies a strip of remnant vegetation followed by residential housing. Baldivis Playgroup and Baldivis Reserve are located approximately 360 m north of the site and the Kwinana Freeway approximately 830 m east.

- Potential sources of contamination identified at the Site comprise former agricultural/cropped area, Laying Sheds, Rearing Sheds, potential buried carcasses/poultry waste, rail carriage, House Office Building, Pump Shed, Main Workshop and sheds (former and current) and equipment storage/laydown areas. Off-site sources include current and historical market gardening to the east (up-gradient).

- Key chemicals of potential concern (CoPCs) identified in relation to these sources comprised metals [antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), boron (Bo), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mg), mercury (Hg), molybdenum (Mo), nickel (Ni), lead (Pb), selenium (Se), tin (Sn) and zinc (Zn)], total recoverable hydrocarbon (TRH), benzene, toluene, ethyl-benzene, xylenes (BTEX), polycyclic aromatic hydrocarbons (PAH), phenols, organochlorine and organophosphorous (OC/OP) pesticides, carbamates, phenoxy acidic herbicides, triazines, nutrients, bacteria and pathogens and volatile organic compounds/semi-volatile organic compounds (VOCs/SVOCs) and asbestos containing material (ACM).
- Potential receptors comprise on-site workers, intrusive maintenance workers, current/future occupants, off-site residents, workers and visitors, on and off-site groundwater bore users, on and off-site flora and fauna, the aquatic environment (down-gradient receiving waterbodies, i.e. Spot Swamp, Opwin Swamp and Lake Cooloongup) and groundwater beneath the Site.
- Limited soil investigation locations included the Rearing Sheds (1 and 2), Laying Sheds (1 to 4), House, House Shed, Office Building, Main Workshop/Storage Shed, Pump House and Storage Shed. The laboratory results reported concentrations of CoPCs below all applicable health investigation limits across all sample locations (S01 to S16). Several sources/areas of potential contamination identified were not sampled, including the former agricultural/cropped area, Wooden Rail Carriage, Staff Room/Office and equipment storage/laydown areas.
- ACM was identified at the Site within buildings and as minor surface debris associated with damage to an ACM fibre cement wall associated with the Office Building. No ACM was identified within the soil profile; however, the potential for asbestos impacted soils to occur within the Site was considered possible due to the preliminary nature of the investigation.
- Minor exceedances of the ecological investigation level for urban residential/POS land use were identified for zinc at six locations (Laying Sheds 1, 2 and 4, Office Building and Main Workshop). These are likely associated with poultry waste (i.e. zinc within poultry feed) and/or minor quantities of metal waste materials present at these locations.
- One location (Laying Shed 3) reported a concentration of TRH F3 fraction above the ecological screening criteria for urban residential land use; however, it is considered that organic material may be attributing to elevated TRH at this location.
- Concentrations of B[a]P exceeded the ecological screening level (ESL) for urban residential/POS at a single location adjacent to Laying Shed 2. Detections of several PAH compounds above the laboratory limits of reporting (LORs) were identified at various locations across the Site, indicating the broadscale presence of minor PAH compounds in the vicinity of on-site infrastructure. Whilst the source is not confirmed; it is considered that elevated PAH concentrations may be associated with wood impregnation/preservation with creosote, given the construction of buildings (which include treated timber components), or formed during incomplete combustion of organic material, although no evidence of burning was identified at relevant sample locations.

- A visual assessment of the Lot did not identify any visual and/or olfactory cues of contamination, other than those associated with the poultry waste, isolated ACM fragments and minor hydrocarbon staining at the Pump House. As the management and disposal of poultry carcasses and waste is unknown, there remains the possibility that further buried waste materials may be present on-site.
- Various inert equipment and building materials associated with poultry farming were located in front of Laying Sheds 2 and 3, adjacent the rear of Laying Shed 4 and adjacent the Main Shed/Workshop and Storage Shed. Some minor inert fly-tipped domestic waste i.e. clothes, toys, scrap materials were dumped within the vehicle turning area near the Storage Shed.
- A preliminary risk assessment has been undertaken as part of the conceptual site model (CSM) developed for the Site, which identified that a credible exposure scenario exists in association with the following:
    - Inhalation of vapours/asbestos fibres, inhalation of contaminated particulate dust – while all results were below health investigation and screening levels, not all sources of potential contamination have been assessed.
    - Dermal contact/ingestion with potentially impacted soils – while all results were below health investigation and screening levels, not all sources of potential contamination were assessed.
    - Plant uptake of contaminants – minor elevated concentrations of zinc B[a]P and TRH F3 fraction are unlikely to pose an appreciable exposure risk to on-site flora and fauna; however, further consideration of this exposure scenario is warranted.
    - Impacts to groundwater from soil – leaching of contaminants to groundwater – not investigated.
    - Inhalation of vapours associated with potentially impacted groundwater – not investigated.
    - Dermal contact/ingestion of potentially impacted groundwater – not investigated.
    - Discharge to receiving water body.

Based on the findings of this PSI, WEPL provided the following recommendations:

- The PSI report is to be issued to an accredited Contaminated Sites Auditor, Ms Vanessa Bryant from Senversa, to assess if the report has been prepared in accordance with DWER requirements.
- That further investigation, comprising a DSI, be undertaken (including development of a SAQP) to characterise soil and groundwater conditions at the Site and understand any potential risks to human health and the environment in the context of the proposed land use. It is considered that further investigation should, at a minimum, consider the following key components:
    - Further sampling and analysis of soils across the Site to address CoPCs and potential sources of contamination excluded from the limited sampling program. Further investigations should also consider the requirement for further spatial characterisation of soil conditions across the entirety of the Site.

- Completion of a DoH (2021) compliant asbestos assessment.
- Implementation of a detailed groundwater investigation to understand potential impacts to groundwater associated with identified sources or secondary impacts in soil. Groundwater investigations should also be adequate to characterise up-and-down gradient groundwater quality and understand local hydrogeological conditions (i.e. groundwater flow direction, seepage velocity etc).

- All ACM located within building structures on-site, including any associated ACM debris, must be removed in accordance with the Work Health and Safety Commission (2022) How to Safely Remove Asbestos: Code of Practice. All ACM removal works must be carried out by a suitably licensed asbestos removalist and a clearance inspection completed by an independent competent person.
- WEPL recommend that all buildings and infrastructure are removed from Site prior to the DSI being undertaken.
- On completion of all subsequent investigation stages and associated remedial works, when a Site classification is possible and the Site is rendered suitable for the proposed land use, the Auditor will prepare a Voluntary Audit Report for submission to the DWER for clearance of the anticipated condition.

The PSI was reviewed by the CSA in November 2022. As specified in the SAQP, the sample locations from the PSI were used to achieve the required sampling density for the DSI and are therefore the analytical data from soil samples collected during the PSI is included in Section 8.1.3.

2.3.2 Sampling and Analysis Quality Plan

The objective of the SAQP was to document appropriate soil and groundwater investigations that would adequately assess the source-pathway-receptor (SPR) linkages identified in the CSM of the PSI to determine the suitability of the site fort the proposed residential land use.

The SAQP was reviewed by the CSA in November 2022 and was uses as the basis for the fieldwork described in Section 6. The SAQP was designed with the sample numbers chosen to complement the existing dataset from the PSI. On this basis the analytical data from soil samples collected during the PSI is included in Section 8.1.3.

2.3.3 Asbestos Removal

Asbestos removal and disposal from existing structures was managed through the Site demolition works. The assessment of fibre cement material from the structures completed by Capital Recycling confirmed that asbestos was present as a construction material in only one building on-site (the former office) which comprised approximately 200 m^2 of wall cladding. An asbestos removal control plan (ARCP) was prepared and a clearance certificate provided by Environmental Site Services (ESS) prior to the demolition works commencing that confirmed all the ACM had been removed from the building.

The ARCP and asbestos clearance certificate are included in Appendix C.

3. Site Attributes

Detailed information regarding the site attributes is provided in the PSI (WEPL, 2022a) and a summary of information relevant to the soil and groundwater investigation is provided in the following sections.

3.1 Site History

A review of the available historical information documented in the PSI indicated that:

- The Site was undeveloped bushland until the 1960s.
- The Site was largely cleared of native vegetation between 1962 and 1970, with the first structures (two large sheds and one small structure) established during this period.
- By 1974 the Site had been completely cleared of remnant vegetation and strip cultivation/cropping was established with these operations continuing until the late 1980s.
- The residential house was constructed between 1981 and 1985.
- The poultry farm land uses commenced in the mid-1980s with the majority of infrastructure established by 1995.
- No significant changes in land use or infrastructure occurred between 1995 and 2023 when demolition works were completed.

3.2 Topography

Topographical data obtained from the Landgate Large Scale Topography dataset (LGATE-140) indicates that natural ground surface level ranges from approximately 10 mAHD on the western boundary of the Site, inclining slightly up to 12 mAHD towards the centre of the lot, then gradually sloping down to approximately 7 mAHD on the eastern boundary to Baldivis Road.

3.3 Geology

3.3.1 Regional Geology

Geological mapping indicates the Site is located within the Spearwood Dune System, comprising medium to coarse grained eolian calcarenite. The area is underlain by Tamala Limestone consisting of quartz sand, fine to medium grained shell fragments and minor clayey lenses (Davidson, 1995).

Regional soil information detailed on the map *1:50,000 Environmental Geology Rockingham Mapsheet* (Gozzard, 1983) indicates the soils within and immediately surrounding the Site comprise Bassendean Sand (map unit S8). This soil type is described as white to pale grey at surface yellow at depth, fine to medium grained moderately sorted, subangular to sub-rounded, minor heavy minerals of eolian origin.

3.3.2 Site-specific Geology

The surface soil profile encountered during the PSI soil investigations generally consisted of the following:

- 0.0-0.15 mBGL: SAND, grey to brown, medium grained, poorly sorted with some gravels and organic material. Soils surrounding the Laying Sheds contained shell grit and poultry waste and minor to moderate odour was noted in areas proximal to the Laying Sheds.
- 0.15-0.40 mBGL: SAND, grey becoming pale yellow with depth, medium grained, moderately sorted with some gravel. No odour or staining.

Generally, no fill material was evident across the broader Site; however, differing soil profiles proximal to the base of structures on-site, and size of on-site structures, indicates either the potential for fill material to be present beneath buildings or the presence of organics from manure has produced a loamy soil.

3.4 Hydrogeology

Regional hydrogeological mapping indicates the site lies within the superficial Jandakot Mound (Davidson, 1995). The area overlies the Osborne Formation, Leederville Formation and Yarragadee Formation (in that order). The superficial aquifer is a major unconfined aquifer that can be separated into ten specific hydrogeological areas; one of these is the Jandakot Mound (Davidson, 1995).

The Jandakot Groundwater Mound has been divided into seven separate groundwater flow-channels, each originating at the crest of the mound and carrying groundwater to the discharge boundaries formed by Lake Forrestdale, Karnup Drain, Southern River, Canning River, Swan River and the Indian Ocean (Davidson, 1995). Most of the Jandakot Mound is underlain by the Bassendean and Spearwood Dune Systems which have aquifer transmissivities ranging between 200 m2/d and 1,000 m2/d (Davidson, 1995). Davidson (1995) estimates the aquifer transmissivity at the site to be over 1000 m^2/d. The saturated thickness of the superficial aquifer is around 25 m giving a hydraulic conductivity of 40 m/day.

The Site is located in a moderate vulnerability region for potential groundwater contamination due to the area's geological and hydrogeological characteristics of sand and limestone with a relatively shallow water-table (Davidson, 1995).

The Perth Groundwater Map indicates that the superficial aquifer is intersected at 2.0 mAHD across the Site and the base of the aquifer is reported to be at an elevation of -15.0 mAHD, therefore its saturated thickness is anticipated to be approximately 17 m.

3.4.1 Regional Groundwater Depth and Flow Direction

Based on a superficial aquifer elevation of 2 mAHD and the topographic contours of the Site, groundwater is expected to be present at depths between 5 and 10 m below ground level (mBGL) across much of the Site.

Regional groundwater data presented on the Perth Groundwater Map indicates groundwater flow is to the west and is expected to discharge into a series of wetlands located down-gradient former the Site.

3.4.2 Wetlands

The Department of Biodiversity, Conservation and Attractions (DBCA) maintains the Geomorphic Wetlands of the Swan Coastal Plain dataset (DBCA-019) which identifies wetland areas with a unique field identifier (UFI) and categorises individual wetlands into specific management categories. This dynamic dataset is continually updated with site-specific wetland surveys providing new and relevant information. The wetland categories include:

- Conservation category wetland (CCW): Support high levels of ecological attributes and functions. Management objectives seek to preserve these attributes and functions through reservation and protection under environmental protection policies.
- Resource enhancement wetland (REW): Partly modified but still support substantial functions and attributes. Management objectives seek to restore the wetland through maintenance and enhancement of the existing functions and attributes.
- Multiple use wetland (MUW): Heavily modified, retain few wetland attributes but still provide important hydrological functions.

A review of the dataset indicates that there are no mapped wetland areas located within 1 km down-gradient from the Site. The closest down-gradient wetlands are:

- Spot Swamp (UFI 6622): A CCW located approximately 1.1 km west of the Site.
- Opwin Swamp (UFI 6400): A CCW located approximately 1.2 km west of the site and 250 m north of Spot Swamp.
- Cooloongup Swamp (UFI 6385) located over 2 km west of the Site.

3.4.3 Local and Potential Groundwater Uses

The DWER Water Register confirms that no down-gradient groundwater licences are present within a 500 m radius of the Site. Other wells present within the 500 m radius are all located within areas zoned ‘Development’ or ‘Public Purposes’ (Baldivis Primary School).

The anticipated beneficial use of groundwater in the vicinity of the Site is for:

- Maintenance of freshwater ecosystems, i.e. Spot Swamp, Opwin Swamp and Lake Cooloongup.
- Non-potable purposes (e.g. domestic irrigation).
- Short term irrigation (agricultural/crop irrigation). No active market gardens are present immediately down-gradient of the Site; however, rural/residential properties are present between approximately 1 km west of the Site through to Mandurah Road, with potential grazing/cropping occurring on 72 Fifty Road (approximately 1.24 km west). However, this land use continuing for a period of more than 20 years is considered unlikely given the residential development present in the area.

- Groundwater salinity suggests that groundwater is brackish and not suitable for potable use (i.e. drinking water purposes). Residential developments west of the Site are unlikely to utilise groundwater for drinking water purposes due to access to scheme water and the Site is not located within or near any Public Drinking Water Source Areas (PDWSA).

4. Preliminary Conceptual Site Model

The preliminary conceptual site model (CSM) as described in the SAQP is reproduced in the following sections.

4.1 Potential Sources

The potential sources of contamination and their associated contaminants of potential concern (CoPCs) are identified in the following sections and the associated potential areas of concern (PAoCs) are shown on Figure 2.

4.1.1 On-site Potential Sources

A list of on-site potential sources is presented in Table C.

Table C: Summary of Potential Sources

Area/Source	Contaminants of Potential Concern	Comments	Summary of Preliminary Soil Results (WEPL, 2022a)
On-site			
Former Strip Cultivation/ Cropped Area	Metals, OC/OP pesticides, nutrients*	Evidence of historical strip cultivation/cropping is present across the majority of the Site (excluding footprints of two large sheds present in 1970) between the 1974 and 1983 historical aerial photographs. Potential historical fertiliser and pesticide applications.	Not sampled.
Laying Sheds (1 to 4)	Metals, TRH, BTEX, PAH, phenols, OC/OP pesticides, nutrients*, bacteria and pathogens, ACM	Laying Sheds (1 and 4) have been present since 1989 and Laying Sheds 2 and 3 were constructed between 1989 and 1995. Waste materials i.e. poultry manure appear to have been removed from Site, with areas within and beneath sheds visibly scraped in areas and no evidence of storage of manure on-site. Minor residual waste materials are still present i.e. manure beneath or within sheds. Laying sheds are largely constructed of metal and wood framework and metal sheeting, wire and grating and concrete or wooden flooring. Potential ACM fibre cement sheeting was identified within Laying Sheds 2 and 3. Intensive agriculture is a potentially contaminating land use as per DWER (2021). Potential for historical termiticide application and residual ACM associated with proposed demolition activities.	Zinc > Ecological Investigation Level (EIL) (Laying Sheds 1, 2, 4). B(a)P > ESL (Laying Shed 2). TRH > C16-34 (F3) > ESL (Laying Shed 3).
Rearing Sheds (1 and 2)	Metals, TRH, BTEX, PAH, phenols, OC/OP pesticides, nutrients*, bacteria and pathogens, ACM	Rearing Shed 2 is present within the 1995 aerial photograph and Rearing Shed 1 in the 2000 aerial photograph. A food hopper currently present adjacent Rearing Shed 2 indicates this was utilised to house poultry at some point. Rearing Shed 1 appears to have also been utilised for chick hatching/rearing. Both constructed of metal framework with concrete flooring. No obvious staining on the floors. Potential for historical termiticide application and residual ACM associated with proposed demolition activities.	Below adopted guideline criteria.
Potential Buried Carcasses/ Poultry Waste (presence unconfirmed)	Metals, PAH, OC/OP pesticides, phenols, nutrients*, bacteria and pathogens, biological oxygen demand (BOD)	Presence of historically buried carcasses unconfirmed; however, due to the lack of historical Site information the potential for poultry carcass burial to have occurred cannot be excluded.	Not sampled. Location/existence unconfirmed.
Wooden Rail Carriage	Metals, OC/OP pesticides, ACM	Utilised for storage of inert equipment and materials. Potential for historical termiticide application and residual ACM associated with proposed demolition activities.	Not sampled.
House Shed	Metals, OC/OP pesticides, ACM	House Shed built between 2001 and 2002. Constructed of metal framework and sheeting with a concrete floor. Used for storage of domestic items. No ACM observed. Potential for historical termiticide application and potential residual ACM associated with proposed demolition activities.	Below adopted guideline criteria.

Area/Source	Contaminants of Potential Concern	Comments	Summary of Preliminary Soil Results (WEPL, 2022a)
Pump Shed	Metals, TRH, BTEX, methyl ter-butyl ether (MTBE), PAH, VOCs/SVOCs	Structure present from 2005, possibly earlier (aerial photography quality too poor to determine). Metal construction, with concrete slab floor. No ACM observed. Evidence of minor hydrocarbon staining. Fuels would have historically been utilised and possibly stored to operate the pump.	Below adopted guideline criteria.
House	Metals, OC/OP pesticides, ACM	The residential house was built between 1983 and 1985. Potential ACM fibre cement sheeting present. Potential for historical termiticide application and potential residual ACM associated with proposed demolition activities.	Below adopted guideline criteria.
Garden Shed	ACM	Constructed of metal with concrete flooring. Internally lined with potential ACM fibre cement sheeting. Used for storage of domestic garden tools. Not considered source of potential contamination other than potential residual ACM associated with demolition.	Not sampled.
Office Building	Metals, OC/OP pesticides, ACM	Structure present at this location since 1970. ACM visually identified within external wall sheeting and minor ACM debris/fragments adjacent damage to external wall. Potential for historical termiticide application and potential residual ACM associated with proposed demolition activities.	Zinc > EIL.
Main Workshop/ Storage Shed	Metals, OC/OP pesticides, TRH, BTEX, PAH, phenols, VOCs/SVOCs, nutrients*, ACM	Main Workshop/Storage Shed, utilised for cold storage (i.e. cold rooms) and storage of packing materials as well as possible cleaning and processing of eggs. Southern section contains general tools, equipment and storage of some minor chemicals. A structure has been present within this building footprint since 1970; however, there has been alterations to the building structure with the current footprint unchanged since 2000. The shed is constructed of metal sheeting with concrete floors and no ACM observed, although previous historical structures within the footprint may have contained asbestos. Some minor cracks and staining on internal flooring. Potential for historical termiticide application and potential residual ACM associated with proposed demolition activities.	Zinc > EIL.
Staff Room/ Office	Metals, OC/OP pesticides, ACM	Constructed from wooden framework and metal roof and wall sheeting with concrete slab flooring, no ACM observed. Potential for historical termiticide application and potential residual ACM associated with proposed demolition activities.	Not sampled.
Storage Shed	Metals, OC/OP pesticides, ACM	Constructed from wooden framework/sheeting with roof insulation panels and concrete slab flooring, no ACM observed. Potential for historical termiticide application and potential residual ACM associated with proposed demolition activities.	Below adopted guideline criteria.

Area/Source	Contaminants of Potential Concern	Comments	Summary of Preliminary Soil Results (WEPL, 2022a)
Former Sheds/ Structures	Metals, OC/OP pesticides, TRH, BTEX, PAH, phenols, VOCs/SVOCs, nutrients*, ACM	Two large sheds were originally present in the 1970 aerial photograph. These were later demolished and additional sheds rebuilt within/overlaying the former shed footprints. Two small structures were also present immediately west of the residential House in the 1981 and 1983 aerial photograph and were demolished by 1985. Possible historical storage of chemicals and/or fuels. Potential historical termiticide application and residual ACM associated with proposed demolition activities. A dilapidated metal structure stored near the Pump Shed was not originally located there and this was not considered an area of potential contamination.	Not sampled.
Equipment storage/ laydown area (various areas)	Metals, nutrients*, OC/OP pesticides, phenols, TRH, BTEX, PAH, phenols, VOCs/SVOCs, ACM	Various equipment, building materials, poultry cages and packing materials stored around the front of Laying Sheds 2 and 3 and rear of Laying Shed 4 and north-east of the Storage Shed. Possible historical storage of chemical containers and/or waste materials. No fuel storage evident.	Not sampled.

*** Relevant to groundwater impacts only.**

Note: Only select CoPCs were analysed for as part of the PSI (WEPL, 2022).

4.2 Off-site Potential Sources

Regional groundwater contours indicate that groundwater flows in a f westerly direction, therefore potential off-site sources of contamination include:

- Former market gardens east of the Site (east of Baldivis Road).
- Historical market gardening, orchards, nursery operations, agricultural land use to the north and south of the Site; however, based on inferred groundwater flow direction these sites are cross-gradient of the Site.

4.3 Transport Mechanisms

Transport mechanisms are the pathways by which contamination migrates through different media in the environment. The relevant transport mechanisms identified for soil and groundwater CoPCs have been detailed in the following sections.

4.3.1 Soil

The transport mechanisms associated with potential soil contamination on-site comprise:

- Wind erosion, dust generation and atmospheric dispersion.
- Vertical or lateral migration of contaminants through the soil profile i.e. leaching.
- Overland flow with surface run-off associated with heavy seasonal rains.

4.3.2 Groundwater

The transport mechanisms associated with potential groundwater contamination on-site comprise:

- Upward vapour migration through unsaturated soils above dissolved phase or phase separated hydrocarbon groundwater plume and subsequent vapour intrusion/accumulation.
- Migration along the hydraulic flow path.

4.4 Potential Exposure Pathways

An exposure pathway is a means by which an ecosystem, human population or individual (receptor) may be exposed to site-derived contaminants. Exposure pathways are natural and/or anthropogenic and based on a review of the Site geology/hydrogeology and infrastructure.

4.4.1 Soil

Potential exposure pathways presented in the CSM were determined based on the potential migration of possible contaminants through soil types identified at the Site, assumed to have high permeability and include:

- Human health:
    - Inhalation of vapour, contaminated soil particulates or asbestos fibres in soil.
    - Ingestion/dermal contact of contaminated soils.
- Ecological:
    - Potential plant uptake of contaminants.
    - Potential plant intake and subsequent fauna consumption of impacted plant material.
    - Infiltration and leaching of contaminants through unsaturated soils, followed by downward vertical migration to groundwater.

4.4.2 Groundwater

Potential exposure pathways for groundwater contaminants at the Site include the following:

- Human health:
    - Ingestion and/or dermal contact if impacted groundwater is abstracted for use or intercepted i.e. on-site groundwater use or down-gradient bore users.
    - Inhalation of vapours associated with volatiles in groundwater.
- Ecological:
    - Migration of impacted groundwater down-hydraulic gradient to sensitive environmental receptors i.e. Spot Swamp (approximately 1 km west), Lake Cooloongup (approximately 2.1 km west).

4.5 Potential Receptors

A receptor can be defined as persons, structures, utilities, ecological receptors and water supply wells that may be adversely affected by contact with, or exposure to, a contaminant.

4.5.1 Soil

The following potential receptors of soil impacts were identified for the Site:

- Human health:
    - On-site workers (Site development, construction and maintenance workers - non-intrusive).
    - Intrusive maintenance workers.
    - Current/future occupants (residents, users and/or visitors).
    - Off-site residents, workers and visitors (i.e. on neighbouring lots).
- Ecological
    - On-site flora and fauna.
    - Groundwater beneath the Site.

4.5.2 Groundwater

The following potential receptors of groundwater impacts were considered relevant for the Site:

- Human Health
    - Potential on-site and off-site down-gradient bore users.
    - Intrusive maintenance workers.
    - Current/future occupants, users, visitors etc.
- Ecological
    - Terrestrial on-site flora and fauna.
    - Aquatic environment: Down-gradient receiving water bodies i.e. Spot Swamp (approximately 1 km west), Lake Cooloongup (approximately 2.1 km west).
    - Off-site flora and fauna associated with down-hydraulic gradient environmental receptors, (i.e. Spot Swamp and Lake Cooloongup surrounding bushland).

4.6 Preliminary CSM

The preliminary CSM is presented below in Table D and represents potential Site conditions at the conclusion of the PSI and limited soil sampling.

Table D: Preliminary Conceptual Site Model

Primary Sources	Secondary Sources	Transport Mechanisms	Exposure Pathways	Receptors	Pathway Status and Risk Discussion
On-site sources	Impacted soils	Wind erosion (or mechanical disturbance) and atmospheric dispersion	Inhalation of vapour, contaminated soil particulates and asbestos fibres	On-site workers/ /future occupants/ off-site residents, workers and visitors.	**Potentially Complete:** Whilst ACM was only identified within building structures and a few minor surface fragments associated with a recently broken external wall sheet within the Office Building, the potential for ACM to be present in association with uncontrolled fill, buried waste and/or former structures cannot be discounted given the constraints of the investigation program i.e. preliminary in nature with access limitations and absence of test pitting. On this basis, whilst information available to date suggests that asbestos fibres will not pose an unacceptable risk to human health during or post development, further assessment of soil is warranted. The potential risk to human health present in association with inhalation of vapours from secondary impacts in soil is considered to be low on the basis that limited sampling undertaken at point sources on-site has not identified concentrations of volatile contaminants above the health screening level (HSL) guidelines and no significant identifiable on-site sources of vapour, i.e. limited fuel and/or chemical storage, exist. Only minor hydrocarbon staining was noted within the Pump Shed. With regards to potential inhalation of contaminated particulate matter, it should be noted that all soil results were below the adopted health investigation level (HIL) and HSL guidelines, although further spatial characterisation is required. Visual and/or olfactory indicators of potentially contaminated soils include residual poultry waste around current infrastructure, minor ACM fragments and staining within the Pump House. Storage of equipment and materials within laydown areas are considered to pose a low risk to human health. Minor fly-tipped waste on-site was domestic in nature and considered inert. Although no significant risks to human health have yet been identified, there still exists the possibility of further areas/sources of potential contamination to be present at the Site i.e. uncontrolled fill material and/or buried waste, including poultry carcasses and waste. On the basis of the above, WEPL consider further assessment of these exposure scenarios is required in association with identified sources.

Primary Sources	Secondary Sources	Transport Mechanisms	Exposure Pathways	Receptors	Pathway Status and Risk Discussion
On-site sources	Impacted soils	Incidental direct contact	Direct contact (oral ingestion and/or dermal contact)	On-site workers/ future occupants/ off-site residents, workers and visitors.	**Potentially Complete:** The potential risk to human health present in association with direct contact is considered to be low on the basis that limited sampling undertaken at point sources on-site has not identified concentrations of CoPCs above the HIL and HSL guidelines. Although no significant risks have yet been identified, there still exists the possibility of further areas/sources of potential contamination to be present at the Site i.e. uncontrolled fill material and/or buried waste, including poultry carcasses and waste. On the basis of the above, WEPL consider further assessment of this exposure scenario is required.
		Plant uptake of contaminants	Direct uptake (flora) or subsequent ingestion of plant material (fauna)	On-site flora and fauna.	**Potentially Complete:** Zinc was identified above the EILs for urban residential and POS areas at six locations in association with the Laying Sheds, Main Workshop and Office Building. Similarly, B[a]P (one location) and TRH (one location) were identified at concentrations marginally above the ESL for urban residential land use. WEPL note that no signs of vegetation stress were evident on-site; however, as several Threatened Ecological Communities (TECs) overlay the Site there is potential for these contaminants to impact on-site flora and fauna. Given the proposed use of the Site for residential and POS, and in consideration of the proposed highly urbanised nature of the Site, the minor elevated concentrations of zinc, B[a]P and TRH (F3) are unlikely to pose an appreciable exposure risk to on-site flora and fauna; however, further consideration of this exposure scenario is warranted.
		Leaching, vertical migration	Leaching of contaminants to groundwater	Groundwater.	**Potentially Complete:** Groundwater flow direction and quality has not been assessed beneath the Site, as such this remains a data gap. While the preliminary soil results obtained have not identified gross contamination within soil at the Site, Zinc, B[a]P and TRH were reported above applicable ecological assessment criteria, it is possible that additional areas of soil contamination may exist at the Site. Furthermore, the prolonged historical operation of the Site (>30 years) as a poultry farm, which has only recently ceased within the last two years, indicates a potential for on-site activities to have impacted groundwater quality beneath the Site, particularly in regard to nutrient loading, which was visually evidenced in soils as 'abundant organic material'. The minimum depth to groundwater is anticipated to be between 8 to 13 mbgl, however, this may decrease once earthworks are completed (proposed cut and fill plans were not available at the time of this investigation). On the basis of the above, WEPL consider further assessment of groundwater is warranted.

Primary Sources	Secondary Sources	Transport Mechanisms	Exposure Pathways	Receptors	Pathway Status and Risk Discussion
On-site and off-site sources	Impacted groundwater	Migration along the flow path	Direct contact (accidental oral ingestion and/or dermal contact)	On-site and off-site bore users. Intrusive maintenance workers. Future occupants, users, visitors.	**Potentially Complete:** Groundwater flow direction and quality has not been assessed beneath the Site, as such this remains a data gap. Groundwater is present from approximately 8 to 13 m below current Site levels, although this will be altered following proposed earthworks (proposed cut and fill plans were not available at the time of this investigation). This is generally beyond the depth of primary services and utilities and the vertical extent of proposed construction activities and therefore interception with groundwater is not considered to be a credible exposure scenario. Abstraction of groundwater for non-potable use on and off-site is considered a credible exposure pathway. However, exposure through abstraction is likely to be limited due to the presence of scheme water proposed as part of the development on-site and within the surrounding area. On the basis of the above, WEPL consider further assessment of these exposure scenarios is required in association with identified sources.
			Atmospheric dispersion and volatilisation. Vapour intrusion into future buildings/ inhalation	On-site bore users. Intrusive maintenance workers. Future occupants, users, visitors.	
		Migration along groundwater flow path	Direct contact (accidental oral ingestion and/or dermal contact)	On-site and off-site terrestrial flora.	**Potentially Complete:** Groundwater is present approximately 8 to 13 m below current Site levels, although this will be altered following proposed earthworks. Depth of groundwater likely precludes impacts to flora and fauna unless abstracted for irrigation. Similarly, anticipated depth to groundwater is beyond the root and burrowing zone of habitat species (>2 mbgl). However, Site specific groundwater investigations have not been undertaken and as such this remains a data gap. On this basis, WEPL consider further assessment is warranted.
			Plant uptake		
			Subsequent ingestion of plants		
			Discharge into aquatic environment	Receiving aquatic environment.	**Potentially Complete:** Groundwater flow direction and quality has not been assessed beneath the Site, as such this remains a data gap. While the preliminary soil results obtained have not identified gross contamination within soil at the Site, zinc, B[a]P and TRH were reported above applicable ecological assessment criteria. Therefore, a risk to groundwater quality may be present in association with historical activities at the Site.

5. Assessment Levels

The assessment levels adopted for the intrusive investigation, as specified in the SAQP, are documented in the following sections. WEPL notes that groundwater assessment levels were not included in the SAQP due to an oversight.

5.1 Soil

DWER (2021) defer to the ASC NEPM for all soil assessment levels. Schedule B1 of the ASC NEPM provides the following generic soil assessment levels:

- Health Investigation Levels (HILs) which are applicable for assessing human health risk via all exposure pathways and are applicable to all soil types.
- Health Screening Levels (HSLs) for petroleum hydrocarbons (PHCs) which have been developed to assess human health risk for selected petroleum compounds and fractions via inhalation and direct contact.
- Management Limits (MLs) which have been developed for PHCs in soil to avoid or minimise other potential effects due to the nature of PHCs which could include formation of free product, fire and explosion hazards and effects on buried infrastructure.
- Ecological Investigation Levels (EILs) which have been developed for assessing risk to ecological receptors. While some EILs are generic, others are site specific and calculated based on soil parameters collected on-site.
- Ecological Screening Levels (ESLs) for PHCs which have been developed to assess the potential impact of PHCs in soil on ecological systems.

As specified in the SAQP, the assessment levels adopted for the soil investigation component of the DSI are provided in Table E .

Table E: Tier 1 Soil Assessment Levels

Media	Adopted Assessment Criteria	
	Human Health	Ecological
Soil	HIL, HSL for vapour intrusion (VI) and HSL for direct contact (DC) relevant to a residential land use (HIL-A, HSL-A (VI) and HSL-A (DC)). HIL, HSL (VI) and HSL (DC) relevant to a recreational/ public open space (POS) land use (HIL-C, HSL-C (VI) and HSL-C (DC)). HSL (VI) and HSL-DC relevant to intrusive maintenance workers (HSL-MW (VI) and HSL-MW (DC)). ML relevant for residential, parkland and public open space (ML-A).	EIL for urban residential/POS land use (EIL-A). ESL for urban residential/POS land use (ESL-A).

Where an analyte is reported above the laboratory limit of reporting (LoR), and no applicable Australian assessment level is available:

- An equivalent United States Environmental Protection Agency (US EPA) regional screening level (RSL) for residential land use (RSL-A) has been applied to assess risk to human health.
- The uncontaminated fill guidelines (UFG) provided in (DWER, 2019) have been applied as these assessment levels take into consideration of risk to both the environment and human health.

5.1.1 Site Specific EILS

Site specific EILs for Cr, Ni, Cu and Zn require the input of soil properties including:

- Cation exchange capacity (CEC).
- pH.
- Clay content.
- Total organic carbon (TOC).
- Iron content.

A background sample (BG01) was collected during the DSI from the western side of Eighty Road with the specific parameters and calculated EILs provided in Table F. Copies of the ASC NEPM EIL workbook spreadsheets for each of the contaminants is provided in Appendix D.

Table F: Site Specific EIL Values

CeC	pH	Clay Content	TOC	Fe Content	Cr EIL	Cu EIL	Ni EIL	Zn EIL
3.2	6.4	36	1.3	690	170	60	10	190
meq/100g	pH units	%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg

5.2 Asbestos

Assessment levels for asbestos in soil have been provided in the ASC NEPM and are based upon those published in *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia* (DOH, 2021). The ASC NEPM recommends that ACM is used as the primary measure of asbestos contamination where FA and AF are not likely to be significant, such as where FA and AF are likely to comprise less than 10% of asbestos present. Therefore, asbestos as ACM will be used as the primary indicator of potential impact and are considered the equivalent of HILs with the relevant residential (HIL-A) and recreational/ POS (HIL-C) land uses.

On this basis, the risk-based criteria to be used in this investigation comprised:

- HIL-A (bonded ACM) - 0.01 % w/w asbestos.
- HIL-C (bonded ACM) - 0.02 % w/w asbestos.
- All site uses (FA and AF) – 0.001 % w/w asbestos.
- Surface soils free of visible ACM.

5.3 Groundwater

Assessment levels to determine the relevance of contaminant concentrations identified at the site in relation to groundwater are based on the guidelines contained in the following documents:

- *Assessment and Management of Contaminated Sites* (DWER, 2021).
- Schedule B1 of the ASC NEPM title *Guideline on Investigation Levels for Soil and Groundwater* (NEPC, 2013b).

The ASC NEPM provides the following generic groundwater assessment levels:

- Fresh waters (FW), which are based on the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG) (ANZECC and ARMCANZ, 2018) and are applicable to freshwater ecosystems.
- Marine waters (MW) which are based on the ANZG and are applicable for marine ecosystems.
- Drinking Waters (DW) which are based on the Australian Drinking Water Guidelines (ADWGs) NHMRC & NRMMC (2011).
- HSLs for vapour intrusion via hydrocarbon contamination, with land uses consistent with those described for soil.

In addition, the current DWER (2021) guidelines provide the following further assessment levels:

- Non-potable use guidelines (NPUG) which are based on 10 times the ADWG health value, with the exception of some odoriferous chemicals which are equal to the aesthetic value from the ADWG. These have been supplemented with the US EPA maximum contaminant level for drinking water (MCL) multiplied by a factor of 10 where the NPUG does not provide a specific value for a CoPC.
- Long-term irrigation waters (LTIW) which are based on ANZG (2018) and are applicable to agricultural irrigation for up to 100 years.
- Short-term irrigation waters (STIW) which are based on ANZG (2018) and are applicable to agricultural irrigation for periods of up to 20 years.

The assessment levels adopted for the groundwater investigation are as follows:

- Human health:
    - NPUG to assess the potential risk to on-site and down-gradient human receptors that may incidentally come into contact with groundwater, primarily via irrigation.
    - HSL-A to assess the potential risk from vapour intrusion into future structures. As a conservative measure the concentrations for groundwater within 4 m of ground level will be applied.
- Ecological:
    - The FW assessment levels. The ANZG (2018) provides for species protection levels (SPLs) of 99%, 95%, 90% and 80%. The 95% SPL applicable to moderately disturbed ecosystems (FW (95%)) is consider the most appropriate for the investigation. It should be noted that this approach does adopt the 99% species protection level for compounds that bioaccumulate.
    - The STIW on the basis that the vast majority of surrounding land is likely to be developed for residential purposes within the next 20 years.

The following assessment levels were not adopted for the DSI:

- DW on the basis that reticulated scheme water is present in the area.
- MW on the basis that the conductivity and TDS values from the groundwater investigation confirm groundwater is fresh.
- LTIW on the basis that commercial scale crop irrigation is unlikely to continue for a period longer than 20 years given the rate of residential development in the area.

6. Fieldwork Summary

Fieldwork for the DSI was completed between 29 June 2023 and 23 August 2023 as summarised in the following sections.

6.1 Soil Investigation

Test pit installation and sampling was completed on 13 July 2023 and 14 July 2023. A total of 34 test pits were installed to the target depth of 1.0 mBGL with an excavator as described in the SAQP in accordance with the following procedure:

- All test pits were installed directly at the point of interest with no access restrictions encountered.
- Once the target depth was reached, the soil profile and specific observations of soil staining and/or odour were noted on the test pit logs.
- Samples for laboratory analysis were collected at the required depths (0.15 m, 0.5 m and 1.0 m), the sample jars immediately closed and placed in a chilled esky with ice for storage and transport.
- Samples were collected directly from the wall of the test pit. Fresh soil was exposed by scraping the back of a nitrile glove across the wall and soil collected using a trowel was not in contact with the excavator bucket at any stage. QA/ QC samples were collected from immediately adjacent to the primary sample.
- A 10 L sample of soil from each 1 m profile of soil was collected for field screening for ACM in accordance with the following procedure:
    - A 10 L sub sample of the material from across the 1 m interval was collected from the spoil.
    - The sub sample was weighed and passed through a 7 mm by 7 mm sieve.
    - The retained fraction was examined for evidence of ACM fragments.
    - The number and total combined weight of any fragments was recorded to allow quantification of the total asbestos as ACM concentration in soil.

The locations the 34 test pits are shown on Figure 4 and summarised in Table G where co-ordinates are provided in Grid Datum of Australia 20202 (GDA20), Map Grid of Australia (MGA) Zone 50 format. The shallow sample from each location (0.15 m) was submitted for laboratory analysis consistent with the PAoC contaminants identified in the SAQP. Test pit logs are provided in Appendix E. Further analysis of deeper samples requested if elevated concentrations were detected in the shallow sample as summarised in Table G.

Table G: Test Pit Installation Summary

Name	Easting	Northing	PAoC	Sample Depth	Laboratory Analysis
TP01	388727	6424490	Rearing Shed 1	0.15	Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn) TRH, BTEX, PAH, phenols, OC/OP pesticides
TP02	388747	6424488	Rearing Shed 2	0.15	Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn) TRH, BTEX, PAH, phenols, OC/OP pesticides
TP03	388762	6424477	Former Sheds/Structures	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), TRH, BTEX, PAH, phenols, VOCs/SVOCs, OC/OP pesticides
TP04	388749	6424446	Domestic Residence	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), OC/OP pesticides
				0.5	OC pesticides
TP05	388731	6424456	Former Sheds/Structures	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), TRH, BTEX, PAH, phenols, VOCs/SVOCs, OC/OP pesticides
TP06	388733	6424430	Former Sheds/Structures	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), TRH, BTEX, PAH, phenols, VOCs/SVOCs, OC/OP pesticides
TP07	388766	6424512	Staff Room/Office	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), OC/OP pesticides
TP08	388779	6424510	Former Sheds/Structures	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), TRH, BTEX, PAH, phenols, VOCs/SVOCs, OC/OP pesticides
TP09	388791	6424517	Equipment Storage/Laydown Area	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn) TRH, BTEX, PAH, phenols, VOCs/SVOCs, OC/OP pesticides
TP10	388781	6424488	Main Workshop/Storage Shed	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn) TRH, BTEX, PAH, phenols, VOCs/SVOCs, OC/OP pesticides
TP11	388829	6424491	Laying Shed 4	0.15	Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn) TRH, BTEX, PAH, phenols, OC/OP pesticides
TP12	388848	6424495	Laying Shed 4	0.15	Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn) TRH, BTEX, PAH, phenols, OC/OP pesticides
TP13	388854	6424500	Equipment Storage/Laydown Area	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn) TRH, BTEX, PAH, phenols, VOCs/SVOCs, OC/OP pesticides
TP14	388886	6424503	Laying Shed 3	0.15	Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn) TRH, BTEX, PAH, phenols, OC/OP pesticides

Name	Easting	Northing	PAoC	Sample Depth	Laboratory Analysis
TP15	388908	6424504	Laying Shed 3	0.15	Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn) TRH, BTEX, PAH, phenols, OC/OP pesticides
TP16	388907	6424492	Equipment Storage/Laydown Area	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn) TRH, BTEX, PAH, phenols, VOCs/SVOCs, OC/OP pesticides
TP17	388910	6424475	Wooden Rail Carriage	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), OC/OP pesticides
TP18	388953	6424490	Laying Shed 1	0.15	Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn) TRH, BTEX, PAH, phenols, OC/OP pesticides
				0.5	TRH, BTEX,
TP19	388968	6424481	Laying Shed 1	0.15	Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn) TRH, BTEX, PAH, phenols, OC/OP pesticides
TP20	388948	6424446	Equipment Storage/Laydown Area	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn) TRH, BTEX, PAH, phenols, VOCs/SVOCs, OC/OP pesticides
				0.5	PAHs
TP21	388908	6424439	Laying Shed 2	0.15	Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn) TRH, BTEX, PAH, phenols, OC/OP pesticides
TP22	388952	6424438	Laying Shed 2	0.15	Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn) TRH, BTEX, PAH, phenols, OC/OP pesticides
TP23	388661	6424431	Former Agricultural/Cropped Area	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), OC/OP pesticides
TP24	388702	6424459	Former Agricultural/Cropped Area	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), OC/OP pesticides
TP25	388818	6424513	Former Agricultural/Cropped Area	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), OC/OP pesticides
TP26	388823	6424437	Former Agricultural/Cropped Area	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), OC/OP pesticides
TP27	388858	6424449	Former Agricultural/Cropped Area	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), OC/OP pesticides
TP28	388927	6424521	Former Agricultural/Cropped Area	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), OC/OP pesticides
TP29	388982	6424510	Former Agricultural/Cropped Area	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), OC/OP pesticides
TP30	389030	6424510	Former Agricultural/Cropped Area	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), OC/OP pesticides
TP31	389021	6424492	Former Agricultural/Cropped Area	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), OC/OP pesticides

Name	Easting	Northing	PAoC	Sample Depth	Laboratory Analysis
TP32	389032	6424473	Former Agricultural/Cropped Area	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), OC/OP pesticides
TP33	389012	6424444	Former Agricultural/Cropped Area	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), OC/OP pesticides
TP34	388880	6424434	Former Agricultural/Cropped Area	0.15	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), OC/OP pesticides

During the fieldwork for the soil investigation a concrete drainage sump was observed to be present in the vicinity of the former workshop, main office and storage sheds. An opportunistic sample of the accumulated sediment in the base of the sump (Sed01) was collected and submitted for laboratory analysis for TRH, BTEX, PAHs, phenols and metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn). The data was compared to the adopted soil assessment levels based on the exposure routes and likely receptors identified for the site. It is not considered to represent an aquatic ecosystem that would warrant adoption of sediment specific assessment levels that are only relevant when sediment are routinely submerged for long periods.

The following field QA/ QC samples were collected during the soil investigation:

- Two field duplicate samples: Dup01, Dup03.
- Two field triplicate sample: Trip01, Trip 02.
- Two rinsate blank samples: RN/FB01, RN/FB02.
- One combined field/ transport blank sample: TB01.

6.1.1 SAQP Deviations

The soil investigation was completed as proposed in the SAQP without significant deviations. All test pits were installed directly at the point of interest to the target depth without access restriction or refusal. All samples were submitted for laboratory analysis as intended with analyses specific to the PAoC being assessed. No evidence of buried waste or carcasses were observed in test pits TP21 - TP34 so the expanded analytical suite proposed for this scenario was not required.

The CSA provided a comment in the Interim Audit Advice (IAA) for the SAQP regarding justification of the number of spatial characterisation test pits (TP23-TP34) that were adopted for the investigation. The locations for these 12 test pits were judgementally selected to be placed in areas where the potential for buried waste was most likely to have occurred. This was considered to be areas not in too close proximity to the poultry farm infrastructure as waste would have been unlikely to be buried immediately adjacent to buildings. Areas of mature trees were also considered to be indicators that no significant historical excavations had occurred so the test pits generally targeted less heavily vegetated areas.

The number of test pits installed is conservative given the absence of a visible indicators of waste burial occurring on-site during any of the site inspections or fieldwork.

6.2 Surface ACM Assessment

The quantification of asbestos in the upper 1 m of the soil profile at the 34 test pit locations was completed in conjunction with the soil investigation on 13 July 2023 and 14 July 2023 as documented in Section 6.1 . The grid-based surface ACM assessment was completed between 14 July 2023 and 23 August 2023.

Hand-picking refers to the visual inspection of the soil surface and manual collection of ACM. This method was considered appropriate given the ARCP and clearance certificate confirm any residual ACM is likely to be surface scatter only and associated with the building demolition works. Hand-picking for the surface ACM assessment was undertaken in compliance with Section 5.7.1 of DOH (2021) as follows:

- A total of 52 grid squares (GS1-GS52) were established on the multiple building footprints within the Site as shown on Figure 5.
- Each grid square was subject to a minimum of three passes of hand-picking with a 90° direction change between each pass and raking completed to the extent possible on the 2nd pass. Additional passes were completed at 90° to the preceding pass until no fragments were observed in the final pass.
- The number, dimensions and total weight of fragments collected for each pass was recorded and the percentage composition of asbestos as ACM in soil calculated for each pass, using 1 cm as the effective soil depth for hand-picking.
- Upon completion of the visual inspection one test pit was installed in the centre of each grid square to a depth of 0.3 – 0.5 m below ground level (mBGL) and field screening to quantify the concentration of any subsurface ACM completed in accordance with the field screening procedure described in Section 6.1.

The extent to which the visual inspection and raking could effectively be completed was limited by dense vegetation in grid squares GS14-GS16 and GS25 - GS40. The remaining 33 grid squares were largely free of vegetation with clear access to the surface soils that was amenable to raking.

6.2.1 SAQP Deviations

The DSI as implemented deviated from the SAQP by comprising 52 grid squares across the footprint of the buildings as opposed to the 199 across a larger area of the Site proposed in the SAQP. Given the general lack of ACM identified for management in the ACRP and the clearance certification provided for the affected building, a reduced number of grid squares targeting the areas of greatest risk around the building footprints was considered appropriate. These areas also provided best access to shallow soils given the demolition works that had been completed. The remainder of the Site, which was not subject to demolition, comprised vegetative ground cover that would have made visual inspection, and particularly raking, difficult to complete with little benefit. In addition, the absence of uncontrolled fill or burial pits identified in any of the test pits confirms that the intent of the surface ACM assessment is to verify good demolition practices as opposed to assessing potential ACM contamination from uncontrolled fill.

6.3 Groundwater Investigation

Fieldwork for the groundwater investigation was completed between 29 June and 19 July 2023

6.3.1 Monitoring well installation and survey

Four monitoring wells (GW01 - GW04) were installed on 29 June 2023 using a direct push drill rig in accordance with the procedure described in the SAQP. A survey was undertaken to determine the location, top of casing (ToC) and adjacent ground level elevation for the monitoring wells. The locations were obtained in GDA20 MGA Zone 50 coordinates, and the ToC elevations were obtained in mAHD to enable comparative groundwater elevations to be determined. The ground surface elevation adjacent to the well enabled completion of the monitoring well construction logs and comparative levels for the lithology.

A summary of the monitoring well construction and survey details is provided in Table H and the locations of the wells are shown on Figure 6. Monitoring well construction logs are provided in Appendix E.

Table H: Monitoring Well Location and Construction Details

Well ID	Easting	Northing	ToC elevation	Ground elevation	Total depth	Screened interval
GW01	388695.495	6424482.600	10.997	10.330	10.5	7.5-10.5
GW02	388815.768	6424493.156	12.708	12.000	12.0	9.0-12.0
GW03	388842.808	6424438.195	11.534	10.870	10.5	7.5-10.5
GW04	389053.280	6424478.137	7.376	6.870	5.5	2.5-5.5
Units	*m*	*m*	*mAHD*	*mAHD*	*mBGL*	*mBGL*

6.3.2 Groundwater monitoring event

The GME was undertaken on 19 July 2023 after allowing a period of approximately three weeks for the wells to equilibrate with the surrounding aquifer. The GME was completed as described in the SAQP and in accordance with the following procedure.

Water Level Measurement

The standing water level (SWL) or depth to water (DTW) in each monitoring well was measured prior to sample collection. This measurement and the elevation survey data allowed the groundwater level to be determined in mAHD to an accuracy of 0.01 m. The depth to base (DTB) in each well was measured after sampling to prevent the suspension of any fine particulates accumulated at the bottom of the well.

The water level was measured using an interface meter referenced to a marked point on the top of the monitoring well casing. The probe and tape of the interface meter was decontaminated between sampling locations.

Purging

Purging was undertaken prior to sample collection using a submersible electric pump fitted with a flow controller. The pump intake was lowered to approximately 0.5 m below the standing water level. This intake depth was chosen to prevent re-suspension of solids that may be present at the base of the well but also as the portion of the aquifer where contaminant concentrations are likely to be greatest.

The pumping rate during purging was <1 L/min and drawdown monitored to ensure it did not exceed 0.1 m. The upper end of the inert low-density polyethylene (LDPE) tubing was connected to the flow cell of a water quality meter positioned to prevent entrapment of oxygen. Measurements of water quality parameters were taken immediately after the flow cell was full and continued thereafter at three-minute intervals. Purging continued until stabilised field water quality parameters were attained over three consecutive measurements that adhere to the following criteria:

- pH: ± 0.1 pH units.
- Electrical conductivity (EC): ± 5%.
- Reduction/ oxidation potential (redox): ± 10%.
- Dissolved oxygen (DO): ± 10%.

Water temperature was also measured but did not form part of the stabilisation parameters. The colour, turbidity and any odour were also noted.

Dedicated tubing was used for each monitoring well and did not require decontamination. An equipment rinsate sample was collected from the water level meter and submersible pump to confirm appropriate decontamination had occurred.

Sampling

Sample collection utilised the same submersible pump used for purging. The pump was operated continuously and was not removed from the well between purging and sample collection.

Samples were collected directly from the LDPE tubing into laboratory supplied sample containers. Select sample bottles were supplied pre-preserved as required. All bottles for the designated analysis were

completely filled sequentially. Vials for volatile contaminant were filled first to minimise potential for volatilisation, followed by semi-volatiles and so on. Samples for dissolved metals analysis were field filtered using an inline 45 µm disposable filter.

Upon collection, the groundwater sample bottles were closed immediately and placed in a chilled esky containing ice for storage and transport. At the completion of sample collection, the well cap was replaced and the monument cover closed.

One sample was collected from each monitoring well for laboratory analysis and the following field QA/ QC samples were collected:

- One field duplicate sample: Dup01.
- One field triplicate sample: Trip01.
- One rinsate blank sample: Rinsate.
- One combined field/ trip blank sample: FB/TB.

Laboratory analysis

All groundwater samples collected were submitted for laboratory analysis consistent with the CoPCs listed in the SAQP.

6.3.3 SAQP Deviations

The groundwater investigation was completed as proposed in the SAQP without significant deviations. All monitoring wells were installed directly at the point of interest to the target depth without access restriction or refusal. All samples were submitted for laboratory analysis as proposed in the SAQP (WEPL, 2022).

6.4 Investigation Derived Waste

A small volume of general waste was generated during the investigation which included:

- Used personal protective equipment (PPE).
- Decontamination fluids.
- Monitoring well development and purge water.

Used PPE was bagged and disposed of with municipal rubbish. Decontamination fluids and development water generated comprised a small quantity of water and was sufficiently low to allow disposal at the site without significant risk to the environment.

7. Quality Assurance and Quality Control Review

The following sections asses the QC data obtained from the field samples and QA documentation/ protocols used along with the results of the laboratory internal QA procedures to evaluate the reliability and integrity of the analytical results obtained with respect to the aims of the investigation.

7.1 Field QA/QC

7.1.1 Field QA/QC Compliance

Details of field QA/QC procedures and compliance during the investigation are detailed in Table I.

Table I: Field QA/QC Procedure Compliance

Field QA/QC Element	Completed (Yes/No)	Comments
Soil Investigation (including surface ACM assessment)		
Documentation	Yes	Soil bore logs, sample collection records and asbestos grid assessment records were generated as required and are provided in Appendix E.
Equipment calibration	No	No equipment that required calibration was used during the soil investigation.
Sample collection	Yes	Samples were collected using nitrile gloves directly into laboratory supplied sample jars. Where QA/QC samples were collected, samples were collected in the order of primary, field duplicate and then field triplicate samples from immediately next to each other on the test pit wall.
QC sample collection	Yes	Duplicate samples, triplicate samples and blank samples were collected at the target frequency of 5% as documented Section 7.1.2.
Sample identification	Yes	All samples were marked with a unique identifier including project number, sample location, sample depth and date.
QC sample identification	Yes	All samples were labelled with a unique identifier. No indication of the corresponding primary sample was given to the laboratory where replicate samples were collected.
Chain of custody forms	Yes	CoC forms were completed detailing sample identification, collection date, sampler and the laboratory analysis required. CoC forms along with sample receipt notifications were returned to WEPL for review and are included in Appendix F.
Equipment decontamination	Yes	Decontamination of the soil sampling trowel was undertaken by washing with a phosphate-free detergent prior to rinsing with potable water. One rinsate sample was collected on each day of sampling
Sample preservation	Yes	Samples were placed in chilled esky with ice for storage immediately after collection and transported to the laboratory as soon as possible.
Groundwater investigation		
Documentation	Yes	Monitoring well construction logs and groundwater sampling records were generated as required and are provided in Appendix E and Appendix G.
Equipment calibration	Yes	The water quality meter was calibrated prior to use and the calibration record is provided in Appendix G.
Equipment decontamination	Yes	Decontamination of the interface meter and submersible electric pump was undertaken between sampling locations. New LDPE tubing was used for each monitoring well and did not require decontamination. .

Field QA/QC Element	Completed (Yes/No)	Comments
Groundwater level measurement	Yes	Water levels were measured from the marked position on the Poly Vinyl Chloride (PVC) casing and recorded on the sampling record.
Groundwater purging	Yes	Groundwater was purged from the monitoring well prior to sample collection until the parameters stabilised. Groundwater sampling records are provided in Appendix G.
Sample collection	Yes	Groundwater samples were collected directly into laboratory supplied sample containers from the LDPE tubing. Disposable nitrile gloves were worn during sample collection to prevent cross-contamination. Volatile sample containers were filled first, followed by semi-volatile and then non-volatile. Where QA/QC samples were collected, samples were collected in the order of primary, duplicate and then triplicate samples.
QC sample collection	Yes	Duplicate samples, triplicate samples and blank samples were collected at the target frequency of at least 5%
Sample identification	Yes	All samples were marked with a unique identifier including project number, sample location and date.
QC sample identification	Yes	All samples were labelled with a unique identifier and no indication of the corresponding primary sample was given to the laboratory where a replicate sample was collected.
Chain of custody forms	Yes	A CoC form was prepared detailing sample identification, collection date, sampler and laboratory analysis required. CoC forms along with sample receipt notifications were returned to WEPL for review and are supplied in Appendix F.
Sample preservation	Yes	Laboratory provided sample bottles contained preservative where appropriate. Samples were placed in a chilled esky with ice for storage immediately after collection and transported to the laboratory as soon as possible.

7.1.2 QA/QC Sample Collection

The number and frequency of field QA/QC samples collected during the investigation is provided in Table J.

Table J: Field QC Sample Collection Summary

Investigation Element	Sample Type, Number and ID				
	Primary	Duplicate	Triplicate	Rinsate	Field/Trip
Soil investigation	37	2 (5.4%)	2 (5.4%)	2	1
Groundwater investigation	4	1 (25%)	1 (25%)	1	1

The information in Table J demonstrates that all QC duplicate/triplicate samples were collected at the required frequency of at least 5% based on the number of samples submitted for analysis. Remaining QC samples collected during the soil and groundwater investigation were submitted at the following rates:

- One rinsate per piece of re-useable equipment per day.
- One combined field/ trip blank per delivery of samples to the laboratory per day.

7.1.3 Blank sample results

The equipment rinsate blank samples and field/ trip blank samples reported all contaminant concentrations below the laboratory LoR. On this basis there is not considered to be any significant bias to the data set from cross-contamination, ambient site conditions or sample handling and transport.

7.1.4 RPD Determination

Calculations for RPD were undertaken for primary/ duplicate and primary/ triplicate sample pairs as described in the SAQP. The field QA/QC samples and their respective primary samples are provided in Table K. The laboratory results and full RPD calculations are provided in Tables 1 and 2.

Table K: Field QA/QC Sample Pairs

Date	Investigation Component	Sample Identification		
		Primary	Duplicate	Triplicate
13/07/2023	Soil Investigation	TP08-0.15	Dup01	Trip01
13/07/2023	Soil Investigation	TP15-0.15	Dup02*	Trip02
14/07/2023	Soil Investigation	TP02-0.15	Dup03	Trip03*
19/07/2023	Groundwater Investigation	GW01	DUP01	TRIP01

*** Indicates that sample was collected but not submitted for analysis**

All calculated RPD values for the primary/ duplicate and primary/triplicate samples for the groundwater investigation were below the 30% target criteria.

The only RPD values that exceeded the 30% target criteria for the soil investigation was for sample pairs:

- TP08-0.15/Dup01 which had a RPD of 150% for Zn. As both concentrations of Zn (63 mg/kg and 9 mg/kg) were below all relevant assessment levels, the uncertainty in the accuracy of the data exists at a level an order of magnitude below the point at which they would impact decisions in relation to the lowest assessment level (190 mg/kg).

- TP08_0.15/TRIP01 which had a RPD of 159% for Zn. As both concentrations of Zn (63 mg/kg and 7.1 mg/kg) were below all relevant assessment levels, the uncertainty in the accuracy of the data exists at a level an order of magnitude below the point at which they would impact decisions in relation to the lowest assessment level (190 mg/kg).

- TP15-0.15/TRIP02 which had a RPD of 144% for Mn. As both concentrations of Mn (10 mg/kg and 62 mg/kg) were below all relevant assessment levels, the uncertainty in the accuracy of the data exists at a level an order of magnitude below the point at which they would impact decisions in relation to the lowest assessment level (500 mg/kg)

Given the general good agreement between primary and replicate sample concentrations, the data collected during the DSI is considered suitably accurate and precise with respect to the intent of the investigation and is suitable for making risk-based decisions.

7.2 Laboratory QA/ QC

7.2.1 Laboratory accreditation

All laboratories used during this investigation are National Association of Testing Authorities (NATA) accredited for the analyses undertaken as summarised in Table L.

Table L: Analytical Laboratories and NATA Accreditation

Laboratory	Analysis	NATA accreditation	Site ID
ALS Perth	Primary and duplicate sample analysis	825	15847
Eurofins ARL	Triplicate sample analysis	2377	2370

7.2.2 Laboratory QA/ QC procedure compliance

Compliance with the laboratory QA/ QC requirements and DQOs for the investigation are summarised in Table M.

Table M: Laboratory QA/ QC Procedure Compliance Summary

Laboratory work order	Sample date	Laboratory QA/ QC requirement achieved								
		NATA accreditation	CoC completed and returned	Sample received within holding time	Analysis undertaken within holding time	Laboratory internal duplicate analysis	Method blank analysis	Laboratory control spike analysis	Matrix spike recovery analysis	Surrogate sample analysis
Soil Investigation										
EP2309599	13-14/07/2023	Yes	Yes	Yes	5 NC	Yes	Yes	4 NC	3 NC	Yes
EP2310835	13-14/07/2023	Yes	Yes	Yes	3 NC	Yes	Yes	Yes	3 NC	Yes
1009147	13-14/07/2023	Yes	Yes	Yes	Yes	1 NC	Yes	Yes	2 NC	Yes
Groundwater Investigation										
EP2310835	19/07/2023	Yes	Yes	Yes	1 NC	Yes	Yes	1 NC	2 NC	1 NC
1009258	19/07/2023	Yes	Yes	Yes	Yes	Yes	Yes	Yes	2 NC	Yes

* NC - Non-conformance

Non-conformance with the laboratory QA/ QC procedures is discussed in Appendix H which indicates that the identified non-conformances are minor in nature and have not had a significant impact on the analytical data or the conclusions drawn from the dataset.

7.3 Data quality indicator assessment

A data quality assessment was undertaken via a review and assessment of Data Quality Indicators (DQIs) consistent with the requirements of Schedule B2 of the ASC NEPM (EPHC 2013b). The five DQIs considered are:

- Completeness
- Comparability
- Representativeness
- Precision
- Accuracy (bias).

7.3.1 Soil

An assessment of the data against the DQIs for the soil investigation (including the surface ACM assessment) is provided in Table N.

Table N: DQI Assessment - Soil and Surface ACM Assessment

Criteria	Acceptable	Comments
Completeness		
Field documentation	Yes	All fieldwork documentation including CoCs sample collection records and grid inspection records are complete.
Sample locations	Yes	Sampling was undertaken at all intended locations and depths. An additional sample was collected from the drainage sump observed on-site.
Sample collection	Yes	Samples were collected as intended from all locations and depths for chemical analysis.
Laboratory analysis	Yes	Laboratory analysis of all samples was undertaken as intended based on the PAoC being targeted.
Laboratory QA/ QC	Yes	With the exception of some minor non-conformances, laboratory QA/ QC data indicated a suitable level of confidence in the analytical results.
Comparability		
Sample collection	Yes	The sampling methods and protocols adopted during sampling across both days was consistent.
Sample handling	Yes	Samples were collected, managed, stored and transported consistently.
Site conditions	Yes	There was no significant change in climatic conditions across sampling that would impact on sample collection or the analytical data.
Laboratory procedures	Yes	Laboratory analysis procedures were consistent across all samples.
Laboratory QA/ QC	Yes	The laboratory QA/ QC data indicated a suitable level of confidence in the analytical data.
Analysis holding times	Yes	With the exception of some minor non-conformances, all analysis was completed in the recommended analytical holding time.
Representativeness		

Criteria	Acceptable	Comments
Sample collection	Yes	Samples were collected at all intended locations and depths which were selected to be representative of site conditions.
Sample handling	Yes	The samples were collected, preserved, stored and transported in an appropriate manner consistent with DWER (2021).
Laboratory analysis	Yes	Laboratory analysis of all samples was undertaken based on the understanding of the likely CoPCs for each PAoC. The analytes selected are considered suitable to assess the nature of the potential impact as described in the SAQP.
Laboratory QA/ QC	Yes	With the exception of some minor non-conformances, laboratory QA/ QC data indicated a suitable level of confidence in the analytical results.
Precision		
Field duplicate sample collection	Yes	Field duplicate samples were collected at the required rate of at least 5% of the total number of samples collected and submitted for analysis across both days of sampling.
Field duplicate sample analysis	Yes	All but one calculated RPD values for primary/ duplicate sample pairs were below the 30% target criterion.
Laboratory duplicate samples	Yes	With the exception of some minor non-conformances, all laboratory duplicate sample RPDs were within the adopted acceptance criteria.
Accuracy		
Field triplicate sample collection	Yes	Field triplicate samples were collected at the required rate of at least 5% of the total number of samples collected and submitted for analysis across both days of sampling.
Field triplicate sample analysis	Yes	Triplicate samples were analysed at an independent laboratory and all but two calculated RPD values for primary/ triplicate sample pairs were below the 30% acceptance criterion.
Rinsate blank samples	Yes	Rinsate blank samples reported all contaminant concentrations below the laboratory LoR.
Matrix spike recoveries	Yes	With the exception of some minor non-conformances, analysis of the matrix spike samples indicated acceptable recovery.
Field/ trip blank sample analysis	Yes	The field/ trip blank samples indicate no bias from ambient site conditions or sample storage and transport.
Surrogate sample analysis	Yes	With the exception of some minor non-conformances, analysis of the surrogate spike samples indicated suitable analyte recovery and therefore an acceptable level of performance from the analytical methods.
Laboratory control samples	Yes	With the exception of some minor non-conformances, analysis of the laboratory control samples indicate recovery within the acceptable control limits.

7.3.2 Groundwater

An assessment of the data against the DQIs for the groundwater investigation is provided in Table O.

Table O: DQI Assessment - Groundwater

Criteria	Acceptable	Comments
Completeness		
Field documentation	Yes	All fieldwork documentation including CoCs, well construction logs and sampling records are complete.
Sample locations	Yes	Sampling was undertaken at all intended locations.

Criteria	Acceptable	Comments
Sample collection	Yes	Sampling was undertaken as intended.
Laboratory analysis	Yes	Laboratory analysis of all samples was undertaken as intended.
Laboratory QA/ QC	Yes	The laboratory QA/ QC data indicated a suitable level of confidence in the analytical data.
Comparability		
Sample collection	Yes	The sampling methods and protocols adopted during sampling across all locations were consistent.
Sample handling	Yes	Samples were collected, managed, stored and transported consistently.
Site conditions	Yes	There was no significant change in climatic conditions across sampling that would impact on sample collection or analytical data.
Laboratory procedures	Yes	Laboratory analysis procedures were consistent across all samples.
Laboratory QA/ QC	Yes	With the exception of some minor exceedances, laboratory QA/ QC data indicated a suitable level of confidence in the analytical data.
Analysis holding times	Yes	All analysis was completed within the recommended holding time with the exception of pH in all samples.
Representativeness		
Sample collection	Yes	Samples were collected from all intended locations which were selected to be representative of site conditions.
Sample handling	Yes	The samples were collected, preserved, stored and transported in an appropriate manner consistent with DWER (2021).
Laboratory analysis	Yes	Laboratory analysis was undertaken as intended and consistent with the anticipated CoPCs described in the SAQP.
Laboratory QA/ QC	Yes	With the exception of some minor exceedances, laboratory QA/ QC data indicated a suitable level of confidence in the analytical data.
Precision		
Field duplicate sample collection	Yes	Field duplicate samples were collected at the required rate of at least 5%.
Field duplicate sample analysis	Yes	All calculated RPD values for primary/ duplicate sample pairs were below the 30% target criterion.
Laboratory duplicate samples	Yes	The laboratory duplicate sample RPDs were within the laboratory's acceptance criteria.
Accuracy		
Field triplicate sample collection	Yes	Field triplicate samples were collected at the required rate of at least 5%.
Field triplicate sample analysis	Yes	Triplicate samples were analysed at an independent laboratory and all calculated RPD values for primary/ triplicate sample pairs were below the 30% target criterion.
Field/ trip blank samples	Yes	Analysis of the field/ trip blank samples indicated there had been no bias from the sample handling and shipping procedures or ambient site conditions.
Equipment rinsate blank samples	Yes	Analysis of the equipment rinsate blank samples indicated there had been no bias from cross-contamination.
Matrix spike recoveries	Yes	With the exception of some minor non-conformances, analysis of the matrix spike samples indicated acceptable recovery and therefore an acceptable level of performance from the analytical methods.

Criteria	Acceptable	Comments
Surrogate sample analysis	Yes	With the exception of some minor non-conformances, analysis of the surrogate spike samples indicated suitable analyte recovery and therefore an acceptable level of performance from the analytical methods.
Laboratory control samples	Yes	With the exception of some minor non-conformances, analysis of the laboratory control samples indicates recovery within the acceptable control limits.

A review of the DQI assessment, the field procedures and the laboratory results confirm:

- Field procedures were suitable and appropriate records completed.
- Blank samples identified no significant bias on the laboratory data.
- The majority of sample analysis was completed in the recommended analytical holding time. As discussed in Appendix H, the few non-conformances are not considered to have an impact on interpretation of the data.
- A review of RPDs indicates acceptable precision and accuracy.
- Whilst there were some minor non-conformances with the laboratory QC data, these are of a trivial nature and have not adversely affected the acceptability of the results.
- The DQI assessment confirms the body of analytical data has a suitable level of completeness, comparability, representativeness, precision and accuracy in relation to the identified DQOs.

On this basis there is considered to be an acceptable level of confidence on which risk-based decisions can be made with respect to soil and groundwater at the Site.

8. Results and Discussion

The results of the soil, surface ACM and groundwater investigations are provided in the following sections and discussion is generally limited to those contaminants where concentrations were reported above the laboratory LoR. Where appropriate, a Tier 1 risk assessment has been conducted to clarify the risk presented by the site to the environment and human health with respect to the proposed future residential land use. The full analytical results for all samples are provided in Table 1 - Table 24 and laboratory documentation is provided in Appendix F.

8.1 Soil Investigation

The locations of all test pits are shown on Figure 4. The results of the field screening and laboratory analysis are summarised in the following sections. The DSI considers the analytical data collected during the PSI (WEPL, 2022a) as a holistic dataset along with the data collected during the current investigation. This approach is consistent with the SAQP where the sample locations utilised during the PSI were included in the sampling number and design for the DSI. The combined soil dataset is provided in Table 1- Table 13 and the PSI sampling locations are included on Figure 4.

8.1.1 Soil Profile Observations

The soil profile encountered across the Site generally comprised a shallow layer of topsoil, typically 0.2 m thick, underlain by fine to medium grained sands or gravelly sands with colours including grey, white, yellow and orange.

The topsoil layer was not present around the building footprints which had exposed fine to medium grained grey sands on the ground surface. No imported fill material was evident indicating that reworked natural material was likely used to achieve these levels for site infrastructure.

No evidence of subsurface construction and demolition (C&D) waste or buried chicken carcasses were observed in any of the test pits. Surface scattered C&D waste was present across the location of the former residence and the multiple buildings located adjacent to the north.

Test pit logs are included in Appendix E.

8.1.2 Field Screening

A full summary of the asbestos in soil ACM screening from the 34 test pits is provided in Table 14. No fragments of ACM were observed in the retained portion of any of the sample passed through the sieve.

8.1.3 Analytical Data

Including samples assess during the PSI, all reported concentrations for BTEX, PAH, VOC, SVOC, OPPs, chlorinated hydrocarbons and herbicides were below the laboratory LoR. Of the remaining CoPCs, the only concentrations above any of the relevant assessment levels were:

- Cu, Mn, Ni and Zn that exceeded the EIL-A for a combined 17 instances across 11 samples.
- TRH F3 that exceeded the ESL-A for one sample.
- Benzo(a)pyrene (BaP) that exceeded the ESL-A for one sample.
- Heptachlor epoxide that the US EPA RSL for two samples.

The samples that reported exceedances of the assessment levels are summarised in Table P with further discussion provided in the following sections.

Table P: Soil Data

Sample ID	Date	Cu	Mn	Ni	Zn	TRH	BaP	BAP TEQ	Heptachlor Epoxide
S02_0.15	13/07/2022	31	350	2	**340**	**450**	<0.05	<0.5	<0.01
S03_0.15	13/07/2022	37	410	3	**320**	<100	0.05	<0.5	<0.01
S04_0.15	13/07/2022	55	480	5	**710**	<100	<0.05	<0.5	<0.01
S05_0.15	13/07/2022	28	**1,400**	6	**1,700**	<100	<0.05	<0.5	<0.01
S06_0.15	13/07/2022	9	100	2	**220**	<100	**1.2**	1.7	<0.01
S07_0.15	13/07/2022	**65**	**1,900**	8	**980**	<100	0.08	<0.5	<0.01
S08_0.15	13/07/2022	10	110	2	**1,000**	<100	<0.05	<0.5	<0.01
S12_0.15	13/07/2022	12	-	2	**1,000**	<100	<0.05	<0.5	<0.01
S14_0.15	13/07/2022	**96**	-	**13**	**1,400**	<100	0.34	0.6	<0.01
S16_0.15	13/07/2022	37	-	**15**	**320**	<100	<0.05	<0.5	<0.01
SED01	13/07/2023	24	-	<2	**466**	<100	<0.05	<0.5	<0.01
TP04_0.15	14/07/2023	<5	-	<2	11	<100	<0.05	<0.5	0.08
TP04_0.5	14/07/2023	-	-	-	-	-	-	-	0.09
EIL/ ESL-A		**60**	**500**	**10**	**190**	**300**	**0.7**	**-**	**-**
HIL-A/ US EPA RSL		6,000	3,800	400	7,400		3	3	0.07
LoR		1	1	1	1	100	0.05	0.5	0.05
Units		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg

Metals

10 of the 11 samples that reported metal concentrations above the EIL-A were collected during the PSI in 2022 and seven of these 10 samples were collected from adjacent to the laying sheds. At this time the infrastructure remained on site and remnant poultry excrement was accumulated below the elevated base of the laying sheds. The metals that reported elevated concentrations (Mn, Cu, Ni and Zn) are all common additives to commercial grade poultry feed and have likely leached from the poultry excrement to soil over time.

As part of the site demolition works all infrastructure and remnant excrement was removed from site, after which, all of the samples collected during the DSI in 2023 (with the exception of the sediment sample from

the drain) reported all metal concentrations below all relevant assessment levels. It is therefore likely that the elevated concentrations were limited to the shallow soil profile and this was incidentally removed/ remediated during the site demolition works, particularly in the vicinity of the laying sheds. Disposal documentation including transport dockets have been requested form the demolition contractor, though at the time of preparing this report had not been received.

On this basis, elevated concentrations of metals in soil are no longer a source of potential site contamination that requires further consideration.

The sediment sample (Sed01) collected from a contained drainage sump was the only sample collected during the DSI that reported an exceedance of the EIL-A for Zn. This is a small, localised and contained impact with the reported concentration (466 mg/kg) only marginally exceeding the adopted assessment level that will be removed as part of Site preparation works.

Given that zinc impacted soils (and the associated drainage sump) have been, or will be removed as part of site preparation works, no further consideration of the risk associated with zinc in soil is warranted.

TRH and PAHs

One sample collected during the PSI (S02_0.15) from Laying Shed 3 reported an elevated concentration of TRH F3 that exceeded the EIL-A. This is expected to be largely from organic matter associated with the poultry excrement and enriched shallow soils present at the time of the PSI. No other sources of TRH were identified on-site and the impact identified is extremely localised. As such, the minor occurrence of TRH in soil around Laying Shed 3 is not thought to be a potential source of contamination that requires further consideration.

The single sample that reported the elevated concentration of B[a]P (S06_0.15) during the PSI was also collected from Laying Shed 3 and exceeded the EIL-A. While the source of B[a]P and other PAH compounds across the Site is not confirmed, it is possibly associated with wood impregnation/preservation with creosote, given the construction of buildings (which include treated timber components). As the presence of B[a]P is likely from an anthropogenic source and may remain in soil at the Site, its potential as a source of contamination for environmental harm is considered further in Section 9.

It is acknowledged that a number of additional PAH compounds with no specific assessment levels were identified in some of the soil samples collected during the PSI and TP20 during the DSI. However, the adopted EIL-A uses a total PAH criterion of 300 mg/kg, which was not exceeded for any of the samples that reported PAHs above the LoR.

The adopted HIL-A is based on the eight carcinogenic PAHs and their potency relative to B[a]P. The B[a]P toxicity equivalence quotient (TEQ) is calculated by multiplying the concentration of each carcinogenic PAH in the sample by its B[a]P Total Equivalent Factor (TEF) and summing these products. The HIL-A B[a]P TEQ uses a criterion of 3 mg/kg, which was not exceeded for any of the samples that reported PAHs above the LoR.

Pesticides

Two samples from test pit TP04, installed at the location of the former residence, reported concentrations of heptachlor epoxide and trans-chlordane above the LoR. The surface sample was initially submitted for analysis with the sample collected from 0.5 m submitted for analysis following an initial review of the data. The presence of these compounds is likely a result of termite/ pesticide treatment within the footprint of the former residence.

There is no Australian based assessment level for these compounds but the reported concentrations in both samples exceeded the US EPA RSL for heptachlor epoxide that are relevant to the protection of human health. The reported concentration for trans-chlordane were an order of magnitude below the relevant US EPA RSL.

On this basis, the potential risk to human health from heptachlor epoxide is considered further in Section 9.1, along with potentially suitable assessment levels for the protection of the environment for heptachlor epoxide and trans-chlordane.

8.2 Surface ACM Assessment

The locations of all surface ACM assessment grids are shown on Figure 5 and data from the field assessment is provided in Table 15. A summary of the observations for Pass 1 is provided in Table Q noting that no ACM was observed in Pass 2 or Pass 3 for any of the grids.

Table Q: Pass 1 Surface ACM Observations

Grid Cell #	# of ACM Frags	Weight of Fragments (kg)	Notes	Asbestos Concentration
GS01	0	0	No ACM	0.000%
GS02	0	0	No ACM	0.000%
GS03	0	0	No ACM	0.000%
GS04	0	0	No ACM	0.000%
GS05	0	0	No ACM	0.000%
GS06	0	0	No ACM	0.000%
GS07	0	0	No ACM	0.000%
GS08	0	0	No ACM	0.000%
GS09	0	0	No ACM	0.000%
GS10	0	0	No ACM	0.000%
GS11	0	0	No ACM	0.000%
GS12	0	0	No ACM	0.000%
GS13	0	0	No ACM	0.000%
GS14	0	0	No ACM	0.000%
GS15	0	0	No ACM	0.000%
GS16	0	0	No ACM	0.000%

Grid Cell #	# of ACM Frags	Weight of Fragments (kg)	Notes	Asbestos Concentration
GS17	0	0	No ACM	0.000%
GS18	0	0	No ACM	0.000%
GS19	0	0	No ACM	0.000%
GS20	0	0	No ACM	0.000%
GS21	0	0	No ACM	0.000%
GS22	0	0	No ACM	0.000%
GS23	0	0	No ACM	0.000%
GS24	0	0	No ACM	0.000%
GS25	0	0	No ACM	0.000%
GS26	0	0	No ACM	0.000%
GS27	0	0	No ACM	0.000%
GS28	0	0	No ACM	0.000%
GS29	0	0	No ACM	0.000%
GS30	0	0	No ACM	0.000%
GS31	0	0	No ACM	0.000%
GS32	0	0	No ACM	0.000%
GS33	0	0	No ACM	0.000%
GS34	0	0	No ACM	0.000%
GS35	1	0.054	No ACM	0.049%
GS36	0	0	No ACM	0.000%
GS37	1	0.019	Non friable	0.017%
GS38	1	0.031	Non friable	0.028%
GS39	1	0.028	Non friable	0.025%
GS40	0	0	No ACM	0.000%
GS41	0	0	No ACM	0.000%
GS42	1	0.022	Non friable	0.020%
GS43	0	0	No ACM	0.000%
GS44	0	0	No ACM	0.000%
GS45	1	0.025	Non friable	0.023%
GS46	0	0	No ACM	0.000%
GS47	0	0	No ACM	0.000%
GS48	0	0	No ACM	0.000%
GS49	0	0	No ACM	0.000%
GS50	0	0	No ACM	0.000%
GS51	0	0	No ACM	0.000%

Grid Cell #	# of ACM Frags	Weight of Fragments (kg)	Notes	Asbestos Concentration
GS52	0	0	No ACM	0.000%

No ACM was observed in 46 of the 52 grid squares during any of the three inspection passes. A single fragment of bonded ACM in good condition was observed during the first pass in 6 grid squares (GS35, GS37, GS38, GS39, GS42 and GS45) with weights ranging between 19 g and 54 g. The locations of these grids are highlighted on Figure 5. These grid squares are in the general vicinity of the former office building and the fragments may have been deposited prior to the asbestos removal works being completed, noting that the PSI indicated that the building was not entirely intact.

The calculation of asbestos content in soil was completed using the following formulae:

% (w/w) asbestos = (15% x weight of fragments (kg))/ weight of soil sample).

The weight of the soil sample was assumed to be 1,600 kg based on the grid square area of 100 m^2, the effective inspection depth of 0.01 m and an assumed soil density of 1,650 kg/m. In all cases where a fragment was recovered, the calculated concentrations of asbestos ACM in soil exceeded the HIL-A (0.01%). However, the fragments were collected for disposal and no additional ACM was encountered during the 2nd and third inspection passes for these grid squares. Surficial asbestos as ACM is therefore not a source for potential site contamination that requires further consideration.

There was no evidence of any ACM in the retained fraction any of samples that were collected from shallow hand pits excavated in the centre of each grid square passed through the 7 mm sieve. Surface and shallow subsurface asbestos as ACM is therefore not a source for potential site contamination that requires further consideration.

8.3 Groundwater

The locations of all groundwater monitoring wells are shown on Figure 6. The results of the field data collection and laboratory analysis are summarised in the following sections.

8.3.1 Groundwater Levels

Depth to water measurements recorded during the groundwater investigation are provided in Table R and confirms that the screened portion of the well bisects the surface of the superficial aquifer.

Table R: Groundwater Level Information

Well ID	Date	TOC	Depth to Water	Groundwater Elevation
GW01	19/07/2023	10.997	8.625	2.372
GW02	19/07/2023	12.708	10.190	2.518
GW03	19/07/2023	11.534	8.920	2.614
GW04	19/07/2023	7.376	3.740	3.636
Units	-	mAHD	mBTOC	mAHD

Monitoring wells GW01-GW03 located over the western half of the site all consistently indicate a groundwater elevation of just over 2 mAHD which is consistent with the groundwater elevation precited by the Perth Groundwater Map. However, well GW04 at the eastern site boundary indicates groundwater is over 1 m higher at 3.63. mAHD. It would be unlikely that such a big difference in groundwater elevation would be evident across only half of the site, so there may be some error associated with the survey data or field readings at that location.

Nonetheless, the calculated groundwater elevations confirm that groundwater is flowing in a general westerly direction. The inferred groundwater flow direction was calculated using the USEPA Hydraulic Gradient Calculator (US EPA, 2021) under two scenarios; one using the data from all four wells and one using only the data from wells GW01, GW02 and GW03. The four point flow direction calculation indicates a direction of 237° (south-west) and the three point flow direction calculation indicates a direction of 310° (west-north-west), while the actual flow direction is likely somewhere in between. The calculation outputs are included in Appendix I.

Therefore, while there is some uncertainty associated with the finer resolution of the flow direction, the data confirms it is in a general westerly direction and that the monitoring wells are positioned suitably to achieve the project objectives.

8.3.2 Field Data

Stabilised field chemistry data collected at the completion of purging and prior to sample collection is summarised in Table S where the TDS values were calculated by multiplying the EC measurements by a factor of 0.64.

Table S: Groundwater Field Chemistry Data

Well ID	Date	pH	EC	TDS	DO	Redox	Temperature
GW01	19/07/2023	6.16	631	403.84	0.71	12.8	20.2
GW02	19/07/2023	5.76	514.3	329.152	1.54	-11.7	21.0
GW03	19/07/2023	6.21	165	105.6	2.61	11.1	20.7
GW04	19/07/2023	6.60	426.5	272.96	0.42	-89.9	19.9
Units	-	*pH units*	*µS/cm*	*mg/L*	*mg/L*	*mV*	*oC*

The field chemistry data in Table S indicates that groundwater beneath the site is:

- Slightly acidic with pH ranging from 5.76 to 6.60.
- Fresh (TDS <500).
- In neither a significantly oxidising or reducing state with redox values being near 0 with two positive values and two negative values.
- Lower in dissolved oxygen for wells GW01 and GW04 located at the western and eastern site boundaries respectively.

Groundwater sampling logs with all purging data are provided in Appendix G.

8.3.3 Analytical Data

All samples reported concentrations of TRH, BTEX, PAHs, phenols, OCs, OPs, SVOCs and VOCs below the laboratory LoR and as such do not require further consideration for potential risk to the environment or human health. The only analytes with reported concentrations above the laboratory LoR were some metals, nutrients and other inorganic parameters.

Metals

A summary of the metals that exceeded the LoR at one or more locations is provided in Table T.

Table T: Groundwater Data - Metals

Field ID	As	Cr	Cu	Ni	Zn
GW01	<0.001	0.001	<0.001	0.002	**0.016**
GW02	<0.001	0.002	**0.002**	<0.001	<0.005
GW03	<0.001	<0.001	<0.001	0.005	<0.005
GW04	0.004	<0.001	<0.001	<0.001	<0.005
LoR	0.001	0.001	0.001	0.001	0.005
FW (95%)	**0.013**	**0.0033**	**0.0014**	**0.011**	**0.008**
STIW	*2*	*1*	*5*	*2*	*5*
NPUG	0.01	1	20	0.2	3
Units	mg/L	mg/L	mg/L	mg/L	mg/L

The data in Table T confirms that the reported concentration of metals in groundwater are below all adopted assessment levels relevant to human health and therefore not considered a potential source of contamination for human receptors.

The data in Table T also confirms that exceedances of the adopted assessment levels was limited to the FW (95%) for Zn at well GW01 and Cu for well GW02. Zn is a common poultry feed additive for improving bird growth, eggshell quality and disease resistance. Similarly, Cu is a common feed additive that has bactericidal properties which positively impacts feed efficiency and growth rate. The elevated concentrations in groundwater are therefore likely to have originated from poultry excrement which subsequently leached to groundwater, noting that the excrement has now been removed from Site and poultry farming has ceased operation.

Groundwater as a potential source of environmental harm through elevated Zn and Cu is considered further in Section 9.3.2. The remaining metals are not a potential source of contamination given all concentrations were below the same assessment levels.

Nutrients

A summary of the groundwater nutrient concentrations is provided in Table U.

Table U: Groundwater Data - Nutrients

Well ID	TN	TKN	NO3	NO2	NOx	NH3	TP	FRP	SO4
GW01	**8.4**	1.0	7.33	0.02	**7.35**	0.09	0.05	<0.01	66
GW02	**23.2**	1.3	21.9	0.01	**21.9**	<0.01	0.04	<0.01	60
GW03	**5.6**	0.7	4.86	0.02	**4.88**	0.12	0.04	<0.01	8
GW04	0.6	0.6	0.02	0.01	0.03	0.18	0.15	<0.01	60
FW (95%)	**1.2**	**-**	**-**	**-**	**0.15**	**0.9**	**-**	**0.04**	**-**
STIW	*25*	-	-	-	-	-	-	-	-
NPUG	-	-	113	9	-	0.411	-	-	1,000
LoR	0.1	0.1	0.01	0.01	0.01	0.01	0.01	0.01	1
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L

The data in Table U indicates that:

- Exceedances of the adopted assessment levels was limited to TN and NO that both exceeded the FW (95%) assessment levels at wells GW01, GW02 and GW03.
- The most dominant nitrogen species is NO3 which represents between 87% and 95% of the TN concentration at wells GW01, GW02 and GW03.
- Nitrogen species concentrations are typically at least an order of magnitude lower at up-gradient well GW04.
- No exceedances of assessment levels relevant to the protection of human health were reported.

The source of elevated nutrients in groundwater is most likely to be leaching from poultry excrement, which has now been removed from the Site. Groundwater as a potential source of environmental harm through elevated nutrients (TN and NOx) is considered further in Section 9.3.2. Nutrients are not thought to be a potential source of contamination in relation to human health given all concentrations were below all relevant assessment levels.

9. Risk Screening

A screening process is documented in the following sections for potential risks identified in Section 8 requiring further consideration. Risks that are considered to have the potential to pose an unacceptable risk to the environment or human health are then documented in a revised CSM to undergo a qualitative risk assessment.

9.1 Soil investigation

9.1.1 Human Health Risk Screening

The identification of potential risk to human health from soil was limited to concentrations of heptachlor epoxide in two samples collected from the former residence footprint that exceeded the US EPA RSL. It should be noted that the ASC NEPM provides a HIL-A assessment level for heptachlor, but not heptachlor epoxide, while the USE EPA RSL provides an assessment level for both. The ASC NEPM HIL-A for heptachlor is an order of magnitude larger than the corresponding US EPA RSL. A comparison of the HIL-A to the US EPA RSL for all available OCPs confirms that the Australian guidance consistently adopts an assessment level an order of magnitude greater than the US EPA RSL as shown in Table V.

Table V: OCP Assessment Level Comparison

OCP	HIL-A	US EPA RSL
Endosulfan	270	47
Endrin	10	1.9
Heptachlor	6	0.13
Methoxychlor	300	32
Units	mg/kg	mg/kg

The consistent difference between the assessment levels is likely a result of different assumptions and exposure profiles adopted for the calculations, with those adopted for the ASC NEPM providing a less conservative assessment level. To be consistent with this pattern, an applicable Australian assessment level for heptachlor epoxide may reasonably be assumed to be one order of magnitude greater than the US EPA RSL which would give a value of 0.7 mg/kg. The reported concentrations of heptachlor epoxide in the samples collected during the DSI (0.08 mg/kg and 0.09 mg/kg) are below this revised assessment level by an order of magnitude.

Nonetheless, it should also be noted that the source of the impact (residence construction materials) has been removed from-site and ongoing termiticide treatment is not expected. With an adsorption co-efficient of 7,800 (NCBI, 1992) heptachlor epoxide is expected to bind tightly to soil but is known to be semi-volatile, with a representative half-life of 250-290 days (NPIC, 1996). On this basis, the current maximum concentration of 0.09 mg/kg would be expected to decrease to 0.045 mg/kg within approximately 9-10 months which would make it less than the US EPA RLS of 0.07 mg/kg. That being said, it is considered that

heptachlor epoxide concentrations would likely to degrade more rapidly through soil disturbance undertaken as part of site works.

On this basis and given the limited extent of heptachlor epoxide identified in soil, it can be reasonably concluded that there is no unacceptable risk to any human receptors from heptachlor epoxide in soil that requires consideration in the CSM or through further risk assessment.

9.1.2 Environmental Risk Screening

Heptachlor Epoxide

The identification of potential risk to the environment from soil included two samples that reported concentrations of heptachlor epoxide and trans chlordane above the LoR for which there is no relevant assessment level for the protection of the environment.

Dutch guideline values provided in support of the *Soil Protection Act* (RMIE, 2013) provide intervention values which indicate when the functional properties of soil for humans, plants, and animals is seriously impaired or is in danger of being so. This description is considered suitable for protection of environmental values in a low-risk urban setting where vegetation will be limited to ornamental species and estate level landscaping. The values provided in RMIE (2013) are 4 mg/kg for both total chlordane and heptachlor epoxide which is an order of magnitude greater than the maximum trans chlordane concentration and two orders of magnitude greater than the maximum heptachlor epoxide concentration identified in soil at the Site.

On this basis it can be reasonably concluded that there is no unacceptable risk to the environment under the proposed residential land use that requires consideration in the CSM or through further risk assessment.

BaP

One soil sample collected from Laying Shed 3 during the PSI reported a B[a]P concentration (1.2 mg/kg) that exceeds the EIL-A (0.7 mg/kg). While the source of B[a]P is not confirmed, it is possibly associated with wood impregnation/preservation with creosote, given the construction of buildings (which include treated timber components). Although the likely source has been removed and the spatial extent of the impacted soil is limited, the potential risk of environmental harm is considered in further detail in the CSM and risk assessment documented in Section 10.

9.2 Asbestos

The results of the surface ACM assessment in conjunction with the subsurface screening completed at each of the test pit locations confirm that all reported concentration of asbestos are below the relevant assessment levels. On this basis, asbestos as ACM in soil is not a secondary source of contamination and will be removed from the CSM without further consideration of risk.

9.3 Groundwater investigation

9.3.1 Human Health Risk Screening

The concentration of all potential contaminants in groundwater were below all assessment levels relevant to the protection of human health. On this basis the potential SPR linkage for human health through groundwater will be removed from the CSM without further consideration of risk.

9.3.2 Environmental Risk Screening

Potential risk to the environment from groundwater were limited to concentrations of Zn, Cu, TN and NOx that were reported above the relevant assessment levels at one or more monitoring locations and is considered further in the following sections.

Copper

The concentration of Cu at well GW02 (0.002 mg/L) exceeded the FW (95%) assessment level (0.0014 mg/L), though the remaining three wells reported all concentrations below the laboratory LoR (<0.001 mg/L). On this basis, the extent of copper impact to groundwater is limited to the vicinity of well GW02 only. As discussed in Section 8.3.3, Cu is a common poultry feed additive with bactericide properties which positively impacts feed efficiency and growth rate. Given the elevated concentrations of Cu in shallow soil samples collected during the PSI, it would appear likely that high concentrations of Cu in poultry excrement leaching to groundwater is the likely source. It should be noted that all remnant poultry excrement has been removed from site during demolition works so the primary source of impact no longer remains.

It should be noted that are currently no freshwater ecosystem on the site, nor are there planned to be any in the future as part of the proposed development. Furthermore, the data from down-gradient well GW01 confirms that the concentration of Cu in groundwater migrating off-site does not pose a risk to off-site receptors. On this basis it can be reasonably concluded that there is no unacceptable risk to any current or future on-site or off-site receptors that requires consideration in the CSM or through further risk assessment.

Zinc

The concentration of Zn at well GW01 (0.016 mg/L) exceeded the FW (95%) assessment level (0.008 mg/L), though the remaining three wells reported all concentrations below the laboratory LoR (<0.005 mg/L). As well GW01 is located at the down-gradient site boundary, the data indicates that the site may be contributing to the contaminant load of Zn in groundwater. As discussed in Section 8.3.3, Zn is a common poultry feed additive to aid growth, maintenance and other functions such as bone development, feather development, enzyme structure and function. Given the elevated concentrations of Zn in shallow soil samples collected during the PSI, it would appear likely that high concentrations of Zn in poultry excrement leaching to groundwater is the likely source. It should be noted that all remnant poultry excrement was removed from site during demolition works so the primary source of impact no longer remains.

Elevated Zn was only present in well GW01 which is located down-gradient of the two rearing sheds near the western Site boundary. It therefore appears likely that higher concentrations of Zn may be present in feed for young developing chickens in the rearing sheds as opposed to mature chickens in the laying sheds.

The elevated concentration of Zn in groundwater migrating off-site is considered in further datil in the CSM and risk assessment documented in Section 10.

Nutrients

The available data indicates that the poultry farm land use has been contributing to the nitrogen load in groundwater given that up-gradient well GW04 reported nutrient concentrations at least one order of magnitude below the remaining three wells. The nutrient concentrations at each of the wells is shown on Figure 7.

The maximum concentrations of TN and NO3 were reported at well GW02 which is directly down-gradient from three former laying sheds (Laying Sheds 1, 3 and 4) and less than 10 m from Laying Shed 4. The concentrations at well GW03 which is located over 50 m down-gradient of only one former laying shed (Laying Shed 2) were elevated compared to up-gradient well GW04 but lower than well GW02. This distribution indicates that the increased number of chickens up-gradient from well GW02 is likely to have resulted in a greater volume of excrement that will have contributed to elevated nutrient concentrations in groundwater.

Well GW01 is located at the down-gradient Site boundary, approximately 120 m west of well GW02, and the nitrogen species concentrations at well GW01 are approximately one third of those reported at well GW02. If this rate of attenuation is maintained, the:

- Concentration of TN in groundwater would fall below the FW (95%) assessment level within 240 m of the down-gradient Site boundary.
- Concentration of NOx in groundwater would fall below the FW (95%) assessment level within 480 m of the down-gradient Site boundary.

The potential risk to the environment from elevated concentrations of TN and NOx in groundwater migrating off-site are considered in further detail the CSM and risk assessment documented in Section 10.

10. Revised Conceptual Site Model and Risk Assessment

The revised CSM and associated risk assessment based on the understanding of the site at the completion of the DSI is provided in the following sections.

10.1 Conceptual site model

The conceptual site model developed prior to the intrusive site investigations has been revised considering the field and analytical data obtained for all potential sources and the assessment levels for each exposure pathway. The revised CSM documents only the potential source-pathway-receptor linkages for the contaminants identified in Section 9 as requiring further consideration.

10.1.1 Sources

At the completion of the investigation:

- No sources of potential contamination were identified with respect to a potential human health risk.
- The sources of potential contamination identified that may pose a theoretical risk to the environments were:
    - An elevated concentration of Bap in soil.
    - Elevated concentrations of nutrients (TN and NOx) and Zn in groundwater that are migrating off-site.

10.1.2 Receptors

The assessment level for BaP in soil is based on phytotoxicity in plants and bioaccumulation in plant tissue with bioaccumulation and consumption by higher order fauna. Current on-site receptors for BaP in soil are limited to predominantly grasses and weeds with some mature trees present and native fauna. Future on-site receptors will be limited to domestic pets, ornamental gardens and estate scale landscaping given the development concept plans indicates residential lots typically <500 m^2 with 1,914 m^2 of POS. There was no evidence of significant overland flow of surface water that would transport soil to off-site receptors, though wind transport of soil and dust is possible, particularly during site development works.

There are no on-site receptors relevant to the potential environmental risk posed by elevated nutrients or Zn in groundwater. The closest off-site receptors are Spot Swamp and Opwin Swamp located over 1 km form the Site and Cooloongup Swamp located over 2 km from the Site.

10.1.3 Exposure Pathways

The exposure pathways relevant to the identified sources and receptors are:

- Soil:
    - Potential uptake of contaminants by plants.
    - Subsequent consumption of impacted plant material by fauna.
- Groundwater: Migration of impacted groundwater down-hydraulic gradient to sensitive environmental receptors.

10.1.4 Revised CSM

The CSM based on the potentially complete source-pathway-receptor linkages is summarised in Table W.

Table W: Revised Conceptual Site Model

Contaminant	Source	Transport Mechanisms	Exposure Pathways	Receptors	Pathway Status
Soil					
BaP	Impacted soil	-	Uptake/ bioaccumulation and Ingestion	On-site flora and fauna (that ingest flora)	**Potentially Complete:** BaP is present in soil in a limited area of the site at concentrations exceeding the adopted EIL-A assessment level.
Groundwater					
Nutrients	Impacted groundwater	Migration along groundwater flow path	Discharge into aquatic environment	Spot Swamp Opwin Swamp Cooloongup Swamp	**Potentially Complete:** Groundwater at the down-gradient Site boundary contains elevated nutrients (TN and NOx) and Zn that appears to be a result of the historic poultry farm land use and have the potential to pose a theoretical risk to the environment.
Zinc	Impacted groundwater	Migration along groundwater flow path	Discharge into aquatic environment	Spot Swamp Opwin Swamp Cooloongup Swamp	**Potentially Complete**: Groundwater at the down-gradient Site boundary contains elevated Zn that appears to be a result of the historic poultry farm land use and have the potential to pose a theoretical risk to the environment.

10.2 Qualitative Risk Assessment

The CSM indicates that elevated concentrations of nutrients (TN and NOx) and Zn have the potential to pose a theoretical risk to down-gradient freshwater receptors. On this basis a qualitative risk assessment was undertaken using a matrix which assesses the risk posed by a particular scenario by considering the probability of an event occurring and the consequences if the event does occur.

The qualitative risk criteria used in the assessment are consistent with *Australian Standard AS/NZS 4360:2004 Risk management* (Standards Australia, 2004), the handbook *HB 203:2006 Environmental Risk Management - Principles and Process* (Standards Australia, 2006) and the DWER document *Guidance Statement - Risk Assessments* (DER, 2017) The criteria used and their application are outlined in the following sections.

10.2.1 Consequences

The five categories of risk consequence used in the risk matrix are summarised in Table X. In determining the appropriate risk consequence category for a contaminant and PAoC, the environmental attributes at risk and human health impacts must generally be considered, though in this case the concentrations have already been assessed as not posing a risk to human health.

Table X: Qualitative Measures of Consequence

Classification	Description
Negligible	Human health: Minimal impacts to amenity or inconsequential in nature.
	Environment: Limited damage to minimal area of low significance.
Minor	Human health: Non-permanent or easily preventable effects for a small population.
	Environment: Minor short to medium-term localised impacts to a small area of limited significance. Insignificant changes to overall ecological function.
Moderate	Human health: Non-permanent or easily preventable effects for a large population or potentially chronic effects for a small population. Low level or occasional medical treatment.
	Environment: Moderate effects on biological or physical environment with minimal impact on local ecosystem functions. Reversible harm to an ecosystem on a regional scale.
Major	Human health: Chronic, irreversible damage to human health and/or acute non-permanent health effects on human health for a small population. Mid-level or frequent medical treatment.
	Environment: Irreversible damage to the local ecosystem and widespread harmful impacts with noticeable impairment on local ecosystem functions. Relatively widespread and short to medium-term impacts.
Severe	Human health: Loss of life or acute irreversible damage to human health for a large population. High level or ongoing medical treatment.
	Environment: Irreversible damage to regional ecosystem, threatened species and/or widespread fatal effects with significant impairment on local ecosystem functions. Mid to long term or permanent impact to an area of high conservation value or special significance.

An assessment of the potential consequences from the identified impact is summarised in Table Y.

Table Y: Site Specific Risk Quantification

Contaminant	Risk category	Risk consequence	Reasoning
Soil			
BaP	Environment	Negligible	**On-Site**: Given the intended residential development, the on-site receptors at risk of exposure will not be supporting any significant ecosystem functions. The limited extent of the impacted soil will also mean that any exposure is limited to a very small population.
Groundwater			
Nutrients	Environment	Minor	Given the ongoing source of nutrients in groundwater (poultry excrement) have been removed from Site, any impacts associated with the discharge of groundwater to the freshwater ecosystems would be expected to be a short-term impact only as the concentrations naturally decrease over time. However, as the three wetland receptors are classified as CCW, the 'Negligible' classification is not considered appropriate.
Zn	Environment	Minor	Given the ongoing source of Zn in groundwater (poultry excrement) have been removed from Site, any impacts associated with the discharge of groundwater to the freshwater ecosystems would be expected to be a short-term impact only as the concentrations naturally decrease over time. However, as the three wetland receptors are classified as CCW, the 'Negligible' classification is not considered appropriate.

10.2.2 Likelihood

The five categories of likelihood used in the risk matrix are summarised in Table Z.

Table Z: Qualitative Measures of Exposure Likelihood

Classification	Description	Frequency
Almost Certain	Consequences expected to occur in most circumstances.	More than 1 event per month
Likely	Reasonable expectation that consequences will probably occur in most circumstances.	More than 1 event per year
Possible	Reasonable expectation that consequences could occur.	1 event per 1 to 10 years
Unlikely	Consequences will probably not occur in most circumstances.	1 event per 10 to 100 years
Rare	The possibility of consequence may occur under exceptional circumstances.	Less than 1 event per 100 years

An assessment of the potential consequences from the identified impact is summarised in Table AA.

Table AA: Site Specific Exposure Likelihood Quantification

Contaminant	Risk category	Risk likelihood	Reasoning
Soil			
BaP	Environment	Rare	**On-Site:** The limited extent of the impacted soil means the exposure pathway will need to be completed within a very small portion of the site which limits the likelihood of it occurring.
Groundwater			
Nutrients	Environment	Rare	As discussed in Section 10.2.1 the concentrations of nutrients in groundwater are only expected to decrease over time given the primary source of impact (poultry excrement) has been removed form Site. Furthermore, the concentrations are expected to reduce as distance from the site increases with indicative calculations provided in Section 8.3.3 indicate that if the distance form source to concentration gradient remans consistent, the nutrient concentrations in groundwater would be expected to fall below the relevant assessment levels within 500 m of the site, which is 500 m before it reaches Spot Swamp and Opwin Swamp and over 1.5 km before it reaches Cooloongup Swamp.
Zn	Environment	Rare	As discussed in Section 10.2.1 the concentrations of Zn in groundwater are only expected to decrease over time given the primary source of impact (poultry excrement) has been removed form Site). Furthermore, the original impact area for Zn in groundwater is a much smaller portion of the site compared to nutrients, being limited to down-gradient of the two smaller rearing sheds. As such, the maximum concentration is only two times the assessment level, as opposed to at least 15 times for nutrients. Therefore zinc would be expected to attenuate to concentrations well below the adopted assessment level before the point of discharge (i.e. closest aquatic receptor).

10.2.3 Risk classification

The risk matrix classifies the overall risk based on the likelihood and consequence categories as detailed in Table BB.

Table BB: Risk Matrix

Likelihood	Consequence				
	Negligible	Minor	Moderate	Major	Severe
Almost certain	Low	Moderate	High	Extreme	Extreme
Likely	Low	Moderate	High	Extreme	Extreme
Possible	Very low	Low	Moderate	High	Extreme
Unlikely	Very low	Low	Moderate	High	Extreme

Likelihood	Consequence				
	Negligible	Minor	Moderate	Major	Severe
Rare	Very low	Very Low	Low	High	High

An assessment of the cumulative risk to the environment from the identified impact under the current site conditions is summarised in Table CC.

Table CC: Site specific risk quantification

Contaminant	Category	Consequence	Likelihood	Risk classification
Soil				
BaP	Environment	Negligible	Rare	Very low
Groundwater				
Nutrients	Environment	Minor	Rare	Very low
Zn	Environment	Minor	Rare	Very low

10.2.4 Action requirements

A description of likely actions required for each risk classification is provided in Table DD.

Table DD: Action requirements

Risk classification	Action required
Extreme	Unacceptable level of risk. Urgent action is likely to be required.
High	Urgent action may be required to reduce the risk in the short-term and action is likely to be required in the long term.
Moderate	Action may be required to reduce the risk in the short term or long-term.
Low	Action to reduce the risk is unlikely to be required or will be limited in nature, extent and duration.
Very low	No action required.

Based on the risk classification outcomes, the risk associated with the reported concentrations of nutrients and Zn in groundwater along with BaP in soil are all 'Very low'. Based on the action requirements in Table DD, the current site conditions and the proposed future land use, no action is considered necessary to reduce the risk associated with the site in relation to the potential for environmental harm currently or after/ during the proposed development.

11. Community Consultation

Schedule B8 of the ASC NEPM indicates that an appropriate level of community consultation is required when investigating, remediating and managing all contaminated sites in Western Australia. In terms of the ASC NEPM, community refers to those individuals and/or groups residing in the locality where a site assessment is to be conducted and who may be affected by the assessment and/or possible site contamination.

Community consultation should take into account a number of underlying principles including:

- The community should have an opportunity to give input into decisions about matters which may affect their lives.
- The community consultation process should actively seek out and facilitate the involvement of those individuals and groups potentially affected by the decision(s).
- All participants should have fair and equitable access to the community consultation process.
- The planned community consultation process should be clearly communicated to all participants at the outset, and participants should be involved in defining how they participate. In particular, the decision-making process and the purpose of the consultation and the level of influence of the community's input will have on the decision-making process (such as advice, comment or right of veto) should be clearly communicated to all participants at the outset.
- The community should be provided with the information they need to participate effectively, in an accessible and understandable format.
- The community consultation process should communicate the interests and concerns of all participants.
- The community's contributions and concerns must be taken into account when making decisions.
- The community consultation process should provide feedback to the participants on how their input was incorporated and how it affected the decision.
- All commitments made as part of the community consultation process should be made in good faith.

As the investigation and risk assessment has indicated that all potential sources and exposure routes are classified as 'Very low' risk, a formal community consultation has not been undertaken and is not considered necessary in the context of the proposed development.

12. Conclusions and Recommendations

The results of the laboratory data from the current investigation confirmed that:

- The contaminant concentrations identified in soil and groundwater do not pose an unacceptable risk to human receptors either currently or under the proposed future residential development.
- A concrete sump on-site contains a minor amount of sediment with Zn present above the EIL-A. It does not pose an exposure risk but the excavation and disposal of the sump and material contained within should be managed during future site works.
- The contaminant concentrations of BaP in soil had the potential to pose a theoretical risk to on-site and off-site ecological receptors.
- The contaminant concentrations of nutrients and Zn in groundwater had the potential to pose a theoretical risk to aquatic receptors.

With respect to soil, the on-site ecological receptors with the potential to be impacted are not environmentally sensitive or supporting of significant ecosystem functions/ values. This is likely to become even more so in the future as the site is cleared for development, reducing the native fauna habitat values of the Site.

There are currently no aquatic receptors on-site with the potential to be adversely affected by the reported concentrations of nutrients and Zn in groundwater, nor are there likely to be following the proposed residential development. Therefore, the only receptors potentially at risk from impacted groundwater are two CCW located over 1 km from the Site and a third CCW located over 2 km from the Site.

A qualitative risk assessment was completed with consideration of the likelihood of the source-pathway-receptor-linkages being complete along with the consequences if it were to be complete. The potential linkage for all potential linkages was assigned an overall risk classification of 'Very low' with a consequence of 'Negligible' or 'Minor' and a likelihood of 'Rare'. On this basis there is not considered to be an unacceptable risk to the environment, currently or I the future, and no further assessment, remedial action or management measures need to be implemented to reduce the risk.

Contamination in the CS Act is defined '*in relation to land, water or a site, means having a substance present in or on that land, water or site at above background concentrations that presents, or has the potential to present, a risk of harm to human health, the environment or any environmental value*.' Based on the data obtained during the current investigation and the outcome of the risk assessment, it can be reasonably concluded that the site does not meet this definition of contamination and is suitable for the proposed residential development.

It is recommended that this investigation and associated Voluntary Auditors Report (VAR) be submitted to the Western Australian Planning Commission (WAPC) with the future subdivision application to prevent a Condition related to potential Site contamination being added to the subdivision approval.

13. References

Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC and ARMCANZ). (2018). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* National Water Quality Management Strategy, Commonwealth of Australia.

Davidson, W. A. (1995). *Hydrogeology and Groundwater Resources of the Perth Region, Western Australia*. Geological Survey of Western Australia. Department of Minerals and Energy Bulletin 142.

Department of Environment Regulation (DER). (2017). *Guidance Statement - Risk Assessments* (Department of Environment Regulation, Ed.).

Department of Health (DoH). (2021). *Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia* (Department of Health, Ed.).

Department of Water and Environmental Regulation (DWER). (2019). *Landfill Waste Classification and Waste Definitions 1996*.

Department of Water and Environmental Regulation DWER. (2021). Assessment and Management of Contaminated Sites. In Department of Environment Regulation (Ed.), *Contaminated Sites Guidelines*. State of Western Australia.

Gozzard, J. R. (1983). *Rockingham, Sheets 2033 III and 2033 II*. Perth Metropolitan Region 1:50 000 Environmental Geology Series. Geological Survey of Western Australia.

National Centre for Biotechnology Information (NCBI). (1992). *PubChem Annotation Record for, HEPTACHLOR EPOXIDE*. https://pubchem.ncbi.nlm.nih.gov.

National Environment Protection Council (NEPC). (2013a). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)*

National Environment Protection Council (NEPC). (2013b). *National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999 (as amended 2013) Schedule B1 Guideline on Investigation Levels for Soil and Groundwater* (

National Health and Medical Research Council and Natural Resource Management Ministerial Council (NHMRC & NRMMC). (2011). *Australian Drinking Water Guidelines 2011 Version 3.8 Updated September 2022* Ed.). National Water Quality Management Strategy.

National Pesticide Information Centre (NPIC). (1996). *Pesticide Information Profiles - Heptachlor and heptachlor epoxide*.

NSW Environment Protection Authority (NSW EPA). (2022a). Sampling design part 1 - application. *Contaminated Land Guidelines*.

NSW Environment Protection Authority (NSW EPA). (2022b). Sampling design part 2 - interpretation. *Contaminated Land Guidelines*.

Rijkswaterstaat Ministry of Infrastructure and Environment (RMIE). (2013). *Soil Remediation Circular 2013, Version of 1 July 2013*).

Standards Australia. (2004). *AS/NZS 4360:2004 Risk management*. Standards Australia.

Standards Australia. (2006). *HB 203:2006 Environmental Risk Management - Principles and Process*.

United States Environmental Protection Agency (US EPA). (2021). *Hydraulic Gradient Calculator*.

Western Environmental Pty Ltd (WEPL). (2022a). *Lot 3 (No. 392) Baldivis Road, Baldivis, WA: Preliminary Site Investigation with Limited Sampling*.

Western Environmental Pty Ltd WEPL. (2022b). *Lot 3 (No. 392) Baldivis Road, Baldivis, WA: Sampling and Analysis Quality Plan*.

Figures

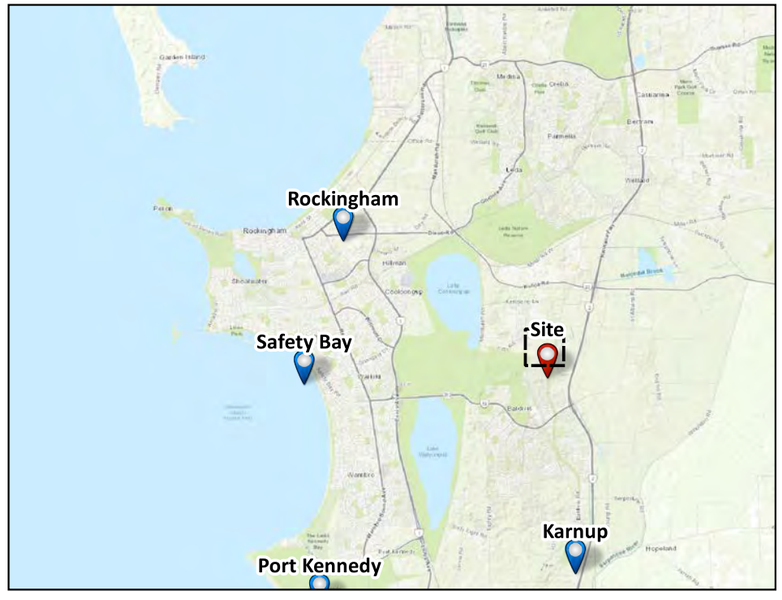

Figure 1: Site Location

N

0 40 80 120 160 m

PROJECT/REPORT NAME	Detailed Site Investigation Lot 3 Baldivis Road, Baldivis
SCALE: 1:3,000	SHEET SIZE: A3 COLOUR
CLIENT: Spatial Property Group	
COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 50	PROJECT NUMBER: P22.142 / VERSION: 0
DATA SOURCE: LANDGATE AERIAL IMAGERY Summer 2023	DRAWN BY / REVIEWED BY: RA / KS / DATE: 3/10/2023

Legend

Site Boundary

No	Description	Drawn	Approved	Date
A	Original issue	RA	KS	3/10/2023

NOTES:

Cadastral boundary (LGATE-002). Base map ESRI Topo. Townsites (LGATE-248).

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Figure 2: Site Layout and Potential Areas of Concern.

N

0 18 36 54 72 m

PROJECT/REPORT NAME	Detailed Site Investigation Lot 3 Baldivis Road, Baldivis
SCALE: 1:1,200	SHEET SIZE: A3 COLOUR
CLIENT: Spatial Property Group	
COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 50	PROJECT NUMBER: P22.142 / VERSION: 0
DATA SOURCE: LANDGATE AERIAL IMAGERY Summer 2023	DRAWN BY / REVIEWED BY: RA / KS / DATE: 3/10/2023

Legend

- Site Boundary
- **PAoCs**
- Garden Shed
- House
- House Shed
- Main Workshop/Storage
- Office Building
- Pump Shed
- Staff Room/Office
- Storage Shed
- Laying Shed
- Rearing Shed
- Rail Carriage
- Shelter
- Equipment Storage/Laydown
- Former crop area

No	Description	Drawn	Approved	Date
A	Original issue	RA	KS	3/10/2023

NOTES:

Cadastral boundary from LANDGATE 2022

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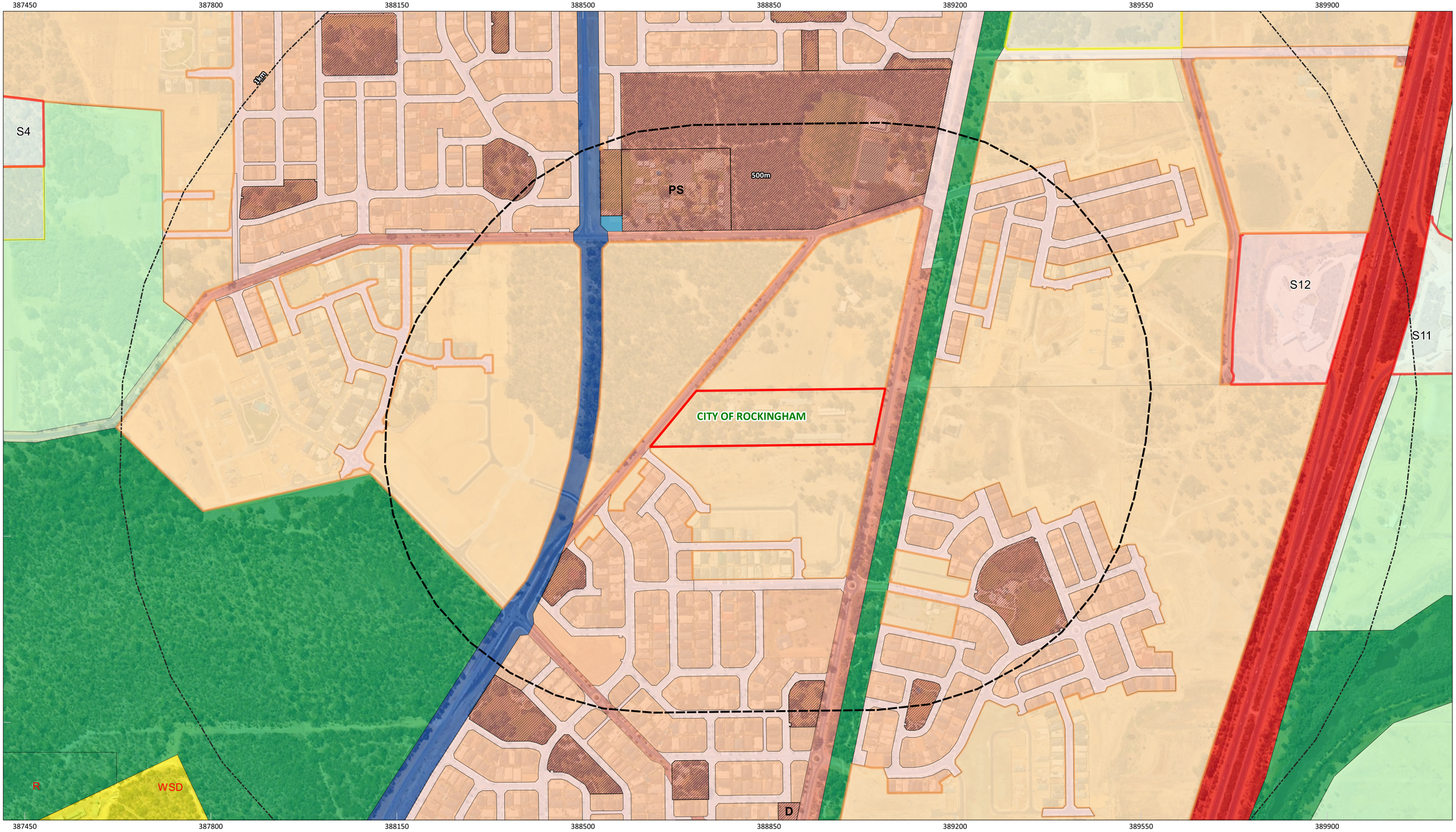

Figure 3: Surrounding Land Use and Zoning

N

0 100 200 300 400 m

PROJECT/REPORT NAME	Detailed Site Investigation Lot 3 Baldivis Road, Baldivis
SCALE: 1:7,000	SHEET SIZE: A3 COLOUR
CLIENT	Spatial Property Group
COORDINATE REFERENCE SYSTEM	GDA2020 / MGA zone 50
PROJECT NUMBER	22.142
VERSION	0
DATA SOURCE	LANDGATE AERIAL IMAGERY 02/2022
DRAWN BY / REVIEWED BY	AC / JC
DATE	12/7/2022

Legend

Site Boundary

Local Planning Scheme - Zones and Reserves (DPLH-071)
- Commercial
- Development
- Local roads
- Public open space
- Public purposes
- Residential
- Rural
- Special rural
- Special use

Region Scheme - Zones and Reserves (DPLH-023)
- Other regional roads
- Parks and recreation
- Parks and recreation
- Primary regional roads
- Public purposes - Water Authority of WA
- Rural
- Urban
- Urban deferred

No	Description	Drawn	Approved	Date
A	Original issue	AC	JC	12/7/2022

NOTES:

Cadastral boundary from LANDGATE 2022

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Figure 4: Soil Sampling Locations

N

0 15 30 45 60 m

PROJECT/REPORT NAME: Detailed Site Investigation Lot 3 Baldivis Road, Baldivis		
SCALE: 1:1,000	SHEET SIZE: A3 COLOUR	CLIENT: Spatial Property Group
COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 50	PROJECT NUMBER: P22.142	VERSION: 0
DATA SOURCE: LANDGATE AERIAL IMAGERY Summer 2023	DRAWN BY / REVIEWED BY: RA / KS	DATE: 3/10/2023

Legend

- Site Boundary
- PSI Sample Location
- Targeted Test Pit
- Spatial Characterisation Test Pit
- Sediment Sample

PAoC

- Garden Shed
- House
- House Shed
- Main Workshop/Storage
- Office Building
- Pump Shed
- Staff Room/Office
- Storage Shed
- Laying Shed
- Rearing Shed
- Green Waste
- Rail Carriage
- Shelter
- Equipment Storage/Laydown
- Former Sheds/Structures
- Former crop area

No	Description	Drawn	Approved	Date
A	Original issue	RA	KS	3/10/2023

NOTES:

Cadastral boundary from LANDGATE 2022

WESTERN ENVIRONMENTAL

Western Environmental Pty Ltd
08 6244 2310 | enquiries@westenv.com.au
Level 3/25 Prowse St, West Perth WA 6005
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Figure 5: Surface ACM Assessment Grids

N

0 10 20 30 40 m

SCALE	1:750
SHEET SIZE	A3 COLOUR
COORDINATE REFERENCE SYSTEM	GDA2020 / MGA zone 50
DATA SOURCE	LANDGATE AERIAL IMAGERY Summer 2023

PROJECT/REPORT NAME	Detailed Site Investigation Lot 3 Baldivis Road, Baldivis	
CLIENT	Spatial Property Group	
PROJECT NUMBER	P22.142	VERSION 0
DRAWN BY / REVIEWED BY	RA / KS	DATE 4/10/2023

Legend

- Site Boundary

Bulk Buildings

- No ACM Present
- ACM Fragment Observed

No	Description	Drawn	Approved	Date
A	Original issue	RA	KS	4/10/2023

NOTES:

Cadastral boundary from LANDGATE 2022

WESTERN ENVIRONMENTAL

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Figure 6: Monitoring Well Locations

N

0 18 36 54 72 m

PROJECT/REPORT NAME: Detailed Site Investigation Lot 3 Baldivis Road, Baldivis			
SCALE: 1:1,250	SHEET SIZE: A3 COLOUR	CLIENT: Spatial Property Group	
COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 50		PROJECT NUMBER: P22.142	VERSION: 0
DATA SOURCE: LANDGATE AERIAL IMAGERY Summer 2023		DRAWN BY / REVIEWED BY: RA / KS	DATE: 3/10/2023

Legend

- Site Boundary
- Groundwater Monitoring Well

No	Description	Drawn	Approved	Date
A	Original issue	RA	KS	3/10/2023

NOTES:

Cadastral boundary from LANDGATE 2022

WESTERN ENVIRONMENTAL

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Figure 7: Nutrient Concentrations in Groundwater

N

0 18 36 54 72 m

SCALE	1:1,250
SHEET SIZE	A3 COLOUR
COORDINATE REFERENCE SYSTEM	GDA2020 / MGA zone 50
DATA SOURCE	LANDGATE AERIAL IMAGERY Summer 2023

PROJECT/REPORT NAME
Detailed Site Investigation
Lot 3 Baldivis Road, Baldivis

CLIENT: Spatial Property Group

PROJECT NUMBER	VERSION
P22.142	0

DRAWN BY / REVIEWED BY	DATE
RA / KS	3/10/2023

Legend

- Site Boundary
- Groundwater Monitoring Well

No	Description	Drawn	Approved	Date
A	Original issue	RA	KS	3/10/2023

NOTES:

Cadastral boundary from LANDGATE 2022

WESTERN ENVIRONMENTAL

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Tables

Table 1
Soil Analyitcal Results - Metals

	Metals																				
	Aluminium	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium (III+VI)	Cobalt	Copper	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Selenium	Tin	Zinc
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	10	5	2	1	1	3	0.4	50	1	1	1	1	50	1	0.1	1	1	50	2	1	1
EIL with site specifi values	NE	20*	100	500*	4*	NE	1*	NE	240	50*	60	1100	NE	500*	0.5*	10*	10	NE	1*	50*	190
HIL-A	NE	NE	100[#4]	NE	60	4,500	20	NE	NE	100	6,000	300[#5]	NE	3,800	40[#6]	NE	400	NE	200	NE	7,400
HIL-C	NE	NE	300[#4]	NE	90	20,000	90	NE	NE	300	17,000	600[#5]	NE	19,000	80[#6]	NE	1,200	NE	700	NE	30,000
USEPA RSLs Resident Soil THQ=0.1	7,700	3.1		1,500																	
USEPA RSLs Resident Soil THQ=1.0	**77,000**	**31**		**15,000**																	
Field ID	**Date**																				
S01_0.15	**13 Jul 2022**	-	<7	2	9	<1	3	<0.4	-	3	<1	10	3	-	29	<0.1	1	1	-	<2	<1	64
S02_0.15	**13 Jul 2022**	-	<7	5	22	<1	15	<0.4	-	4	2	31	2	-	350	<0.1	3	2	-	<2	2	340
S03_0.15	**13 Jul 2022**	-	<7	6	44	<1	9	<0.4	-	6	2	37	3	-	410	<0.1	3	3	-	<2	2	320
S04_0.15	**13 Jul 2022**	-	<7	10	53	<1	5	<0.4	-	8	3	55	8	-	480	<0.1	3	5	-	<2	3	710
S05_0.15	**13 Jul 2022**	-	<7	12	330	1	9	<0.4	-	12	4	28	12	-	1,400	<0.1	2	6	-	<2	5	1,700
S06_0.15	**13 Jul 2022**	-	<7	7	13	<1	<3	<0.4	-	7	<1	9	3	-	100	<0.1	<1	2	-	<2	3	220
S07_0.15	**13 Jul 2022**	-	<7	13	300	<1	9	<0.4	-	15	5	65	11	-	1,900	<0.1	3	8	-	<2	4	980
S08_0.15	**13 Jul 2022**	-	<7	8	16	<1	4	<0.4	-	6	<1	10	8	-	110	<0.1	2	2	-	<2	3	1,000
S09_0.15	**13 Jul 2022**	-	-	3	-	-	-	<0.4	-	3	-	5	9	-	-	<0.1	-	2	-	-	-	110
S10_0.15	**13 Jul 2022**	-	-	4	-	-	-	<0.4	-	3	-	4	4	-	-	<0.1	-	2	-	-	-	100
S11_0.15	**13 Jul 2022**	-	-	<2	-	-	-	<0.4	-	3	-	5	9	-	-	<0.1	-	<1	-	-	-	75
S12_0.15	**13 Jul 2022**	-	-	4	-	-	-	<0.4	-	7	-	12	5	-	-	<0.1	-	2	-	-	-	1,000
S13_0.15	**13 Jul 2022**	-	-	12	-	-	-	<0.4	-	28	-	39	40	-	-	<0.1	-	4	-	-	-	54
S14_0.15	**13 Jul 2022**	-	-	13	-	-	-	<0.4	-	21	-	96	17	-	-	<0.1	-	13	-	-	-	1,400
S15_0.15	**13 Jul 2022**	-	-	11	-	-	-	<0.4	-	7	-	11	8	-	-	<0.1	-	3	-	-	-	140
S16_0.15	**13 Jul 2022**	-	-	8	-	-	-	<0.4	-	20	-	37	18	-	-	<0.1	-	15	-	-	-	320
BG01	**13 Jul 2022**	<10	-	2	-	-	-	<0.4	1,800	2	-	4	4	200	-	<0.1	-	1	100	-	-	31
BG01	**13 Jul 2023**	680	<5	<5	<10	<1	<50	<1	1,000	<2	<2	<5	<5	100	<5	<0.1	<2	<2	-	<5	<5	<5
SED01	**13 Jul 2023**	-	-	<5	-	-	-	<1	-	3	-	24	5	-	-	<0.1	-	<2	-	-	-	466
TP01_0-0.15	**14 Jul 2023**	-	<5	<5	10	<1	<50	<1	-	3	<2	<5	<5	-	35	-	<2	<2	-	<5	<5	26
TP02_0-0.15	**14 Jul 2023**	-	-	<5	-	-	-	<1	-	2	-	<5	<5	-	-	<0.1	-	<2	-	-	-	93
TP03_0-0.15	**14 Jul 2023**	-	-	<5	-	-	-	<1	-	3	-	<5	<5	-	-	<0.1	-	<2	-	-	-	24
TP04_0-0.15	**14 Jul 2023**	-	-	<5	-	-	-	<1	-	<2	-	<5	<5	-	-	<0.1	-	<2	-	-	-	11
TP05_0-0.15	**14 Jul 2023**	-	-	12	-	-	-	<1	-	15	-	10	<5	-	-	<0.1	-	<2	-	-	-	33
TP06_0-0.15	**14 Jul 2023**	-	-	<5	-	-	-	<1	-	<2	-	<5	<5	-	-	<0.1	-	<2	-	-	-	13
TP07_0-0.15	**13 Jul 2023**	-	-	<5	-	-	-	<1	-	8	-	<5	<5	-	-	<0.1	-	<2	-	-	-	26
TP08_0-0.15	**13 Jul 2023**	-	-	<5	-	-	-	<1	-	7	-	15	<5	-	-	<0.1	-	4	-	-	-	63
TP09_0-0.15	**13 Jul 2023**	-	-	<5	-	-	-	<1	-	<2	-	<5	<5	-	-	<0.1	-	<2	-	-	-	40
TP10_0-0.15	**13 Jul 2023**	-	-	<5	-	-	-	<1	-	7	-	<5	<5	-	-	<0.1	-	<2	-	-	-	48
TP11_0-0.15	**13 Jul 2023**	-	<5	<5	10	<1	<50	<1	-	<2	<2	<5	<5	-	88	-	<2	<2	-	<5	<5	28
TP12_0-0.15	**13 Jul 2023**	-	<5	<5	<10	<1	<50	<1	-	<2	<2	<5	<5	-	<5	-	<2	<2	-	<5	<5	<5
TP13_0-0.15	**13 Jul 2023**	-	-	<5	-	-	-	<1	-	<2	-	<5	<5	-	-	<0.1	-	<2	-	-	-	45
TP14_0-0.15	**13 Jul 2023**	-	<5	<5	<10	<1	<50	<1	-	<2	<2	<5	<5	-	<5	-	<2	<2	-	<5	<5	<5
TP15_0-0.15	**13 Jul 2023**	-	<5	<5	<10	<1	<50	<1	-	<2	<2	<5	<5	-	10	-	<2	<2	-	<5	<5	12
TP16_0-0.15	**13 Jul 2023**	-	-	<5	-	-	-	<1	-	<2	-	<5	<5	-	-	<0.1	-	<2	-	-	-	14
TP17_0-0.15	**13 Jul 2023**	-	-	<5	-	-	-	<1	-	<2	-	<5	14	-	-	<0.1	-	<2	-	-	-	51
TP18_0-0.15	**13 Jul 2023**	-	<5	<5	20	<1	<50	<1	-	2	<2	10	<5	-	155	-	<2	<2	-	<5	<5	140

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Table 1
Soil Analyitcal Results - Metals

	Metals																				
	Aluminium	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium (III+VI)	Cobalt	Copper	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Selenium	Tin	Zinc
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	10	5	2	1	1	3	0.4	50	1	1	1	1	50	1	0.1	1	1	50	2	1	1
EIL with site specifi values	NE	20*	100	500*	4*	NE	1*	NE	240	50*	60	1100	NE	500*	0.5*	10*	10	NE	1*	50*	190
HIL-A	NE	NE	100[#4]	NE	60	4,500	20	NE	NE	100	6,000	300[#5]	NE	3,800	40[#6]	NE	400	NE	200	NE	7,400
HIL-C	NE	NE	300[#4]	NE	90	20,000	90	NE	NE	300	17,000	600[#5]	NE	19,000	80[#6]	NE	1,200	NE	700	NE	30,000
USEPA RSLs Resident Soil THQ=0.1	7,700	3.1		1,500																	
USEPA RSLs Resident Soil THQ=1.0	**77,000**	**31**		**15,000**																	
Field ID	**Date**																				
TP19_0-0.15	**13 Jul 2023**	-	<5	<5	20	<1	<50	<1	-	3	<2	7	<5	-	89	-	<2	<2	-	<5	<5	138
TP20_0-0.15	**13 Jul 2023**	-	-	5	-	-	-	<1	-	7	-	5	<5	-	-	<0.1	-	<2	-	-	-	42
TP21_0-0.15	**13 Jul 2023**	-	<5	<5	<10	<1	<50	<1	-	<2	<2	<5	<5	-	<5	-	<2	<2	-	<5	<5	<5
TP22_0-0.15	**13 Jul 2023**	-	<5	<5	<10	<1	<50	<1	-	<2	<2	<5	<5	-	14	-	<2	<2	-	<5	<5	17
TP23_0-0.15	**14 Jul 2023**	-	-	<5	-	-	-	<1	-	<2	-	<5	<5	-	-	<0.1	-	<2	-	-	-	<5
TP24_0-0.15	**14 Jul 2023**	-	-	<5	-	-	-	<1	-	<2	-	<5	<5	-	-	<0.1	-	<2	-	-	-	7
TP25_0-0.15	**13 Jul 2023**	-	-	<5	-	-	-	<1	-	2	-	7	<5	-	-	<0.1	-	<2	-	-	-	128
TP26_0-0.15	**13 Jul 2023**	-	-	<5	-	-	-	<1	-	<2	-	<5	<5	-	-	<0.1	-	<2	-	-	-	<5
TP27_0-0.15	**13 Jul 2023**	-	-	<5	-	-	-	<1	-	3	-	8	<5	-	-	<0.1	-	<2	-	-	-	90
TP28_0-0.15	**13 Jul 2023**	-	-	<5	-	-	-	<1	-	<2	-	<5	<5	-	-	<0.1	-	<2	-	-	-	53
TP29_0-0.15	**13 Jul 2023**	-	-	<5	-	-	-	<1	-	<2	-	<5	<5	-	-	<0.1	-	<2	-	-	-	<5
TP30_0-0.15	**13 Jul 2023**	-	-	<5	-	-	-	<1	-	<2	-	<5	<5	-	-	<0.1	-	<2	-	-	-	<5
TP31_0-0.15	**13 Jul 2023**	-	-	<5	-	-	-	<1	-	<2	-	<5	<5	-	-	<0.1	-	<2	-	-	-	<5
TP32_0-0.15	**13 Jul 2023**	-	-	<5	-	-	-	<1	-	<2	-	<5	<5	-	-	<0.1	-	<2	-	-	-	6
TP33_0-0.15	**13 Jul 2023**	-	-	<5	-	-	-	<1	-	<2	-	<5	<5	-	-	<0.1	-	<2	-	-	-	6
TP34_0-0.15	**13 Jul 2023**	-	-	<5	-	-	-	<1	-	<2	-	<5	<5	-	-	<0.1	-	<2	-	-	-	24

Table 2
Soil Analyitcal Results - Hydrocarbons

		BTEX								TRH								TPH				
		Naphthalene (BTEX)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	Total BTEX	C6-C10 Fraction (F1)	C6-C10 (F1 minus BTEX)	>C10-C16 Fraction (F2)	>C10-C16 Fraction (F2 minus Naphthalene)	>C16-C34 Fraction (F3)	>C34-C40 Fraction (F4)	>C10-C40 Fraction (Sum)	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Sum)
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		1	0.2	0.5	0.5	0.5	0.5	0.5	0.2	10	10	50	50	100	100	50	10	50	100	100	50
ESL-A		170	50	85	70	NE	NE	105	NE	180	180[#2]	120[#3]	120[#4]	300	2,800	NE	NE	NE	NE	NE	NE
ESL-C		NE	NE	NE	NE	NE	NE	NE	NE	700[#5]	NE	1,000[#5]	NE	2,500	10,000	NE	NE	NE	NE	NE	NE
HSL-A (VI)		3	0.5	160	55	NE	NE	40	NE	NE	45[#2]	NE	110[#7]	NE	NE	NE	NE	NE	NE	NE	NE
HSL-A (DC)		1,400[#8]	100	14,000	4,500[#8]	NE	NE	12,000	NE	4,400	NE	3,300	NE	4,500	6,300	NE	NE	NE	NE	NE	NE
HSL-C (DC)		1,900[#8]	120	18,000	5,300[#8]	NE	NE	15,000	NE	5,100	NE	3,800	NE	5,300	7,400	NE	NE	NE	NE	NE	NE
HSL-MW (DC)		29,000[#8]	1,100	120,000	85,000[#8]	NE	NE	130,000	NE	82,000	NE	62,000	NE	85,000	120,000	NE	NE	NE	NE	NE	NE
USEPA RSLs Resident Soil THQ=0.1							64	58													
USEPA RSLs Resident Soil THQ=1.0							**640**	**580**													
Field ID	**Date**																				
S01_0.15	**13 Jul 2022**	<1	<0.2	<0.5	<1	<2	<1	-	-	<25	<25	<50	<50	<100	<100	-	<25	<50	<100	<100	-
S02_0.15	**13 Jul 2022**	<1	<0.2	<0.5	<1	<2	<1	-	-	<25	<25	<50	<50	450	<100	-	<25	<50	240	240	-
S03_0.15	**13 Jul 2022**	<1	<0.2	<0.5	<1	<2	<1	-	-	<25	<25	<50	<50	<100	<100	-	<25	<50	<100	<100	-
S04_0.15	**13 Jul 2022**	<1	<0.2	<0.5	<1	<2	<1	-	-	<25	<25	<50	<50	110	<100	-	<25	<50	<100	<100	-
S05_0.15	**13 Jul 2022**	<1	<0.2	<0.5	<1	<2	<1	-	-	<25	<25	50	50	260	<100	-	<25	54	130	180	-
S06_0.15	**13 Jul 2022**	<1	<0.2	<0.5	<1	<2	<1	-	-	<25	<25	<50	<50	<100	<100	-	<25	<50	<100	<100	-
S07_0.15	**13 Jul 2022**	<1	<0.2	<0.5	<1	<2	<1	-	-	<25	<25	<50	<50	110	<100	-	<25	<50	<100	<100	-
S08_0.15	**13 Jul 2022**	<1	<0.2	<0.5	<1	<2	<1	-	-	<25	<25	<50	<50	<100	<100	-	<25	<50	<100	<100	-
S09_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S10_0.15	**13 Jul 2022**	<1	<0.2	<0.5	<1	<2	<1	-	-	<25	<25	<50	<50	<100	<100	-	<25	<50	<100	<100	-
S11_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S12_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S13_0.15	**13 Jul 2022**	<1	<0.2	<0.5	<1	<2	<1	-	-	<25	<25	<50	<50	<100	<100	-	<25	<50	<100	<100	-
S14_0.15	**13 Jul 2022**	<1	<0.2	<0.5	<1	<2	<1	-	-	<25	<25	<50	<50	<100	<100	-	<25	<50	<100	<100	-
S14_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S15_0.15	**13 Jul 2022**	<1	<0.2	<0.5	<1	<2	<1	-	-	<25	<25	<50	<50	<100	<100	-	<25	<50	<100	<100	-
S16_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG01	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SED01	**13 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	60	60	200	<100	260	<10	<50	170	<100	170
TP01_0-0.15	**14 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
TP02_0-0.15	**14 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
TP03_0-0.15	**14 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
TP04_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP05_0-0.15	**14 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
TP06_0-0.15	**14 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
TP07_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP08_0-0.15	**13 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
TP09_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP10_0-0.15	**13 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
TP11_0-0.15	**13 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
TP12_0-0.15	**13 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
TP13_0-0.15	**13 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
TP14_0-0.15	**13 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
TP15_0-0.15	**13 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
TP16_0-0.15	**13 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
TP17_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18_0-0.15	**13 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	160	<100	160	<10	<50	<100	120	120
TP18_0.5	**13 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
TP19_0-0.15	**13 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
TP20_0-0.15	**13 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50

Table 2
Soil Analyitcal Results - Hydrocarbons

	BTEX								TRH								TPH				
	Naphthalene (BTEX)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	Total BTEX	C6-C10 Fraction (F1)	C6-C10 (F1 minus BTEX)	>C10-C16 Fraction (F2)	>C10-C16 Fraction (F2 minus Naphthalene)	>C16-C34 Fraction (F3)	>C34-C40 Fraction (F4)	>C10-C40 Fraction (Sum)	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Sum)
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	1	0.2	0.5	0.5	0.5	0.5	0.5	0.2	10	10	50	50	100	100	50	10	50	100	100	50
ESL-A	170	50	85	70	NE	NE	105	NE	180	180[#2]	120[#3]	120[#4]	300	2,800	NE	NE	NE	NE	NE	NE
ESL-C	NE	NE	NE	NE	NE	NE	NE	NE	700[#5]	NE	1,000[#5]	NE	2,500	10,000	NE	NE	NE	NE	NE	NE
HSL-A (VI)	3	0.5	160	55	NE	NE	40	NE	NE	45[#2]	NE	110[#7]	NE	NE	NE	NE	NE	NE	NE	NE
HSL-A (DC)	1,400[#8]	100	14,000	4,500[#8]	NE	NE	12,000	NE	4,400	NE	3,300	NE	4,500	6,300	NE	NE	NE	NE	NE	NE
HSL-C (DC)	1,900[#8]	120	18,000	5,300[#8]	NE	NE	15,000	NE	5,100	NE	3,800	NE	5,300	7,400	NE	NE	NE	NE	NE	NE
HSL-MW (DC)	29,000[#8]	1,100	120,000	85,000[#8]	NE	NE	130,000	NE	82,000	NE	62,000	NE	85,000	120,000	NE	NE	NE	NE	NE	NE
USEPA RSLs Resident Soil THQ=0.1						64	58													
USEPA RSLs Resident Soil THQ=1.0						**640**	**580**													

Field ID	Date																				
TP21_0-0.15	**13 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
TP22_0-0.15	**13 Jul 2023**	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
TP23_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP24_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP25_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP26_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP27_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP28_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP29_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP30_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP31_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP32_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP33_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP34_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 3
Soil Analyitcal Results - Polycyclic Armoatic Hydrocarbons

		PAH																											
		Benzo(b+j+k)fluoranthene	1-Chloronaphthalene	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	7,12-dimethylbenz(a)anthracene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b+j)fluoranthene	Benzo(b+k)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	Benzo(a)pyrene TEQ calc (Half)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ calc (Zero)	PAHs (Sum of total)	PAHs (Sum of positives)
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.2	0.5	0.5	0.5	0.5	0.5	0.1	0.1	0.1	0.1	0.05	0.5	1	0.1	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.5	0.5	0.5	0.05
ESL-A		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0.7	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	300	300
HIL-A		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	3[#1]	3[#1]	3[#1]	300[#2]	NE
HIL-C		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	3[#1]	3[#1]	3[#1]	300[#2]	NE
HSL-A (DC)		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	1,400[#4]	NE	NE	NE	NE	NE	NE	NE
HSL-C (DC)		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	1,900[#4]	NE	NE	NE	NE	NE	NE	NE
HSL-MW (DC)		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	29,000[#4]	NE	NE	NE	NE	NE	NE	NE
Field ID	**Date**																												
S01_0.15	**13 Jul 2022**	<0.2	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.05	-	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	-	<0.05
S02_0.15	**13 Jul 2022**	<0.2	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.05	-	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	-	<0.05
S03_0.15	**13 Jul 2022**	<0.2	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	0.05	-	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	-	0.05
S04_0.15	**13 Jul 2022**	<0.2	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.05	-	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	-	<0.05
S05_0.15	**13 Jul 2022**	1.7	-	-	-	-	-	<0.1	<0.1	0.1	0.8	1.2	-	-	0.8	-	0.8	0.1	1.9	<0.1	0.9	<0.1	0.5	1.9	1.7	1.7	1.7	-	11
S06_0.15	**13 Jul 2022**	<0.2	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.05	-	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	-	<0.05
S07_0.15	**13 Jul 2022**	<0.2	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	0.08	-	-	<0.1	-	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.5	<0.5	<0.5	-	0.29
S08_0.15	**13 Jul 2022**	<0.2	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.05	-	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	-	<0.05
S09_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S10_0.15	**13 Jul 2022**	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.1	<0.05	-	<1	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	-	<0.05
S11_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S12_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S13_0.15	**13 Jul 2022**	<0.2	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.05	-	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	-	<0.05
S14_0.15	**13 Jul 2022**	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	0.2	0.34	-	<1	0.2	-	0.3	<0.1	0.1	<0.1	0.2	<0.1	<0.1	0.2	0.5	0.6	<0.5	-	2.2
S14_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	<0.5	<0.5	-	-	<0.5	-	<0.5	-	<0.5	-	<0.5	-	-	<0.5	-	-	-	-	-
S15_0.15	**13 Jul 2022**	0.4	-	-	-	-	-	<0.1	<0.1	<0.1	0.2	0.24	-	-	0.2	-	0.2	<0.1	0.3	<0.1	0.2	<0.1	<0.1	0.4	<0.5	<0.5	<0.5	-	2.0
S16_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG01	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SED01	**13 Jul 2023**	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP01_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP02_0-0.15	**14 Jul 2023**	<1	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP03_0-0.15	**14 Jul 2023**	<1	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP04_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP05_0-0.15	**14 Jul 2023**	<1	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP06_0-0.15	**14 Jul 2023**	<1	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP07_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP08_0-0.15	**13 Jul 2023**	<1	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP09_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP10_0-0.15	**13 Jul 2023**	<1	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP11_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP12_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP13_0-0.15	**13 Jul 2023**	<1	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP14_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP15_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP16_0-0.15	**13 Jul 2023**	<1	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP17_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP19_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP20_0-0.15	**13 Jul 2023**	<1	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	-	-	<0.5	-	0.6	<0.5	1.2	<0.5	<0.5	<0.5	<0.5	1.2	1.0	1.4	0.7	3.7	-
TP20_0.5		<1	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP21_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP22_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	-
TP23_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP24_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP25_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP26_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP27_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP28_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP29_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP30_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 3
Soil Analyitcal Results - Polycyclic Armoatic Hydrocarbons

		PAH																											
		Benzo(b+j+k)fluoranthene	1-Chloronaphthalene	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	7,12-dimethylbenz(a)anthracene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b+j)fluoranthene	Benzo(b+k)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	Benzo(a)pyrene TEQ calc (Half)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ calc (Zero)	PAHs (Sum of total)	PAHs (Sum of positives)
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.2	0.5	0.5	0.5	0.5	0.5	0.1	0.1	0.1	0.1	0.05	0.5	1	0.1	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.5	0.5	0.5	0.05
ESL-A		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0.7	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HIL-A		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	3[#1]	3[#1]	3[#1]	300[#2]	NE
HIL-C		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	3[#1]	3[#1]	3[#1]	300[#2]	NE
HSL-A (DC)		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	1,400[#4]	NE	NE	NE	NE	NE	NE	NE
HSL-C (DC)		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	1,900[#4]	NE	NE	NE	NE	NE	NE	NE
HSL-MW (DC)		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	29,000[#4]	NE	NE	NE	NE	NE	NE	NE
Field ID	**Date**																												
TP31_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP32_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP33_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP34_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4
Soil Analyitcal Results - Solvents and Phenols

		Solvents								Phenols																		
		Methyl Ethyl Ketone	2-hexanone (MBK)	4-Methyl-2-pentanone	Carbon disulfide	Cyclohexane	Isophorone	MTBE	Vinyl acetate	3&4-Methylphenol (m&p-cresol)	2,3,4,6-Tetrachlorophenol	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2,4-Dinitrophenol	2,6-D	2,6-Dichlorophenol	2-Chlorophenol	2-Methylphenol	2-Nitrophenol	4,6-Dinitro-2-methylphenol	4-chloro-3-methylphenol	4-Nitrophenol	Pentachlorophenol	Picloram	Phenol
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		5	5	5	0.5	1	0.5	0.5	5	0.4	0.2	0.2	0.2	0.2	0.2	4	0.5	0.2	0.2	0.2	0.2	10	0.5	4	1	0.5	0.2
HIL-A		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HIL-A		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	100	4,500	3,000	
HIL-C		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	120	5,700	40,000	
USEPA RSLs Resident Soil THQ=0.1		2,700	20	3,300	77	650	570	47	91	NE	190	630	6.3	19	130	13	NE	NE	39	320	NE	0.51	630	NE	1	440	1,900	
USEPA RSLs Resident Soil THQ=1.0		**27,000**	**200**	**33,000**	**770**	**6,500**	**570**	**47**	**910**	**NE**	**1,900**	**6,300**	**49**	**190**	**1,300**	**130**	**NE**	**NE**	**390**	**3,200**	**NE**	**5.1**	**6,300**	**NE**	**1**	**4,400**	**19,000**	
Field ID	**Date**																											
S01_0.15	**13 Jul 2022**	-	-	-	-	-	-	<0.5	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<4	<0.5	<0.2	<0.2	<0.2	<0.2	<10	<5	<4	<5	<0.5	<0.2
S02_0.15	**13 Jul 2022**	-	-	-	-	-	-	<0.5	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<4	<0.5	<0.2	<0.2	<0.2	<0.2	<10	<5	<4	<5	<0.5	<0.2
S03_0.15	**13 Jul 2022**	-	-	-	-	-	-	<0.5	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<4	<0.5	<0.2	<0.2	<0.2	<0.2	<10	<5	<4	<5	<0.5	<0.2
S04_0.15	**13 Jul 2022**	-	-	-	-	-	-	<0.5	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<4	<0.5	<0.2	<0.2	<0.2	<0.2	<10	<5	<4	<5	<0.5	<0.2
S05_0.15	**13 Jul 2022**	-	-	-	-	-	-	<0.5	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<4	-	<0.2	<0.2	<0.2	<0.2	<10	<5	<4	<5	-	<0.2
S06_0.15	**13 Jul 2022**	-	-	-	-	-	-	<0.5	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<4	<0.5	<0.2	<0.2	<0.2	<0.2	<10	<5	<4	<5	<0.5	<0.2
S07_0.15	**13 Jul 2022**	-	-	-	-	-	-	<0.5	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<4	-	<0.2	<0.2	<0.2	<0.2	<10	<5	<4	<5	-	<0.2
S08_0.15	**13 Jul 2022**	-	-	-	-	-	-	<0.5	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<4	<0.5	<0.2	<0.2	<0.2	<0.2	<10	<5	<4	<5	<0.5	<0.2
S09_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S10_0.15	**13 Jul 2022**	-	-	-	-	<1	<1	<0.5	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<10	-	<0.2	<0.5	<0.5	<0.5	<10	<5	<10	<5	-	<0.5
S11_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S12_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S13_0.15	**13 Jul 2022**	-	-	-	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S14_0.15	**13 Jul 2022**	-	-	-	-	<1	<1	<0.5	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<10	-	<0.2	<0.5	<0.5	<0.5	<10	<5	<10	<5	-	<0.5
S14_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S15_0.15	**13 Jul 2022**	-	-	-	-	-	-	<0.5	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<4	<0.5	<0.2	<0.2	<0.2	<0.2	<10	<5	<4	<5	<0.5	<0.2
S16_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<4	-	<0.2	<0.2	<0.2	<0.2	<10	<5	<4	<5	-	<0.2
BG01	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SED01	**13 Jul 2023**	-	-	-	-	-	-	-	-	<1	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<2	-	<0.5
TP33_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP20_0-0.15	**13 Jul 2023**	<5	<5	<5	<0.5	-	<0.5	-	<5	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<1	-	<0.5
TP34_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP26_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP27_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP12_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	<1	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<2	-	<0.5
TP11_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	<1	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<2	-	<0.5
TP13_0-0.15	**13 Jul 2023**	<5	<5	<5	<0.5	-	<0.5	-	<5	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<1	-	<0.5
TP07_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP10_0-0.15	**13 Jul 2023**	<5	<5	<5	<0.5	-	<0.5	-	<5	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<1	-	<0.5
TP08_0-0.15	**13 Jul 2023**	<5	<5	<5	<0.5	-	<0.5	-	<5	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<1	-	<0.5
TP09_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP25_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP01_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	<1	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<2	-	<0.5
TP02_0-0.15	**14 Jul 2023**	<5	<5	<5	<0.5	-	<0.5	-	<5	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<1	-	<0.5
TP03_0-0.15	**14 Jul 2023**	<5	<5	<5	<0.5	-	<0.5	-	<5	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<1	-	<0.5
TP04_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP05_0-0.15	**14 Jul 2023**	<5	<5	<5	<0.5	-	<0.5	-	<5	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<1	-	<0.5
TP06_0-0.15	**14 Jul 2023**	<5	<5	<5	<0.5	-	<0.5	-	<5	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<1	-	<0.5
TP23_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP24_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP14_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	<1	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<2	-	<0.5
TP15_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	<1	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<2	-	<0.5
TP16_0-0.15	**13 Jul 2023**	<5	<5	<5	<0.5	-	<0.5	-	<5	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<1	-	<0.5
TP17_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	<1	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<2	-	<0.5
TP19_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	<1	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<2	-	<0.5
TP21_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	<1	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<2	-	<0.5
TP22_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	<1	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<2	-	<0.5
TP28_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP29_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP30_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP31_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

WESTERN ENVIRONMENTAL

Table 4
Soil Analyitcal Results - Solvents and Phenols

		Solvents								Phenols																		
		Methyl Ethyl Ketone	2-hexanone (MBK)	4-Methyl-2-pentanone	Carbon disulfide	Cyclohexane	Isophorone	MTBE	Vinyl acetate	3&4-Methylphenol (m&p-cresol)	2,3,4,6-Tetrachlorophenol	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2,4-Dinitrophenol	2,6-D	2,6-Dichlorophenol	2-Chlorophenol	2-Methylphenol	2-Nitrophenol	4,6-Dinitro-2-methylphenol	4-chloro-3-methylphenol	4-Nitrophenol	Pentachlorophenol	Picloram	Phenol
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		5	5	5	0.5	1	0.5	0.5	5	0.4	0.2	0.2	0.2	0.2	0.2	4	0.5	0.2	0.2	0.2	0.2	10	0.5	4	1	0.5	0.2
EIL-A		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HIL-A		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	100	4,500	3,000
HIL-C		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	120	5,700	40,000
USEPA RSLs Resident Soil THQ=0.1		2,700	20	3,300	77	650	570	47	91	NE	190	630	6.3	19	130	13	NE	NE	39	320	NE	0.51	630	NE	1	440	1,900
USEPA RSLs Resident Soil THQ=1.0		**27,000**	**200**	**33,000**	**770**	**6,500**	**570**	**47**	**910**	**NE**	**1,900**	**6,300**	**49**	**190**	**1,300**	**130**	**NE**	**NE**	**390**	**3,200**	**NE**	**5.1**	**6,300**	**NE**	**1**	**4,400**	**19,000**
Field ID	**Date**																											
TP32_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 5
Soil Analyitcal Results - Halogenated Hydrocarbons

		Halogenated Benzenes												Halogenated Hydrocarbons				
		1,2,3-trichlorobenzene	1,2,4,5-tetrachlorobenzene	1,2,4-trichlorobenzene	1,2-dichlorobenzene	1,3-dichlorobenzene	1,4-dichlorobenzene	2-chlorotoluene	4-chlorotoluene	Bromobenzene	Chlorobenzene	Hexachlorobenzene	Pentachlorobenzene	1,2-dibromoethane	Bromomethane	Dichlorodifluoromethane	Iodomethane	Trichlorofluoromethane
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.05	0.5	0.5	1	1	0.5	1
EIL-A		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HIL-A		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	10	NE	NE	NE	NE	NE	NE
HIL-C		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	10	NE	NE	NE	NE	NE	NE
USEPA RSLs Resident Soil THQ=0.1		6.3	0.23	5.8	180	NE	2.6	160	160	29	28	0.078	6.3	0.036	0.68	8.7	NE	2,300
USEPA RSLs Resident Soil THQ=1.0		**63**	**2.3**	**24**	**1,800**	**NE**	**2.6**	**1,600**	**1,600**	**290**	**280**	**0.21**	**63**	**0.036**	**6.8**	**87**	**NE**	**23,000**
Field ID	**Date**																	
S01_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-
S02_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-
S03_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-
S04_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-
S05_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-
S06_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-
S07_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-
S08_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-
S09_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-
S10_0.15	**13 Jul 2022**	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1	<1	<1	<0.1	<0.5	<1	<1	<1	-	<1
S11_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-
S12_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-
S13_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-
S14_0.15	**13 Jul 2022**	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1	<1	<1	<0.1	<0.5	<1	<1	<1	-	<1
S14_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S15_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-
S16_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG01	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SED01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP33_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP20_0-0.15	**13 Jul 2023**	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<0.5	<0.5	<5	<5	<0.5	<5
TP34_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP26_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP27_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP12_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP11_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP13_0-0.15	**13 Jul 2023**	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<0.5	<0.5	<5	<5	<0.5	<5
TP07_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP10_0-0.15	**13 Jul 2023**	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<0.5	<0.5	<5	<5	<0.5	<5
TP08_0-0.15	**13 Jul 2023**	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<0.5	<0.5	<5	<5	<0.5	<5
TP09_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP25_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
BG01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP01_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP02_0-0.15	**14 Jul 2023**	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<0.5	<0.5	<5	<5	<0.5	<5
TP03_0-0.15	**14 Jul 2023**	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<0.5	<0.5	<5	<5	<0.5	<5
TP04_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP05_0-0.15	**14 Jul 2023**	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<0.5	<0.5	<5	<5	<0.5	<5

Table 5
Soil Analyitcal Results - Halogenated Hydrocarbons

		Halogenated Benzenes												Halogenated Hydrocarbons				
		1,2,3-trichlorobenzene	1,2,4,5-tetrachlorobenzene	1,2,4-trichlorobenzene	1,2-dichlorobenzene	1,3-dichlorobenzene	1,4-dichlorobenzene	2-chlorotoluene	4-chlorotoluene	Bromobenzene	Chlorobenzene	Hexachlorobenzene	Pentachlorobenzene	1,2-dibromoethane	Bromomethane	Dichlorodifluoromethane	Iodomethane	Trichlorofluoromethane
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.05	0.5	0.5	1	1	0.5	1
EIL-A		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HIL-A		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	10	NE	NE	NE	NE	NE	NE
HIL-C		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	10	NE	NE	NE	NE	NE	NE
USEPA RSLs Resident Soil THQ=0.1		6.3	0.23	5.8	180	NE	2.6	160	160	29	28	0.078	6.3	0.036	0.68	8.7	NE	2,300
USEPA RSLs Resident Soil THQ=1.0		**63**	**2.3**	**24**	**1,800**	**NE**	**2.6**	**1,600**	**1,600**	**290**	**280**	**0.21**	**63**	**0.036**	**6.8**	**87**	**NE**	**23,000**
Field ID	**Date**																	
TP06_0-0.15	**14 Jul 2023**	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<0.5	<0.5	<5	<5	<0.5	<5
TP23_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP24_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP14_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP15_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP16_0-0.15	**13 Jul 2023**	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<0.5	<0.5	<5	<5	<0.5	<5
TP17_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP18_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP19_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP21_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP22_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP28_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP29_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP30_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP31_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
TP32_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-

Table 6
Soil Analyitcal Results - Chlorinated Hydrocarbons

		Chlorinated Hydrocarbons																																
		1,1,1,2-tetrachloroethane	1,1,1-trichloroethane	1,1,2,2-tetrachloroethane	1,1,2-trichloroethane	1,1-dichloroethane	1,1-dichloroethene	1,1-dichloropropene	1,2,3-trichloropropane	1,2-dibromo-3-chloropropane	1,2-dichloroethane	1,2-dichloropropane	1,3-dichloropropane	2,2-dichloropropane	Bromochloromethane	Bromodichloromethane	Bromoform	Carbon tetrachloride	Chlorodibromomethane	Chloroethane	Chloroform	Chloromethane	cis-1,2-dichloroethene	cis-1,3-dichloropropene	Dibromomethane	Hexachlorobutadiene	Hexachlorocyclopentadiene	Hexachloroethane	Trichloroethene	Tetrachloroethene	trans-1,2-dichloroethene	trans-1,3-dichloropropene	Vinyl chloride
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	1	0.5	1	0.5	0.5	0.5	0.5	2	0.5	0.5	0.5	0.5	0.5	1
HIL-A		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HIL-C		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
USEPA RSLs Resident Soil THQ=0.1		2	810	0.6	0.15	3.6	23	NE	0.0051	0.0053	0.46	1.6	160	NE	15	0.29	19	0.65	8.3	540	0.32	11	6.3	NE	2.4	1.2	0.18	1.8	0.41	8.1	7	NE	0.059
USEPA RSLs Resident Soil THQ=1.0		2	8,100	0.6	1.1	3.6	230	NE	0.0051	0.0053	0.46	2.5	1,600	NE	150	0.29	19	0.65	8.3	5,400	0.32	110	63	NE	24	1.2	1.8	1.8	0.94	24	70	NE	0.059
Field ID	**Date**																																	
S01_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S02_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S03_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S04_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S05_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S06_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S07_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S08_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S09_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S10_0.15	**13 Jul 2022**	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.5	<2	<0.5	<1	<1	<1	<1	<1
S11_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S12_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S13_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S14_0.15	**13 Jul 2022**	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.5	<2	<0.5	<1	<1	<1	<1	<1
S14_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S15_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S16_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG01	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SED01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP33_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP20_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5
TP34_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP26_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP27_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP12_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP11_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP13_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5
TP07_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP10_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5
TP08_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5
TP09_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP25_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP01_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP02_0-0.15	**14 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5
TP03_0-0.15	**14 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5
TP04_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP05_0-0.15	**14 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5
TP06_0-0.15	**14 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5
TP23_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP24_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP14_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP15_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP16_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5
TP17_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP21_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP22_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP28_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP29_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP30_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP31_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP32_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 7
Soil Analyitcal Results - Aromatics and Aliphatics

		MAH									Amino Aliphatics				Amino Aromatics				Nitroaromatics		
		1,2,4-trimethylbenzene	1,3,5-trimethylbenzene	Isopropylbenzene	n-butylbenzene	n-propylbenzene	p-isopropyltoluene	sec-butylbenzene	Styrene	tert-butylbenzene	N-nitrosodiethylamine	N-nitrosodi-n-butylamine	N-nitrosodi-n-propylamine	N-Nitrosomethylethylamine	1-naphthylamine	2-naphthylamine	Diphenylamine	N-Nitrosodiphenyl & Diphenylamine	2-Picoline	4-aminobiphenyl	Pentachloronitrobenzene
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	1	0.5	0.5	0.5
HIL-A		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HIL-C		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
USEPA RSLs Resident Soil THQ=0.1		30	27	190	390	380	NE	780	600	780	0.00081	0.099	0.078	0.02	NE	0.3	630	NE	NE	0.026	2.7
USEPA RSLs Resident Soil THQ=1.0		**300**	**270**	**1,900**	**3,900**	**3,800**	**NE**	**7,800**	**6,000**	**7,800**	**0.00081**	**0.099**	**0.078**	**0.02**	**NE**	**0.3**	**6,300**	**NE**	**NE**	**0.026**	**2.7**
Field ID	**Date**																				
S01_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S02_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S03_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S04_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S05_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S06_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S07_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S08_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S09_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S10_0.15	**13 Jul 2022**	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	<1	<1	-	<1	<1	<1	-	-	-	<1
S11_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S12_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S13_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S14_0.15	**13 Jul 2022**	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	<1	<1	-	<1	<1	<1	-	-	-	<1
S14_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S15_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S16_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG01	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SED01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP33_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP20_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<1.0	<0.5	<0.5	<0.5
TP34_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP26_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP27_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP12_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP11_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP13_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<1.0	<0.5	<0.5	<0.5
TP07_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP10_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<1.0	<0.5	<0.5	<0.5
TP08_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<1.0	<0.5	<0.5	<0.5
TP09_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP25_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP01_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP02_0-0.15	**14 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<1.0	<0.5	<0.5	<0.5
TP03_0-0.15	**14 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<1.0	<0.5	<0.5	<0.5
TP04_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP05_0-0.15	**14 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<1.0	<0.5	<0.5	<0.5
TP06_0-0.15	**14 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<1.0	<0.5	<0.5	<0.5
TP23_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP24_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP14_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP15_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP16_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<1.0	<0.5	<0.5	<0.5
TP17_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 7
Soil Analyitcal Results - Aromatics and Aliphatics

		MAH									Amino Aliphatics				Amino Aromatics				Nitroaromatics		
		1,2,4-trimethylbenzene	1,3,5-trimethylbenzene	Isopropylbenzene	n-butylbenzene	n-propylbenzene	p-isopropyltoluene	sec-butylbenzene	Styrene	tert-butylbenzene	N-nitrosodiethylamine	N-nitrosodi-n-butylamine	N-nitrosodi-n-propylamine	N-Nitrosomethylethylamine	1-naphthylamine	2-naphthylamine	Diphenylamine	N-Nitrosodiphenyl & Diphenylamine	2-Picoline	4-aminobiphenyl	Pentachloronitrobenzene
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	1	0.5	0.5	0.5
HIL-A		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HIL-C		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
USEPA RSLs Resident Soil THQ=0.1		30	27	190	390	380	NE	780	600	780	0.00081	0.099	0.078	0.02	NE	0.3	630	NE	NE	0.026	2.7
USEPA RSLs Resident Soil THQ=1.0		**300**	**270**	**1,900**	**3,900**	**3,800**	**NE**	**7,800**	**6,000**	**7,800**	**0.00081**	**0.099**	**0.078**	**0.02**	**NE**	**0.3**	**6,300**	**NE**	**NE**	**0.026**	**2.7**
Field ID	**Date**																				
TP19_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP21_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP22_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP28_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP29_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP30_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP31_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP32_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 8
Soil Analyitcal Results - Semivolatile Organic Compounds

		SVOCs																		
		2-(acetylamino) fluorene	3,3-Dichlorobenzidine	4-(dimethylamino) azobenzene	4-bromophenyl phenyl ether	4-chlorophenyl phenyl ether	4-Nitroquinoline-N-oxide	Azobenzene	Benzyl alcohol	Bis(2-chloroethoxy) methane	Bis(2-chloroethyl)ether	Bis(2-chloroisopropyl) ether	Dibenzofuran	Hexachloropropene	Isosafrole	Methapyrilene	N-nitrosomorpholine	N-nitrosopiperidine	N-nitrosopyrrolidine	Phenacetin
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.5	0.5	0.5	0.5	0.5	0.5	1	1	0.5	0.5	1	0.5	0.5	2	0.5	0.5	0.5	1	0.5
USEPA RSLs Resident Soil THQ=0.1		0.14	1.2	0.12	NE	NE	NE	5.6	630	19	0.23	310	7.8	NE	NE	NE	0.081	0.058	0.26	250
USEPA RSLs Resident Soil THQ=1.0		**0.14**	**1.2**	**0.12**	**NE**	**NE**	**NE**	**5.6**	**6,300**	**190**	**0.23**	**3,100**	**78**	**NE**	**NE**	**NE**	**0.081**	**0.058**	**0.26**	**250**
Field ID	**Date**																			
S01_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S02_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S03_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S04_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S05_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S06_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S07_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S08_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S09_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S10_0.15	**13 Jul 2022**	<0.5	-	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<0.5	<2	<2	<1	<1	-	<1
S11_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S12_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S13_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S14_0.15	**13 Jul 2022**	<0.5	-	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<0.5	<2	<2	<1	<1	-	<1
S14_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S15_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S16_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG01	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SED01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP33_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP20_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	<1.0	<0.5
TP34_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP26_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP27_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP12_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP11_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP13_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	<1.0	<0.5
TP07_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP10_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	<1.0	<0.5
TP08_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	<1.0	<0.5
TP09_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP25_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP01_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP02_0-0.15	**14 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	<1.0	<0.5
TP03_0-0.15	**14 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	<1.0	<0.5
TP04_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP05_0-0.15	**14 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	<1.0	<0.5
TP06_0-0.15	**14 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	<1.0	<0.5
TP23_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP24_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 8
Soil Analyitcal Results - Semivolatile Organic Compounds

		SVOCs																		
		2-(acetylamino) fluorene	3,3-Dichlorobenzidine	4-(dimethylamino) azobenzene	4-bromophenyl phenyl ether	4-chlorophenyl phenyl ether	4-Nitroquinoline-N-oxide	Azobenzene	Benzyl alcohol	Bis(2-chloroethoxy) methane	Bis(2-chloroethyl)ether	Bis(2-chloroisopropyl) ether	Dibenzofuran	Hexachloropropene	Isosafrole	Methapyrilene	N-nitrosomorpholine	N-nitrosopiperidine	N-nitrosopyrrolidine	Phenacetin
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.5	0.5	0.5	0.5	0.5	0.5	1	1	0.5	0.5	1	0.5	0.5	2	0.5	0.5	0.5	1	0.5
USEPA RSLs Resident Soil THQ=0.1		0.14	1.2	0.12	NE	NE	NE	5.6	630	19	0.23	310	7.8	NE	NE	NE	0.081	0.058	0.26	250
USEPA RSLs Resident Soil THQ=1.0		**0.14**	**1.2**	**0.12**	**NE**	**NE**	**NE**	**5.6**	**6,300**	**190**	**0.23**	**3,100**	**78**	**NE**	**NE**	**NE**	**0.081**	**0.058**	**0.26**	**250**
Field ID	**Date**																			
TP14_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP15_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP16_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	<1.0	<0.5
TP17_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP21_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP22_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP28_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP29_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP30_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP31_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP32_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 9
Soil Analyitcal Results - Volatile Organic Compounds, Explosives and Others

	NA		Other				Explosives					VOCs		
	DCPA (Chlorthal) Diacid	Irgarol	3,5-Dichlorobenzoic acid	Acetophenone	Actril (loxynil)	Phosalone	1,3,5-Trinitrobenzene	1,3-Dinitrobenzene	2,4-Dinitrotoluene	2,6-dinitrotoluene	Nitrobenzene	cis-1,4-Dichloro-2-butene	trans-1,4-Dichloro-2-butene	Pentachloroethane
	mg/kg	µg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
USEPA RSLs Resident Soil THQ=0.1	NE	NE	NE	780	NE	NE	220	0.63	1.7	0.36	5.1	0.0074	0.0074	7.7
USEPA RSLs Resident Soil THQ=1.0	**NE**	**NE**	**NE**	**7,800**	**NE**	**NE**	**2,200**	**6.3**	**1.7**	**0.36**	**5.1**	**0.0074**	**0.0074**	**7.7**
Field ID	**Date**													
S01_0.15	**13 Jul 2022**	<0.5	<500	<0.5	-	<1	-	-	-	-	-	-	-	-
S02_0.15	**13 Jul 2022**	<0.5	<500	<0.5	-	<1	-	-	-	-	-	-	-	-
S03_0.15	**13 Jul 2022**	<0.5	<500	<0.5	-	<1	-	-	-	-	-	-	-	-
S04_0.15	**13 Jul 2022**	<0.5	<500	<0.5	-	<1	-	-	-	-	-	-	-	-
S05_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-
S06_0.15	**13 Jul 2022**	<0.5	<500	<0.5	-	<1	-	-	-	-	-	-	-	-
S07_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-
S08_0.15	**13 Jul 2022**	<0.5	<500	<0.5	-	<1	-	-	-	-	-	-	-	-
S09_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-
S10_0.15	**13 Jul 2022**	-	-	-	<1	-	<0.5	-	<1	-	<1	<1	-	-	<0.5
S11_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S12_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S13_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S14_0.15	**13 Jul 2022**	-	-	-	<1	-	<0.5	-	<1	-	<1	<1	-	-	<0.5
S14_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S15_0.15	**13 Jul 2022**	<0.5	<500	<0.5	-	<1	-	-	-	-	-	-	-	-	-
S16_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG01	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SED01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP33_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP20_0-0.15	**13 Jul 2023**	-	-	-	<0.5	-	-	<0.5	-	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5
TP34_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP26_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP27_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP12_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP11_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP13_0-0.15	**13 Jul 2023**	-	-	-	<0.5	-	-	<0.5	-	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5
TP07_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP10_0-0.15	**13 Jul 2023**	-	-	-	<0.5	-	-	<0.5	-	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5
TP08_0-0.15	**13 Jul 2023**	-	-	-	<0.5	-	-	<0.5	-	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5
TP09_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP25_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP01_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP02_0-0.15	**14 Jul 2023**	-	-	-	<0.5	-	-	<0.5	-	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5
TP03_0-0.15	**14 Jul 2023**	-	-	-	<0.5	-	-	<0.5	-	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5
TP04_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 9
Soil Analyitcal Results - Volatile Organic Compounds, Explosives and Others

	NA		Other				Explosives					VOCs		
	DCPA (Chlorthal) Diacid	Irgarol	3,5-Dichlorobenzoic acid	Acetophenone	Actril (loxynil)	Phosalone	1,3,5-Trinitrobenzene	1,3-Dinitrobenzene	2,4-Dinitrotoluene	2,6-dinitrotoluene	Nitrobenzene	cis-1,4-Dichloro-2-butene	trans-1,4-Dichloro-2-butene	Pentachloroethane
	mg/kg	µg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
USEPA RSLs Resident Soil THQ=0.1	NE	NE	NE	780	NE	NE	220	0.63	1.7	0.36	5.1	0.0074	0.0074	7.7
USEPA RSLs Resident Soil THQ=1.0	**NE**	**NE**	**NE**	**7,800**	**NE**	**NE**	**2,200**	**6.3**	**1.7**	**0.36**	**5.1**	**0.0074**	**0.0074**	**7.7**
Field ID	**Date**													
TP05_0-0.15	**14 Jul 2023**	-	-	-	<0.5	-	-	<0.5	-	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5
TP06_0-0.15	**14 Jul 2023**	-	-	-	<0.5	-	-	<0.5	-	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5
TP23_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP24_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP14_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP15_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP16_0-0.15	**13 Jul 2023**	-	-	-	<0.5	-	-	<0.5	-	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5
TP17_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP21_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP22_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP28_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP29_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP30_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP31_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP32_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 10
Soil Analyitcal Results - Pesticides, Anilines and Phthalates

		Pesticides								Anilines						Phthalates					
		Carbaryl	Carbofuran	Chlorobenzilate	Carbazole	Demeton-S-methyl	Fenamiphos	Parathion	Pirimphos-ethyl	2-nitroaniline	3-nitroaniline	4-chloroaniline	4-nitroaniline	2-methyl-5-nitroaniline	Aniline	Bis(2-ethylhexyl) phthalate	Butyl benzyl phthalate	Diethylphthalate	Dimethyl phthalate	Di-n-butyl phthalate	Di-n-octyl phthalate
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.5	0.5	0.5	0.5	0.05	0.05	0.1	0.05	1	1	0.5	0.5	0.5	0.5	5	0.5	0.5	0.5	0.5	0.5
USEPA RSLs Resident Soil THQ=0.1		630	32	4.9	NE	NE	1.6	38	NE	63	NE	2.7	25	60	44	39	290	5,100	NE	630	63
USEPA RSLs Resident Soil THQ=1.0		**6,300**	**320**	**4.9**	**NE**	**NE**	**16**	**380**	**NE**	**630**	**NE**	**2.7**	**27**	**60**	**95**	**39**	**290**	**51,000**	**NE**	**6,300**	**630**
Field ID	**Date**																				
S01_0.15	**13 Jul 2022**	<0.5	<0.5	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
S02_0.15	**13 Jul 2022**	<0.5	<0.5	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
S03_0.15	**13 Jul 2022**	<0.5	<0.5	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
S04_0.15	**13 Jul 2022**	<0.5	<0.5	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
S05_0.15	**13 Jul 2022**	-	-	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
S06_0.15	**13 Jul 2022**	<0.5	<0.5	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
S07_0.15	**13 Jul 2022**	-	-	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
S08_0.15	**13 Jul 2022**	<0.5	<0.5	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
S09_0.15	**13 Jul 2022**	-	-	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
S10_0.15	**13 Jul 2022**	-	-	-	<1	-	<0.5	<0.1	-	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1	<5	<1
S11_0.15	**13 Jul 2022**	-	-	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
S12_0.15	**13 Jul 2022**	-	-	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
S13_0.15	**13 Jul 2022**	-	-	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
S14_0.15	**13 Jul 2022**	-	-	-	<1	-	<0.5	<0.1	-	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1	<5	<1
S14_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S15_0.15	**13 Jul 2022**	<0.5	<0.5	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
S16_0.15	**13 Jul 2022**	-	-	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
BG01	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SED01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP33_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP20_0-0.15	**13 Jul 2023**	-	-	<0.5	<0.5	-	-	-	<0.5	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5
TP34_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP26_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP27_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP12_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP11_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP13_0-0.15	**13 Jul 2023**	-	-	<0.5	<0.5	-	-	-	<0.5	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5
TP07_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP10_0-0.15	**13 Jul 2023**	-	-	<0.5	<0.5	-	-	-	<0.5	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5
TP08_0-0.15	**13 Jul 2023**	-	-	<0.5	<0.5	-	-	-	<0.5	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5
TP09_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-

Table 10
Soil Analyitcal Results - Pesticides, Anilines and Phthalates

		Pesticides								Anilines						Phthalates					
		Carbaryl	Carbofuran	Chlorobenzilate	Carbazole	Demeton-S-methyl	Fenamiphos	Parathion	Pirimphos-ethyl	2-nitroaniline	3-nitroaniline	4-chloroaniline	4-nitroaniline	2-methyl-5-nitroaniline	Aniline	Bis(2-ethylhexyl) phthalate	Butyl benzyl phthalate	Diethylphthalate	Dimethyl phthalate	Di-n-butyl phthalate	Di-n-octyl phthalate
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.5	0.5	0.5	0.5	0.05	0.05	0.1	0.05	1	1	0.5	0.5	0.5	0.5	5	0.5	0.5	0.5	0.5	0.5
USEPA RSLs Resident Soil THQ=0.1		630	32	4.9	NE	NE	1.6	38	NE	63	NE	2.7	25	60	44	39	290	5,100	NE	630	63
USEPA RSLs Resident Soil THQ=1.0		**6,300**	**320**	**4.9**	**NE**	**NE**	**16**	**380**	**NE**	**630**	**NE**	**2.7**	**27**	**60**	**95**	**39**	**290**	**51,000**	**NE**	**6,300**	**630**
Field ID	**Date**																				
TP25_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
BG01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP01_0-0.15	**14 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP02_0-0.15	**14 Jul 2023**	-	-	<0.5	<0.5	-	-	-	<0.5	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5
TP03_0-0.15	**14 Jul 2023**	-	-	<0.5	<0.5	-	-	-	<0.5	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5
TP04_0-0.15	**14 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP05_0-0.15	**14 Jul 2023**	-	-	<0.5	<0.5	-	-	-	<0.5	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5
TP06_0-0.15	**14 Jul 2023**	-	-	<0.5	<0.5	-	-	-	<0.5	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5
TP23_0-0.15	**14 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP24_0-0.15	**14 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP14_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP15_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP16_0-0.15	**13 Jul 2023**	-	-	<0.5	<0.5	-	-	-	<0.5	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5
TP17_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP18_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP19_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP21_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP22_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP28_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP29_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP30_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP31_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-
TP32_0-0.15	**13 Jul 2023**	-	-	-	-	<0.05	<0.05	<0.2	<0.05	-	-	-	-	-	-	-	-	-	-	-	-

Table 11
Soil Analyitcal Results - Organophosphorous Pesticides

		Organophosphorous Pesticides																								
		Azinophos methyl	Bromophos-ethyl	Carbophenothion	Chlorfenvinphos	Chlorpyrifos	Chlorpyrifos-methyl	Coumaphos	Diazinon	Dichlorvos	Dimethoate	Disulfoton	Ethion	Ethyl methanesulfonate	Fenitrothion	Fenthion	Malathion	Methidathion	Methyl parathion	Mevinphos (Phosdrin)	Monocrotophos	Phorate	Prothiofos	Ronnel	Safrole
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.05	0.05	0.05	0.05	0.05	0.05	0.5	0.05	0.05	0.05	0.5	0.05	1	0.1	0.05	0.05	0.5	0.2	0.5	0.2	0.5	0.05	0.1	1
USEPA RSLs Resident Soil THQ=0.1		19	NE	NE	4.4	6.3	63	NE	4.4	1.9	14	0.25	3.2	NE	NE	NE	130	9.5	1.6	NE	NE	1.3	NE	390	0.55
USEPA RSLs Resident Soil THQ=1.0		**190**	**NE**	**NE**	**44**	**63**	**630**	**NE**	**44**	**1.9**	**140**	**2.5**	**32**	**NE**	**NE**	**NE**	**1,300**	**95**	**16**	**NE**	**NE**	**13**	**NE**	**3,900**	**0.55**
Field ID	**Date**																								
S01_0.15	**13 Jul 2022**	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	-	<0.1	-	-	-	-	-	-	<0.1	-
S02_0.15	**13 Jul 2022**	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	-	<0.1	-	-	-	-	-	-	<0.1	-
S03_0.15	**13 Jul 2022**	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	-	<0.1	-	-	-	-	-	-	<0.1	-
S04_0.15	**13 Jul 2022**	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	-	<0.1	-	-	-	-	-	-	<0.1	-
S05_0.15	**13 Jul 2022**	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	-	<0.1	-	-	-	-	-	-	<0.1	-
S06_0.15	**13 Jul 2022**	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	-	<0.1	-	-	-	-	-	-	<0.1	-
S07_0.15	**13 Jul 2022**	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	-	<0.1	-	-	-	-	-	-	<0.1	-
S08_0.15	**13 Jul 2022**	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	-	<0.1	-	-	-	-	-	-	<0.1	-
S09_0.15	**13 Jul 2022**	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	-	<0.1	-	-	-	-	-	-	<0.1	-
S10_0.15	**13 Jul 2022**	<0.1	<0.1	-	-	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.5	<0.1	<1	<0.1	<0.5	<0.1	<0.5	<0.5	<0.5	-	<0.5	-	<0.1	<1
S11_0.15	**13 Jul 2022**	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	-	<0.1	-	-	-	-	-	-	<0.1	-
S12_0.15	**13 Jul 2022**	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	-	<0.1	-	-	-	-	-	-	<0.1	-
S13_0.15	**13 Jul 2022**	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	-	<0.1	-	-	-	-	-	-	<0.1	-
S14_0.15	**13 Jul 2022**	<0.1	<0.1	-	-	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.5	<0.1	<1	<0.1	<0.5	<0.1	<0.5	<0.5	<0.5	-	<0.5	-	<0.1	<1
S14_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S15_0.15	**13 Jul 2022**	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	-	<0.1	-	-	-	-	-	-	<0.1	-
S16_0.15	**13 Jul 2022**	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	-	<0.1	-	-	-	-	-	-	<0.1	-
BG01	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SED01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP33_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP20_0-0.15	**13 Jul 2023**	-	-	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	-	-	<0.5	<0.5	-	-	-	-	-	<0.5	-	-
TP34_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP26_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP27_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP12_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP11_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP13_0-0.15	**13 Jul 2023**	-	-	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	-	-	<0.5	<0.5	-	-	-	-	-	<0.5	-	-
TP07_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP10_0-0.15	**13 Jul 2023**	-	-	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	-	-	<0.5	<0.5	-	-	-	-	-	<0.5	-	-
TP08_0-0.15	**13 Jul 2023**	-	-	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	-	-	<0.5	<0.5	-	-	-	-	-	<0.5	-	-
TP09_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP25_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
BG01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP01_0-0.15	**14 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP02_0-0.15	**14 Jul 2023**	-	-	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	-	-	<0.5	<0.5	-	-	-	-	-	<0.5	-	-
TP03_0-0.15	**14 Jul 2023**	-	-	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	-	-	<0.5	<0.5	-	-	-	-	-	<0.5	-	-
TP04_0-0.15	**14 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP05_0-0.15	**14 Jul 2023**	-	-	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	-	-	<0.5	<0.5	-	-	-	-	-	<0.5	-	-
TP06_0-0.15	**14 Jul 2023**	-	-	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	-	-	<0.5	<0.5	-	-	-	-	-	<0.5	-	-
TP23_0-0.15	**14 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP24_0-0.15	**14 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP14_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP15_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP16_0-0.15	**13 Jul 2023**	-	-	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	-	-	<0.5	<0.5	-	-	-	-	-	<0.5	-	-
TP17_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP18_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP19_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP21_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-

Table 11
Soil Analyitcal Results - Organophosphorous Pesticides

		Organophosphorous Pesticides																								
		Azinophos methyl	Bromophos-ethyl	Carbophenothion	Chlorfenvinphos	Chlorpyrifos	Chlorpyrifos-methyl	Coumaphos	Diazinon	Dichlorvos	Dimethoate	Disulfoton	Ethion	Ethyl methanesulfonate	Fenitrothion	Fenthion	Malathion	Methidathion	Methyl parathion	Mevinphos (Phosdrin)	Monocrotophos	Phorate	Prothiofos	Ronnel	Safrole
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.05	0.05	0.05	0.05	0.05	0.05	0.5	0.05	0.05	0.05	0.5	0.05	1	0.1	0.05	0.05	0.5	0.2	0.5	0.2	0.5	0.05	0.1	1
USEPA RSLs Resident Soil THQ=0.1		19	NE	NE	4.4	6.3	63	NE	4.4	1.9	14	0.25	3.2	NE	NE	NE	130	9.5	1.6	NE	NE	1.3	NE	390	0.55
USEPA RSLs Resident Soil THQ=1.0		**190**	**NE**	**NE**	**44**	**63**	**630**	**NE**	**44**	**1.9**	**140**	**2.5**	**32**	**NE**	**NE**	**NE**	**1,300**	**95**	**16**	**NE**	**NE**	**13**	**NE**	**3,900**	**0.55**
Field ID	**Date**																								
TP22_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP28_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP29_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP30_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP31_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-
TP32_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	-	-	<0.05	<0.05	-	<0.2	-	<0.2	-	<0.05	-	-

Table 12
Soil Analyitcal Results - Organochlorine Pesticides

		Organochlorine Pesticides																								
		4,4-DDE	a-BHC	Aldrin	Aldrin + Dieldrin	b-BHC	Chlordane	Chlordane (cis)	Chlordane (trans)	d-BHC	DDD	DDT	DDT+DDE+DDD	Dieldrin	Endosulfan	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	Endrin ketone	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Methoxychlor
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1
EIL with site specifi values		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	180	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HIL-A		NE	NE	NE	6	NE	50	NE	NE	NE	NE	NE	240	NE	270	NE	NE	NE	10	NE	NE	NE	6	NE	300
HIL-C		NE	NE	NE	10	NE	70	NE	NE	NE	NE	NE	400	NE	340	NE	NE	NE	20	NE	NE	NE	10	NE	400
HSL-A (DC)		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HSL-C (DC)		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HSL-MW (DC)		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
USEPA RSLs Resident Soil THQ=0.1		2	0.086	0.039	NE	0.3	NE	3.6	3.6	NE	2.3	1.9	NE	0.034	47	NE	NE	38	1.9	NE	NE	0.57	0.13	0.07	32
USEPA RSLs Resident Soil THQ=1.0		**2**	**0.086**	**0.039**	**NE**	**0.3**	**NE**	**36**	**36**	**NE**	**2.3**	**1.9**	**NE**	**0.034**	**470**	**NE**	**NE**	**380**	**19**	**NE**	**NE**	**0.57**	**0.13**	**0.07**	**320**
Field ID	**Date**																								
S01_0.15	**13 Jul 2022**	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
S02_0.15	**13 Jul 2022**	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
S03_0.15	**13 Jul 2022**	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
S04_0.15	**13 Jul 2022**	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
S05_0.15	**13 Jul 2022**	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
S06_0.15	**13 Jul 2022**	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
S07_0.15	**13 Jul 2022**	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
S08_0.15	**13 Jul 2022**	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
S09_0.15	**13 Jul 2022**	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
S10_0.15	**13 Jul 2022**	<0.1	<0.1	<0.1	-	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
S11_0.15	**13 Jul 2022**	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
S12_0.15	**13 Jul 2022**	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
S13_0.15	**13 Jul 2022**	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
S14_0.15	**13 Jul 2022**	<0.1	<0.1	<0.1	-	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
S14_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S15_0.15	**13 Jul 2022**	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
S16_0.15	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG01	**13 Jul 2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SED01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP33_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP20_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	-	<0.5	-	-	-	<0.5	<0.5	<1.0	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	-
TP34_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP26_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP27_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP12_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP11_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP13_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	-	<0.5	-	-	-	<0.5	<0.5	<1.0	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	-
TP07_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP10_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	-	<0.5	-	-	-	<0.5	<0.5	<1.0	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	-
TP08_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	-	<0.5	-	-	-	<0.5	<0.5	<1.0	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	-
TP09_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP25_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
BG01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP01_0-0.15	**14 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP02_0-0.15	**14 Jul 2023**	<0.5	<0.5	<0.5	-	<0.5	-	-	-	<0.5	<0.5	<1.0	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	-
TP03_0-0.15	**14 Jul 2023**	<0.5	<0.5	<0.5	-	<0.5	-	-	-	<0.5	<0.5	<1.0	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	-
TP04_0-0.15	**14 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	0.18	<0.05	0.18	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	**0.08**	<0.2
TP04_0.5	**14 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	0.20	<0.05	0.20	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	**0.09**	<0.2
TP05_0-0.15	**14 Jul 2023**	<0.5	<0.5	<0.5	-	<0.5	-	-	-	<0.5	<0.5	<1.0	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	-
TP06_0-0.15	**14 Jul 2023**	<0.5	<0.5	<0.5	-	<0.5	-	-	-	<0.5	<0.5	<1.0	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	-
TP23_0-0.15	**14 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP24_0-0.15	**14 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2

Table 12
Soil Analyitcal Results - Organochlorine Pesticides

		Organochlorine Pesticides																								
		4,4-DDE	a-BHC	Aldrin	Aldrin + Dieldrin	b-BHC	Chlordane	Chlordane (cis)	Chlordane (trans)	d-BHC	DDD	DDT	DDT+DDE+DDD	Dieldrin	Endosulfan	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	Endrin ketone	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Methoxychlor
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1
EIL with site specifi values		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	180	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HIL-A		NE	NE	NE	6	NE	50	NE	NE	NE	NE	NE	240	NE	270	NE	NE	NE	10	NE	NE	NE	6	NE	300
HIL-C		NE	NE	NE	10	NE	70	NE	NE	NE	NE	NE	400	NE	340	NE	NE	NE	20	NE	NE	NE	10	NE	400
HSL-A (DC)		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HSL-C (DC)		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HSL-MW (DC)		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
USEPA RSLs Resident Soil THQ=0.1		2	0.086	0.039	NE	0.3	NE	3.6	3.6	NE	2.3	1.9	NE	0.034	47	NE	NE	38	1.9	NE	NE	0.57	0.13	0.07	32
USEPA RSLs Resident Soil THQ=1.0		**2**	**0.086**	**0.039**	**NE**	**0.3**	**NE**	**36**	**36**	**NE**	**2.3**	**1.9**	**NE**	**0.034**	**470**	**NE**	**NE**	**380**	**19**	**NE**	**NE**	**0.57**	**0.13**	**0.07**	**320**
Field ID	**Date**																									
TP14_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP15_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP16_0-0.15	**13 Jul 2023**	<0.5	<0.5	<0.5	-	<0.5	-	-	-	<0.5	<0.5	<1.0	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	-
TP17_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP18_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP19_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP21_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP22_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP28_0-0.15	**13 Jul 2023**	0.11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	0.11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP29_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP30_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP31_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2
TP32_0-0.15	**13 Jul 2023**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2

Table 13
Soil Analyitcal Results - Herbicides

		Herbicides																														
		Metribuzin	2,4,5-Trichlorophenoxy Acetic Acid	2,4,5-TP (Silvex)	Hedonal	2,4-Dichlorprop	2,4,6-Trichlorophenoxy-acetic acid	Dichlorophenoxybutyric Acid (2,4-DB)	2-Chlorophenoxyacetic acid	4-Chlorophenoxy acetic acid	Ametryn	Acifluorfen	Atrazine	Bentazone	Bromoxynil	Chloramben	Clopyralid	Cyanazine	Dicamba	Dinoseb	Fluroxypyr	Hexazinone	2-Methyl-4-chlorophenoxyacetic acid	2-Methyl-4-Chlorophenoxy Butanoic Acid	Mecoprop	Molinate	Prometryn	Pronamide	Propazine	Simazine	Terbutryn	Triclopyr
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	2	0.5	1	0.5	1	0.5	0.5	0.5	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
HIL-A		NE	600	NE	900	NE	NE	NE	NE	NE	NE	NE	320	NE	NE	NE	NE	NE	NE	NE	NE	NE	600	600	600	NE	NE	NE	NE	NE	NE	NE
HIL-C		NE	800	NE	1,300	NE	NE	NE	NE	NE	NE	NE	400	NE	NE	NE	NE	NE	NE	NE	NE	NE	800	800	800	NE	NE	NE	NE	NE	NE	NE
USEPA RSLs Resident Soil THQ=0.1		160		51		NE	NE	NE	NE	NE	57	NE		190	5.3	95	NE	0.65	190	6.3	NE	210				13	250	470	130	4.5	6.3	NE
USEPA RSLs Resident Soil THQ=1.0		1,600		510		NE	NE	NE	NE	NE	570	NE		1,900	5.3	950	NE	0.65	1,900	63	NE	2,100				130	2,500	4,700	1,300	4.5	63	NE
Field ID	Date																															
S01_0.15	13 Jul 2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<1	<0.5	<1	<0.5	<0.5	<0.5	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
S02_0.15	13 Jul 2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<1	<0.5	<1	<0.5	<0.5	<0.5	<1	<1	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
S03_0.15	13 Jul 2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<1	<0.5	<1	<0.5	<0.5	<0.5	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
S04_0.15	13 Jul 2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<1	<0.5	<1	<0.5	<0.5	<0.5	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
S05_0.15	13 Jul 2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S06_0.15	13 Jul 2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<1	<0.5	<1	<0.5	<0.5	<0.5	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
S07_0.15	13 Jul 2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S08_0.15	13 Jul 2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<1	<0.5	<1	<0.5	<0.5	<0.5	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
S09_0.15	13 Jul 2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S10_0.15	13 Jul 2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	-	-	-	-	-	-	-	-	-	-	-	-
S11_0.15	13 Jul 2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S12_0.15	13 Jul 2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S13_0.15	13 Jul 2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S14_0.15	13 Jul 2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	-	-	-	-	-	-	-	-	-	-	-	-
S14_0.15	13 Jul 2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S15_0.15	13 Jul 2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<1	<0.5	<1	<0.5	<0.5	<0.5	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
S16_0.15	13 Jul 2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG01	13 Jul 2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SED01	13 Jul 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP33_0-0.15	13 Jul 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP20_0-0.15	13 Jul 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-
TP34_0-0.15	13 Jul 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP26_0-0.15	13 Jul 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP27_0-0.15	13 Jul 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP12_0-0.15	13 Jul 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP11_0-0.15	13 Jul 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 13
Soil Analyitcal Results - Herbicides

		Herbicides																														
		Metribuzin	2,4,5-Trichlorophenoxy Acetic Acid	2,4,5-TP (Silvex)	Hedonal	2,4-Dichlorprop	2,4,6-Trichlorophenoxy-acetic acid	Dichlorophenoxybutyric Acid (2,4-DB)	2-Chlorophenoxyacetic acid	4-Chlorophenoxy acetic acid	Ametryn	Acifluorfen	Atrazine	Bentazone	Bromoxynil	Chloramben	Clopyralid	Cyanazine	Dicamba	Dinoseb	Fluroxypyr	Hexazinone	2-Methyl-4-chlorophenoxyacetic acid	2-Methyl-4-chlorophenoxy Butanoic Acid	Mecoprop	Molinate	Prometryn	Pronamide	Propazine	Simazine	Terbutryn	Triclopyr
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	2	0.5	1	0.5	1	0.5	0.5	0.5	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
HIL-A		NE	600	NE	900	NE	NE	NE	NE	NE	NE	NE	320	NE	NE	NE	NE	NE	NE	NE	NE	NE	600	600	600	NE	NE	NE	NE	NE	NE	NE
HIL-C		NE	800	NE	1,300	NE	NE	NE	NE	NE	NE	NE	400	NE	NE	NE	NE	NE	NE	NE	NE	NE	800	800	800	NE	NE	NE	NE	NE	NE	NE
USEPA RSLs Resident Soil THQ=0.1		160		51		NE	NE	NE	NE	NE	57	NE		190	5.3	95	NE	0.65	190	6.3	NE	210				13	250	470	130	4.5	6.3	NE
USEPA RSLs Resident Soil THQ=1.0		**1,600**		**510**		**NE**	**NE**	**NE**	**NE**	**NE**	**570**	**NE**		**1,900**	**5.3**	**950**	**NE**	**0.65**	**1,900**	**63**	**NE**	**2,100**				**130**	**2,500**	**4,700**	**1,300**	**4.5**	**63**	**NE**
Field ID	**Date**																															
TP13_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-
TP07_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP10_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-
TP08_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-
TP09_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP25_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG01	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP01_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP02_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-
TP03_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-
TP04_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP05_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-
TP06_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-
TP23_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP24_0-0.15	**14 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP14_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP15_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP16_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-
TP17_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP21_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP22_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP28_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP29_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP30_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP31_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP32_0-0.15	**13 Jul 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 14
Subsurface Asbestos Field Screening

Date:	14 July, 11 and 23 August		WEPL Staff:		Louis Grogan	Robin Anderson	Jade Dennis	

Sample Location	Approximate depth of sieved material (mbgl)	Weight of soil excavated (kg)	Weight of asbestos found (kg)	ACM asbestos concentration (%)	% Asbestos content x ACM (kg)	Asbestos weight/soil weight	Sample concentration of asbestos (% w/w) <0.04 = Pass (Residential B) ≥0.04 = Fail (Residential B)	Sample concentration of asbestos (% w/w) <0.02 = Pass (Recreational) ≥0.02 = Fail (Recreational)	Sample concentration of asbestos (% w/w) <0.01 = Pass (Residential A) ≥0.01 = Fail (Residential A)	ACM notes
TP01	**0-1.0**	15.71	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP02	**0-1.0**	15.32	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP03	**0-1.0**	15.32	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP04	**0-1.0**	16.32	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP05	**0-1.0**	14.620	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP06	**0-1.0**	14.87	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP07	**0-1.0**	14.79	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP08	**0-1.0**	15.13	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP09	**0-1.0**	15.23	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP10	**0-1.0**	14.89	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP11	**0-1.0**	13.92	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP12	**0-1.0**	14.76	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP13	**0-1.0**	15.02	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP14	**0-1.0**	14.54	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP15	**0-1.0**	14.79	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP16	**0-1.0**	14.02	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP17	**0-1.0**	14.89	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP18	**0-1.0**	13.21	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP19	**0-1.0**	15.79	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP20	**0-1.0**	15.37	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP21	**0-1.0**	15.01	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP22	**0-1.0**	15.23	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP23	**0-1.0**	16.11	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP24	**0-1.0**	16.01	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP25	**0-1.0**	15.43	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP26	**0-1.0**	15.42	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP27	**0-1.0**	13.64	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP28	**0-1.0**	14.79	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP29	**0-1.0**	14.24	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP30	**0-1.0**	15.27	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP31	**0-1.0**	15.24	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP32	**0-1.0**	14.40	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP33	**0-1.0**	15.23	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
TP34	**0-1.0**	16.14	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS01	**0-0.3**	15.9	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS02	**0-0.3**	14.26	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS03	**0-0.3**	15.07	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS04	**0-0.3**	14.21	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS05	**0-0.3**	14.41	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS06	**0-0.3**	15.06	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS07	**0-0.3**	15.03	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS08	**0-0.3**	15.66	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS09	**0-0.3**	14.58	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS10	**0-0.3**	14.73	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS11	**0-0.3**	14.32	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS12	**0-0.3**	14.23	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS13	**0-0.3**	16.11	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS14	**0-0.3**	15.4	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS15	**0-0.3**	15.1	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS16	**0-0.3**	14.25	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS17	**0-0.3**	15.53	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS18	**0-0.3**	15.7	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS19	**0-0.3**	15.1	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS20	**0-0.3**	15.7	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM

Table 14
Subsurface Asbestos Field Screening

Date:	14 July, 11 and 23 August		WEPL Staff:		Louis Grogan	Robin Anderson	Jade Dennis	

Sample Location	Approximate depth of sieved material (mbgl)	Weight of soil excavated (kg)	Weight of asbestos found (kg)	ACM asbestos concentration (%)	% Asbestos content x ACM (kg)	Asbestos weight/soil weight	Sample concentration of asbestos (% w/w) <0.04 = Pass (Residential B) ≥0.04 = Fail (Residential B)	Sample concentration of asbestos (% w/w) <0.02 = Pass (Recreational) ≥0.02 = Fail (Recreational)	Sample concentration of asbestos (% w/w) <0.01 = Pass (Residential A) ≥0.01 = Fail (Residential A)	ACM notes
GS21	**0-0.3**	15.96	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS22	**0-0.3**	16.74	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS23	**0-0.3**	16.01	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS24	**0-0.3**	15.78	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS25	**0-0.3**	15.4	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS26	**0-0.3**	15.2	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS27	**0-0.3**	14.6	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS28	**0-0.3**	15.3	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS29	**0-0.3**	14.9	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS30	**0-0.3**	15.6	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS31	**0-0.3**	15.7	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS32	**0-0.3**	15.5	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS33	**0-0.3**	15.1	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS34	**0-0.3**	14.7	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS35	**0-0.3**	14.8	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS36	**0-0.3**	15.9	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS37	**0-0.3**	15.78	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS38	**0-0.3**	16.12	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS39	**0-0.3**	14.91	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS40	**0-0.3**	15.82	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS41	**0-0.3**	16.14	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS42	**0-0.3**	15.16	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS43	**0-0.3**	15.89	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS44	**0-0.3**	16.34	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS45	**0-0.3**	15.15	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS46	**0-0.3**	14.87	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS47	**0-0.3**	15.87	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS48	**0-0.3**	15.56	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS49	**0-0.3**	16.21	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS50	**0-0.3**	14.95	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS51	**0-0.3**	16.01	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM
GS52	**0-0.3**	14.96	0	15	0	0.0000000	0.0000	0.0000	0.0000	No ACM

Table 15
Surface ACM Inspection

Date:	14 July, 11 and 23 August	WEPL Staff:		Louis Grogan	Robin Anderson	Jade Dennis	

	Pass 1				Pass 2				Pass 3			
Grid Cell #	**# of ACM Frags**	**Weight of Fragments (kg)**	**Notes**	**Asbestos Concentration**	**# of ACM Frags**	**Weight of Fragments (kg)**	**Notes**	**Asbestos Concentration**	**# of ACM Frags**	**Weight of Fragments (kg)**	**Notes**	**Asbestos Concentration**
GS01	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS02	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS03	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS04	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS05	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS06	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS07	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS08	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS09	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS10	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS11	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS12	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS13	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS14	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS15	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS16	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS17	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS18	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS19	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS20	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS21	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS22	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS23	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS24	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS25	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS26	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS27	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS28	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS29	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS30	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS31	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS32	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS33	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS34	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS35	1	0.054	No ACM	0.049%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS36	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS37	1	0.019	Non friable	0.017%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS38	1	0.031	Non friable	0.028%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS39	1	0.028	Non friable	0.025%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS40	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS41	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS42	1	0.022	Non friable	0.020%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS43	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS44	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS45	1	0.025	Non friable	0.023%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS46	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS47	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS48	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS49	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS50	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS51	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
GS52	0	0	No ACM	0.000%	0	0	No ACM	0.000%	0	0	No ACM	0.000%
	Total:	0.179			Total:	0						

Table 16
Groundwater Analyitcal Results - Inorganics and Biological

					Field ID	GW01	GW02	GW03	GW04
					Date	19 Jul 2023	19 Jul 2023	19 Jul 2023	19 Jul 2023
	Unit	EQL	FW (95%)	DOH NPUG	STIW				
Inorganics									
Total Phosphorus as P (Organic Phosphate as P)	mg/L	0.01	0.065	NE	0.8	0.05	0.04	0.04	0.15
Sulfate as SO4 - Turbidimetric (filtered)	mg/L	1	NE	NE		66	60	8	60
Nitrite + Nitrate as N	mg/L	0.01	0.15	100		7.35	21.9	4.88	0.03
Alkalinity (Bicarbonate as CaCO3)	mg/L	1	NE	NE		47	30	17	145
Alkalinity (Carbonate as CaCO3)	mg/L	1	NE	NE		<1	<1	<1	<1
Alkalinity (Hydroxide) as CaCO3	mg/L	1	NE	NE		<1	<1	<1	<1
Alkalinity (total) as CaCO3	mg/L	1	NE	NE		47	30	17	145
Ammonia as N	mg/L	0.01	0.9	0.411		0.09	<0.01	0.12	0.18
Anions Total	meq/L	0.01	NE	NE		6.88	5.87	1.62	5.13
Biochemical Oxygen Demand	mg/L	2	NE	NE		<2	<2	<2	<2
Cations Total	meq/L	0.01	NE	NE		6.78	5.55	1.70	4.97
Chloride	mg/L	1	NE	250		162	87	27	35
Magnesium (filtered)	mg/L	1	NE	NE		11	16	5	18
Potassium (filtered)	mg/L	1	NE	NE		6	10	4	4
Calcium (filtered)	mg/L	1	NE	NE		18	37	8	46
Electrical Conductivity (Lab)	µS/cm	1	NE	NE		752	628	192	514
Ionic Balance	%	0.01	NE	NE		0.72	2.78	2.39	1.65
Kjeldahl Nitrogen Total	mg/L	0.1	NE	NE		1.0	1.3	0.7	0.6
Nitrate (as N)	mg/L	0.01	NE	113		7.33	21.9	4.86	0.02
Nitrite (as N)	mg/L	0.01	NE	9		0.02	0.01	0.02	0.01
Organic Nitrogen as N	mg/L	0.1	NE	NE		0.9	1.3	0.6	0.4
Nitrogen (Total)	mg/L	0.1	1.2	NE	25	8.4	23.2	5.6	0.6
pH (Lab)	-	0.01	NE	NE		6.55	6.32	6.62	7.15
Reactive Phosphorus as P (Orthophosphate as P)	mg/L	0.01	0.04	NE		<0.01	<0.01	<0.01	<0.01
Sodium (filtered)	mg/L	1	NE	NE		111	49	18	25
Biological									
Faecal Coliforms	CFU/100mL	1	NE	NE		2[#1]	23	37	15
Coliform	cfu/100 ml	1	NE	NE		15	26	260	120
E. Coli	cfu/100 ml	1	NE	NE		<1	<1	3[#1]	1[#1]

Table 17
Groundwater Analyitcal Results - Metals and Others

						Field ID	**GW01**	**GW02**	**GW03**	**GW04**
						Date	**19 Jul 2023**	**19 Jul 2023**	**19 Jul 2023**	**19 Jul 2023**
	Unit	EQL	FW (95%)	DOH NPUG	STIW					
Metals										
Arsenic (filtered)	**mg/L**	0.001	0.013	0.01	2		<0.001	<0.001	<0.001	0.004
Cadmium (filtered)	**mg/L**	0.0001	0.0002	0.02	0.05		<0.0001	<0.0001	<0.0001	<0.0001
Chromium (III+VI) (filtered)	**mg/L**	0.001	0.0033	1	1		0.001	0.002	<0.001	<0.001
Copper (filtered)	**mg/L**	0.001	0.0014	20	5		<0.001	0.002	<0.001	<0.001
Lead (filtered)	**mg/L**	0.001	0.0034	0.1	5		<0.001	<0.001	<0.001	<0.001
Mercury (filtered)	**mg/L**	0.0001	0.0006	0.01	0.002		<0.0001	<0.0001	<0.0001	<0.0001
Nickel (filtered)	**mg/L**	0.001	0.011	0.2	2		0.002	<0.001	0.005	<0.001
Zinc (filtered)	**mg/L**	0.005	0.008	3	5		0.016	<0.005	<0.005	<0.005
NA										
tert-Amyl ethyl ether (TAEE)	**µg/L**	1	NE	NE			<1	<1	<1	<1
Ethyl tert-Butyl Ether (ETBE)	**µg/L**	1	NE	NE			<1	<1	<1	<1
tert-Butyl alcohol	**µg/L**	5	NE	NE			<5	<5	<5	<5
Other										
Acetophenone	**µg/L**	2	NE	NE			<2	<2	<2	<2

Table 18
Groundwater Analyitcal Results - Hydrocarbons

					Field ID	GW01	GW02	GW03	GW04
					Date	19 Jul 2023	19 Jul 2023	19 Jul 2023	19 Jul 2023
	Unit	EQL	FW (95%)	HSL-A	DOH NPUG				
BTEX									
Naphthalene (BTEX)	mg/L	0.005	0.016	NE	NE	<0.005	<0.005	<0.005	<0.005
Benzene	µg/L	1	950	800	10	<1	<1	<1	<1
Toluene	µg/L	2	180	NE	25	<2	<2	<2	<2
Ethylbenzene	µg/L	2	80	NE	3	<2	<2	<2	<2
Xylene (m & p)	µg/L	2	NE	NE	NE	<2	<2	<2	<2
Xylene (o)	µg/L	2	350	NE	NE	<2	<2	<2	<2
Xylene Total	µg/L	2	NE	NE	20	<2	<2	<2	<2
Total BTEX	µg/L	1	NE	NE	NE	<1	<1	<1	<1
TRH									
C6-C10 Fraction (F1)	µg/L	20	NE	NE	NE	<20	<20	<20	<20
C6-C10 (F1 minus BTEX)	µg/L	20	NE	1,000[#5]	100	<20	<20	<20	<20
>C10-C16 Fraction (F2)	µg/L	100	NE	NE	NE	<100	<100	<100	<100
>C10-C16 Fraction (F2 minus Naphthalene)	µg/L	100	NE	1,000[#2]	900	<100	<100	<100	<100
>C16-C34 Fraction (F3)	µg/L	100	NE	NE	900	<100	<100	<100	<100
>C34-C40 Fraction (F4)	µg/L	100	NE	NE	900	<100	<100	<100	<100
>C10-C40 Fraction (Sum)	µg/L	100	NE	NE	NE	<100	<100	<100	<100
TPH									
C6-C9 Fraction	µg/L	20	NE	NE	NE	<20	<20	<20	<20
C10-C14 Fraction	µg/L	50	NE	NE	NE	<50	<50	<50	<50
C15-C28 Fraction	µg/L	100	NE	NE	NE	<100	<100	<100	<100
C29-C36 Fraction	µg/L	50	NE	NE	NE	<50	<50	<50	<50
C10-C36 Fraction (Sum)	µg/L	50	NE	NE	NE	<50	<50	<50	<50

Table 19
Groundwater Analyitcal Results - Polycyclic Armoatic Hydrocarbons and Volitle Organic Compounds

					Field ID	GW01	GW02	GW03	GW04
					Date	19 Jul 2023	19 Jul 2023	19 Jul 2023	19 Jul 2023
	Unit	EQL	FW (95%)	DOH NPUG					
PAH									
Benzo(b+j+k)fluoranthene	mg/L	0.004	NE	NE		<0.004	<0.004	<0.004	<0.004
2-chloronaphthalene	µg/L	2	NE	NE		<2	<2	<2	<2
2-methylnaphthalene	µg/L	2	NE	NE		<2	<2	<2	<2
3-methylcholanthrene	µg/L	2	NE	NE		<2	<2	<2	<2
7,12-dimethylbenz(a)anthracene	µg/L	2	NE	NE		<2	<2	<2	<2
Acenaphthene	µg/L	2	NE	NE		<2	<2	<2	<2
Acenaphthylene	µg/L	2	NE	NE		<2	<2	<2	<2
Anthracene	µg/L	2	0.4	NE		<2	<2	<2	<2
Benz(a)anthracene	µg/L	2	NE	NE		<2	<2	<2	<2
Benzo(a) pyrene	µg/L	2	0.2	0.1		<2	<2	<2	<2
Benzo(g,h,i)perylene	µg/L	2	NE	NE		<2	<2	<2	<2
Chrysene	µg/L	2	NE	NE		<2	<2	<2	<2
Dibenz(a,h)anthracene	µg/L	2	NE	NE		<2	<2	<2	<2
Fluoranthene	µg/L	2	1.4	NE		<2	<2	<2	<2
Fluorene	µg/L	2	NE	NE		<2	<2	<2	<2
Indeno(1,2,3-c,d)pyrene	µg/L	2	NE	NE		<2	<2	<2	<2
Naphthalene	µg/L	2	16	NE		<2	<2	<2	<2
Phenanthrene	µg/L	2	NE	NE		<2	<2	<2	<2
Pyrene	µg/L	2	2	NE		<2	<2	<2	<2
Benzo(a)pyrene TEQ calc (Zero)	mg/L	0.002	NE	NE		<0.002	<0.002	<0.002	<0.002
PAHs (Sum of total)	µg/L	2	NE	NE		<2	<2	<2	<2
VOCs									
cis-1,4-Dichloro-2-butene	µg/L	5	NE	NE		<5	<5	<5	<5
trans-1,4-Dichloro-2-butene	µg/L	5	NE	NE		<5	<5	<5	<5
Diisopropyl ether	mg/L	0.001	NE	NE		<0.001	<0.001	<0.001	<0.001
Pentachloroethane	µg/L	5	NE	NE		<5	<5	<5	<5

Table 20
Groundwater Analyitcal Results - Semi-Volitle Organic Compounds and Monocyclic Aromatic Hydrocarbons

					Field ID	GW01	GW02	GW03	GW04
					Date	19 Jul 2023	19 Jul 2023	19 Jul 2023	19 Jul 2023
	Unit	EQL	FW (95%)	DOH NPUG					
SVOCs									
2-(acetylamino) fluorene	µg/L	2	NE	NE		<2	<2	<2	<2
3,3-Dichlorobenzidine	µg/L	2	NE	NE		<2	<2	<2	<2
4-(dimethylamino) azobenzene	µg/L	2	NE	NE		<2	<2	<2	<2
4-bromophenyl phenyl ether	µg/L	2	NE	NE		<2	<2	<2	<2
4-chlorophenyl phenyl ether	µg/L	2	NE	NE		<2	<2	<2	<2
4-Nitroquinoline-N-oxide	µg/L	2	NE	NE		<2	<2	<2	<2
Azobenzene	µg/L	2	NE	NE		<2	<2	<2	<2
Bis(2-chloroethoxy) methane	µg/L	2	NE	NE		<2	<2	<2	<2
Bis(2-chloroethyl)ether	µg/L	2	NE	NE		<2	<2	<2	<2
Dibenzofuran	µg/L	2	NE	NE		<2	<2	<2	<2
Hexachloropropene	µg/L	2	NE	NE		<2	<2	<2	<2
Methapyrilene	µg/L	2	NE	NE		<2	<2	<2	<2
N-nitrosomorpholine	µg/L	2	NE	NE		<2	<2	<2	<2
N-nitrosopiperidine	µg/L	2	NE	NE		<2	<2	<2	<2
N-nitrosopyrrolidine	µg/L	4	NE	NE		<4	<4	<4	<4
Phenacetin	µg/L	2	NE	NE		<2	<2	<2	<2
MAH									
1,2,4-trimethylbenzene	µg/L	5	NE	NE		<5	<5	<5	<5
1,3,5-trimethylbenzene	µg/L	5	NE	NE		<5	<5	<5	<5
Isopropylbenzene	µg/L	5	30	NE		<5	<5	<5	<5
n-butylbenzene	µg/L	5	NE	NE		<5	<5	<5	<5
n-propylbenzene	µg/L	5	NE	NE		<5	<5	<5	<5
p-isopropyltoluene	µg/L	5	NE	NE		<5	<5	<5	<5
sec-butylbenzene	µg/L	5	NE	NE		<5	<5	<5	<5
Styrene	µg/L	5	NE	4		<5	<5	<5	<5
tert-butylbenzene	µg/L	5	NE	NE		<5	<5	<5	<5

Table 21
Groundwater Analyitcal Results - Halogenated and Chlorinated Hydrocarbons

					Field ID	GW01	GW02	GW03	GW04
					Date	19 Jul 2023	19 Jul 2023	19 Jul 2023	19 Jul 2023
	Unit	EQL	FW (95%)	DOH NPUG					
Halogenated Benzenes									
1,2,3-trichlorobenzene	µg/L	5	3	NE	<5	<5	<5	<5	
1,2,4-trichlorobenzene	µg/L	2	85	700	<2	<2	<2	<2	
1,2-dichlorobenzene	µg/L	2	160	1	<2	<2	<2	<2	
1,3-dichlorobenzene	µg/L	2	260	20	<2	<2	<2	<2	
1,4-dichlorobenzene	µg/L	2	60	0.3	<2	<2	<2	<2	
2-chlorotoluene	µg/L	5	NE	NE	<5	<5	<5	<5	
4-chlorotoluene	µg/L	5	NE	NE	<5	<5	<5	<5	
Bromobenzene	µg/L	5	NE	NE	<5	<5	<5	<5	
Chlorobenzene	µg/L	5	55	10	<5	<5	<5	<5	
Hexachlorobenzene	µg/L	4	0.1	NE	<4	<4	<4	<4	
Pentachlorobenzene	µg/L	2	2	NE	<2	<2	<2	<2	
Chlorinated Hydrocarbons									
1,1,1,2-tetrachloroethane	µg/L	5	NE	NE	<5	<5	<5	<5	
1,1,1-trichloroethane	µg/L	5	270	2000	<5	<5	<5	<5	
1,1,2,2-tetrachloroethane	µg/L	5	400	NE	<5	<5	<5	<5	
1,1,2-trichloroethane	µg/L	5	6,500	NE	<5	<5	<5	<5	
1,1-dichloroethane	µg/L	5	NE	NE	<5	<5	<5	<5	
1,1-dichloroethene	µg/L	5	700	300	<5	<5	<5	<5	
1,1-dichloropropene	µg/L	5	NE	NE	<5	<5	<5	<5	
1,2,3-trichloropropane	µg/L	5	NE	NE	<5	<5	<5	<5	
1,2-dibromo-3-chloropropane	µg/L	5	NE	2	<5	<5	<5	<5	
1,2-dichloroethane	µg/L	5	1,900	30	<5	<5	<5	<5	
1,2-dichloropropane	µg/L	5	900	NE	<5	<5	<5	<5	
1,3-dichloropropane	µg/L	5	1,100	NE	<5	<5	<5	<5	
2,2-dichloropropane	µg/L	5	NE	NE	<5	<5	<5	<5	
Bromodichloromethane	µg/L	5	NE	800	<5	<5	<5	<5	
Bromoform	µg/L	5	NE	800	<5	<5	<5	<5	
Carbon tetrachloride	µg/L	5	240	30	<5	<5	<5	<5	
Chlorodibromomethane	µg/L	5	NE	NE	<5	<5	<5	<5	
Chloroethane	µg/L	50	NE	NE	<50	<50	<50	<50	
Chloroform	µg/L	5	NE	NE	<5	<5	<5	<5	
Chloromethane	µg/L	50	770	NE	<50	<50	<50	<50	
cis-1,2-dichloroethene	µg/L	5	NE	NE	<5	<5	<5	<5	
cis-1,3-dichloropropene	µg/L	5	NE	NE	<5	<5	<5	<5	
Dibromomethane	µg/L	5	NE	NE	<5	<5	<5	<5	
Hexachlorobutadiene	µg/L	2	NE	7	<2	<2	<2	<2	
Hexachlorocyclopentadiene	µg/L	10	NE	500	<10	<10	<10	<10	
Hexachloroethane	µg/L	2	360	NE	<2	<2	<2	<2	
Trichloroethene	µg/L	5	330	50	<5	<5	<5	<5	
Tetrachloroethene	µg/L	5	70	500	<5	<5	<5	<5	
trans-1,2-dichloroethene	µg/L	5	NE	1000	<5	<5	<5	<5	
trans-1,3-dichloropropene	µg/L	5	NE	NE	<5	<5	<5	<5	
Vinyl chloride	µg/L	50	100	3	<50	<50	<50	<50	
Halogenated Hydrocarbons									
1,2-dibromoethane	µg/L	5	NE	1	<5	<5	<5	<5	
Bromomethane	µg/L	50	NE	10	<50	<50	<50	<50	
Dichlorodifluoromethane	µg/L	50	NE	NE	<50	<50	<50	<50	
Iodomethane	µg/L	5	NE	NE	<5	<5	<5	<5	
Trichlorofluoromethane	µg/L	50	NE	NE	<50	<50	<50	<50	

Table 22
Groundwater Analyitcal Results - Pesticides and Herbicides

				Field ID	GW01	GW02	GW03	GW04
				Date	19 Jul 2023	19 Jul 2023	19 Jul 2023	19 Jul 2023
	Unit	EQL	FW (95%)	DOH NPUG				
Pesticides								
Chlorobenzilate	µg/L	2	NE	NE	<2	<2	<2	<2
Carbazole	µg/L	2	NE	NE	<2	<2	<2	<2
Pirimphos-ethyl	µg/L	2	NE	0.5	<2	<2	<2	<2
Organophosphorous Pesticides								
Chlorfenvinphos	µg/L	2	NE	20	<2	<2	<2	<2
Chlorpyrifos	µg/L	2	0.01	100	<2	<2	<2	<2
Chlorpyrifos-methyl	mg/L	0.002	NE	NE	<0.002	<0.002	<0.002	<0.002
Diazinon	µg/L	2	0.01	40	<2	<2	<2	<2
Dichlorvos	µg/L	2	NE	50	<2	<2	<2	<2
Dimethoate	µg/L	2	0.15	70	<2	<2	<2	<2
Ethion	µg/L	2	NE	40	<2	<2	<2	<2
Fenthion	µg/L	2	NE	70	<2	<2	<2	<2
Malathion	µg/L	2	0.05	700	<2	<2	<2	<2
Prothiofos	µg/L	2	NE	NE	<2	<2	<2	<2
Organochlorine Pesticides								
4,4-DDE	µg/L	2	NE	NE	<2	<2	<2	<2
a-BHC	µg/L	2	NE	NE	<2	<2	<2	<2
Aldrin	µg/L	2	NE	NE	<2	<2	<2	<2
Aldrin + Dieldrin	µg/L	4	NE	3	<4	<4	<4	<4
b-BHC	µg/L	2	NE	NE	<2	<2	<2	<2
d-BHC	µg/L	2	NE	NE	<2	<2	<2	<2
DDD	µg/L	2	NE	NE	<2	<2	<2	<2
DDT	µg/L	4	0.01	90	<4	<4	<4	<4
DDT+DDE+DDD	µg/L	4	NE	NE	<4	<4	<4	<4
Dieldrin	µg/L	2	NE	NE	<2	<2	<2	<2
Endosulfan I	µg/L	2	NE	NE	<2	<2	<2	<2
Endosulfan II	µg/L	2	NE	NE	<2	<2	<2	<2
Endosulfan sulphate	µg/L	2	NE	NE	<2	<2	<2	<2
Endrin	µg/L	2	0.02	20	<2	<2	<2	<2
g-BHC (Lindane)	µg/L	2	0.2	100	<2	<2	<2	<2
Heptachlor	µg/L	2	0.09	3	<2	<2	<2	<2
Heptachlor epoxide	µg/L	2	NE	2	<2	<2	<2	<2
Herbicides								
Pronamide	µg/L	2	NE	700	<2	<2	<2	<2

Table 23
Groundwater Analyitcal Results - Amino Aliphatics, Aromatics, Nitroaromatics, Anilines and Solvents

				Field ID	GW01	GW02	GW03	GW04
				Date	19 Jul 2023	19 Jul 2023	19 Jul 2023	19 Jul 2023
	Unit	EQL	FW (95%)	DOH NPUG				
Amino Aliphatics								
N-nitrosodiethylamine	µg/L	2	NE	NE	<2	<2	<2	<2
N-nitrosodi-n-butylamine	µg/L	2	NE	NE	<2	<2	<2	<2
N-nitrosodi-n-propylamine	µg/L	2	NE	NE	<2	<2	<2	<2
N-Nitrosomethylethylamine	µg/L	2	NE	NE	<2	<2	<2	<2
Amino Aromatics								
1-naphthylamine	µg/L	2	NE	NE	<2	<2	<2	<2
N-Nitrosodiphenyl & Diphenylamine	µg/L	4	NE	NE	<4	<4	<4	<4
Nitroaromatics								
2-Picoline	µg/L	2	NE	NE	<2	<2	<2	<2
4-aminobiphenyl	µg/L	2	NE	NE	<2	<2	<2	<2
Pentachloronitrobenzene	µg/L	2	NE	300	<2	<2	<2	<2
Anilines								
2-nitroaniline	µg/L	4	NE	NE	<4	<4	<4	<4
3-nitroaniline	µg/L	4	NE	NE	<4	<4	<4	<4
4-chloroaniline	µg/L	2	NE	NE	<2	<2	<2	<2
4-nitroaniline	µg/L	2	NE	NE	<2	<2	<2	<2
2-methyl-5-nitroaniline	µg/L	2	NE	NE	<2	<2	<2	<2
Aniline	µg/L	2	250	NE	<2	<2	<2	<2
Solvents								
tert-Amyl Methyl Ether (TAME)	µg/L	1	NE	NE	<1	<1	<1	<1
Methyl Ethyl Ketone	µg/L	50	NE	NE	<50	<50	<50	<50
2-hexanone (MBK)	µg/L	50	NE	NE	<50	<50	<50	<50
4-Methyl-2-pentanone	µg/L	50	NE	NE	<50	<50	<50	<50
Carbon disulfide	µg/L	5	NE	NE	<5	<5	<5	<5
Isophorone	µg/L	2	NE	NE	<2	<2	<2	<2
MTBE	mg/L	0.001	NE	0.02[#2]	<0.001	<0.001	<0.001	<0.001
Vinyl acetate	µg/L	50	NE	NE	<50	<50	<50	<50

Table 24
Groundwater Analyitcal Results - Phenols, Phthalates and Explosives

					Field ID	GW01	GW02	GW03	GW04
					Date	19 Jul 2023	19 Jul 2023	19 Jul 2023	19 Jul 2023
	Unit	EQL	FW (95%)	DOH NPUG					
Phenols									
3&4-Methylphenol (m&p-cresol)	µg/L	4	NE	NE		<4	<4	<4	<4
2,4,5-Trichlorophenol	µg/L	2	NE	NE		<2	<2	<2	<2
2,4,6-Trichlorophenol	µg/L	2	20	200		<2	<2	<2	<2
2,4-Dichlorophenol	µg/L	2	160	2,000		<2	<2	<2	<2
2,4-Dimethylphenol	µg/L	2	NE	NE		<2	<2	<2	<2
2,6-Dichlorophenol	µg/L	2	NE	NE		<2	<2	<2	<2
2-Chlorophenol	µg/L	2	490	3,000		<2	<2	<2	<2
2-Methylphenol	µg/L	2	NE	NE		<2	<2	<2	<2
2-Nitrophenol	µg/L	2	NE	NE		<2	<2	<2	<2
4-chloro-3-methylphenol	µg/L	2	NE	NE		<2	<2	<2	<2
Pentachlorophenol	µg/L	4	10	100		<4	<4	<4	<4
Phenol	µg/L	2	320	NE		<2	<2	<2	<2
Phthalates									
Bis(2-ethylhexyl) phthalate	µg/L	10	NE	100		<10	<10	<10	<10
Butyl benzyl phthalate	µg/L	2	NE	NE		<2	<2	<2	<2
Diethylphthalate	µg/L	2	1,000	NE		<2	<2	<2	<2
Dimethyl phthalate	µg/L	2	3,700	NE		<2	<2	<2	<2
Di-n-butyl phthalate	µg/L	2	26	NE		<2	<2	<2	<2
Di-n-octyl phthalate	µg/L	2	NE	NE		<2	<2	<2	<2
Explosives									
1,3,5-Trinitrobenzene	mg/L	0.002	NE	NE		<0.002	<0.002	<0.002	<0.002
2,4-Dinitrotoluene	µg/L	4	65	NE		<4	<4	<4	<4
2,6-dinitrotoluene	µg/L	4	NE	NE		<4	<4	<4	<4
Nitrobenzene	µg/L	2	550	NE		<2	<2	<2	<2

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Table 25
QA/QC Analytcal Results - Soil Duplicates

Field or Interlab Duplicates

			Lab Report Number	EP2309599	EP2309599		EP2309599	1009147		EP2309599	1009147		EP2309599	EP2309599	
			Field ID	TP08_0-0.15	Dup01		TP08_0-0.15	TRIP01		TP15_0-0.15	TRIP02		TP02_0-0.15	Dup03	
			Matrix Type	Soil	Soil		Soil	Soil		Soil	Soil		Soil	Soil	
			Date	13 Jul 2023	13 Jul 2023	RPD	13 Jul 2023	13 Jul 2023	RPD	13 Jul 2023	13 Jul 2023	RPD	14 Jul 2023	14 Jul 2023	RPD
		Unit	EQL												
BTEX															
	Naphthalene (VOC)	mg/kg	0.5	<1	<1	0	<1	<0.5	0	<1	<0.5	0	<1	<1	0
	Benzene	mg/kg	0.1	<0.2	<0.2	0	<0.2	<0.1	0	<0.2	<0.1	0	<0.2	<0.2	0
	Toluene	mg/kg	0.1	<0.5	<0.5	0	<0.5	<0.1	0	<0.5	<0.1	0	<0.5	<0.5	0
	Ethylbenzene	mg/kg	0.1	<0.5	<0.5	0	<0.5	<0.1	0	<0.5	<0.1	0	<0.5	<0.5	0
	Xylene (m & p)	mg/kg	0.2	<0.5	<0.5	0	<0.5	<0.2	0	<0.5	<0.2	0	<0.5	<0.5	0
	Xylene (o)	mg/kg	0.1	<0.5	<0.5	0	<0.5	<0.1	0	<0.5	<0.1	0	<0.5	<0.5	0
	Xylene Total	mg/kg	0.3	<0.5	<0.5	0	<0.5	<0.3	0	<0.5	<0.3	0	<0.5	<0.5	0
	Total BTEX	mg/kg	0.2	<0.2	<0.2	0	<0.2			<0.2			<0.2	<0.2	0
TRH															
	C6-C10 Fraction (F1)	mg/kg	10	<10	<10	0	<10	<20	0	<10	<20	0	<10	<10	0
	C6-C10 (F1 minus BTEX)	mg/kg	10	<10	<10	0	<10	<20	0	<10	<20	0	<10	<10	0
	>C10-C16 Fraction (F2)	mg/kg	50	<50	<50	0	<50	<50	0	<50	<50	0	<50	<50	0
	>C10-C16 Fraction (F2 minus Naphthalene)	mg/kg	50	<50	<50	0	<50	<50	0	<50	<50	0	<50	<50	0
	>C16-C34 Fraction (F3)	mg/kg	100	<100	<100	0	<100	<100	0	<100	<100	0	<100	<100	0
	>C34-C40 Fraction (F4)	mg/kg	100	<100	<100	0	<100	<100	0	<100	<100	0	<100	<100	0
	>C10-C40 Fraction (Sum)	mg/kg	50	<50	<50	0	<50	<100	0	<50	<100	0	<50	<50	0
Phenols															
	3&4-Methylphenol (m&p-cresol)	mg/kg	0.4	<0.5	<0.5	0	<0.5	<0.4	0	<1	<0.4	0	<0.5	<0.5	0
	2,4,5-Trichlorophenol	mg/kg	0.2	<0.5	<0.5	0	<0.5	<1	0	<0.5	<1	0	<0.5	<0.5	0
	2,4,6-Trichlorophenol	mg/kg	0.2	<0.5	<0.5	0	<0.5	<1	0	<0.5	<1	0	<0.5	<0.5	0
	2,4-Dichlorophenol	mg/kg	0.2	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	2,4-Dimethylphenol	mg/kg	0.2	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	2,6-Dichlorophenol	mg/kg	0.2	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	2-Chlorophenol	mg/kg	0.2	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	2-Methylphenol	mg/kg	0.2	<0.5	<0.5	0	<0.5	<0.2	0	<0.5	<0.2	0	<0.5	<0.5	0
	2-Nitrophenol	mg/kg	0.2	<0.5	<0.5	0	<0.5	<1	0	<0.5	<1	0	<0.5	<0.5	0
	4-chloro-3-methylphenol	mg/kg	0.5	<0.5	<0.5	0	<0.5	<1	0	<0.5	<1	0	<0.5	<0.5	0
	Pentachlorophenol	mg/kg	1	<1	<1	0	<1	<1	0	<2	<1	0	<1	<1	0
	Phenol	mg/kg	0.2	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
Amino Aliphatics															
	N-nitrosodiethylamine	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	N-nitrosodi-n-butylamine	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	N-nitrosodi-n-propylamine	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	N-Nitrosomethylethylamine	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
Amino Aromatics															
	1-naphthylamine	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	N-Nitrosodiphenyl & Diphenylamine	mg/kg	1	<1.0	<1.0	0	<1.0						<1.0	<1.0	0
Other															
	Acetophenone	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
Anilines															
	2-nitroaniline	mg/kg	1	<1.0	<1.0	0	<1.0						<1.0	<1.0	0
	3-nitroaniline	mg/kg	1	<1.0	<1.0	0	<1.0						<1.0	<1.0	0
	4-chloroaniline	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	4-nitroaniline	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	2-methyl-5-nitroaniline	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Aniline	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
Chlorinated Hydrocarbons															
	1,1,1,2-tetrachloroethane	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	1,1,1-trichloroethane	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	1,1,2,2-tetrachloroethane	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	1,1,2-trichloroethane	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	1,1-dichloroethane	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	1,1-dichloroethene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	1,1-dichloropropene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	1,2,3-trichloropropane	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	1,2-dibromo-3-chloropropane	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	1,2-dichloroethane	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	1,2-dichloropropane	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	1,3-dichloropropane	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	2,2-dichloropropane	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Bromodichloromethane	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Bromoform	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Carbon tetrachloride	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Chlorodibromomethane	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Chloroethane	mg/kg	5	<5	<5	0	<5						<5	<5	0

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Table 25
QA/QC Analyitcal Results - Soil Duplicates

Field or Interlab Duplicates

			Lab Report Number	EP2309599	EP2309599		EP2309599	1009147		EP2309599	1009147		EP2309599	EP2309599	
			Field ID	TP08_0-0.15	Dup01		TP08_0-0.15	TRIP01		TP15_0-0.15	TRIP02		TP02_0-0.15	Dup03	
			Matrix Type	Soil	Soil		Soil	Soil		Soil	Soil		Soil	Soil	
			Date	13 Jul 2023	13 Jul 2023	RPD	13 Jul 2023	13 Jul 2023	RPD	13 Jul 2023	13 Jul 2023	RPD	14 Jul 2023	14 Jul 2023	RPD
		Unit	EQL												
	Chloroform	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Chloromethane	mg/kg	5	<5	<5	0	<5						<5	<5	0
	cis-1,2-dichloroethene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	cis-1,3-dichloropropene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Dibromomethane	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Hexachlorobutadiene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Hexachlorocyclopentadiene	mg/kg	2.5	<2.5	<2.5	0	<2.5						<2.5	<2.5	0
	Hexachloroethane	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Trichloroethene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Tetrachloroethene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	trans-1,2-dichloroethene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	trans-1,3-dichloropropene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Vinyl chloride	mg/kg	5	<5	<5	0	<5						<5	<5	0
Explosives															
	1,3,5-Trinitrobenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	2,4-Dinitrotoluene	mg/kg	1	<1.0	<1.0	0	<1.0						<1.0	<1.0	0
	2,6-dinitrotoluene	mg/kg	1	<1.0	<1.0	0	<1.0						<1.0	<1.0	0
	Nitrobenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
Halogenated Benzenes															
	1,2,3-trichlorobenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	1,2,4-trichlorobenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	1,2-dichlorobenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	1,3-dichlorobenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	1,4-dichlorobenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	2-chlorotoluene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	4-chlorotoluene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Bromobenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Chlorobenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Hexachlorobenzene	mg/kg	0.01	<1.0	<1.0	0	<1.0	<0.01	0	<0.05	<0.01	0	<1.0	<1.0	0
	Pentachlorobenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
Halogenated Hydrocarbons															
	1,2-dibromoethane	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Bromomethane	mg/kg	5	<5	<5	0	<5						<5	<5	0
	Dichlorodifluoromethane	mg/kg	5	<5	<5	0	<5						<5	<5	0
	Iodomethane	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Trichlorofluoromethane	mg/kg	5	<5	<5	0	<5						<5	<5	0
MAH															
	1,2,4-trimethylbenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	1,3,5-trimethylbenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Isopropylbenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	n-butylbenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	n-propylbenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	p-isopropyltoluene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	sec-butylbenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Styrene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	tert-butylbenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0

Lot 3 Baldivis Road, Baldivis Detailed Site Investigation

Table 25
QA/QC Analyitcal Results - Soil Duplicates

Field or Interlab Duplicates

	Lab Report Number		EP2309599	EP2309599			EP2309599	1009147		EP2309599	1009147		EP2309599	EP2309599	
	Field ID		TP08_0-0.15	Dup01			TP08_0-0.15	TRIP01		TP15_0-0.15	TRIP02		TP02_0-0.15	Dup03	
	Matrix Type		Soil	Soil			Soil	Soil		Soil	Soil		Soil	Soil	
	Date		13 Jul 2023	13 Jul 2023	RPD		13 Jul 2023	13 Jul 2023	RPD	13 Jul 2023	13 Jul 2023	RPD	14 Jul 2023	14 Jul 2023	RPD
		Unit	EQL												
Metals															
	Antimony	mg/kg	2	<5			<2		<5	<2	0		<5		
	Arsenic	mg/kg	2	<5	<5	0	<5	<5	0	<5	<5	0	<5	<5	0
	Barium	mg/kg	1	<10	<10			2.7		<10	18	N/A		100	
	Beryllium	mg/kg	0.1	<1	<1			<0.1		<1	0.1	0		<1	
	Boron	mg/kg	3	<50	<50			<5		<50	7.6	0		<50	
	Cadmium	mg/kg	0.1	<1	<1	0	<1	<0.1	0	<1	<0.1	0	<1	<1	0
	Chromium (III+VI)	mg/kg	1	7	<2	N/A	7	<1	N/A	<2	<1	0	2	2	0
	Cobalt	mg/kg	1		<2			<1		<2	<1	0		<2	
	Copper	mg/kg	1	15	<5	N/A	15	<1	N/A	<5	<1	0	<5	6	18
	Lead	mg/kg	1	<5	<5	0	<5	<1	0	<5	<1	0	<5	<5	0
	Manganese	mg/kg	1		8			3.4		10	62	144		527	
	Molybdenum	mg/kg	1		<2			<2		<2	<2	0		<2	
	Nickel	mg/kg	1	4	<2	N/A	4	<1	N/A	<2	<1	0	<2	<2	0
	Zinc	mg/kg	1	63	9	150	63	7.1	159	12	4.8	N/A	93	126	30
Nitroaromatics															
	2-Picoline	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	4-aminobiphenyl	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Pentachloronitrobenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5						<0.5	<0.5	0
Organochlorine Pesticides															
	4,4-DDE	mg/kg	0.01	<0.5	<0.5	0	<0.5	<0.01	0	<0.05	<0.01	0	<0.5	<0.5	0
	a-BHC	mg/kg	0.01	<0.5	<0.5	0	<0.5	<0.01	0	<0.05	<0.01	0	<0.5	<0.5	0
	Aldrin	mg/kg	0.01	<0.5	<0.5	0	<0.5	<0.01	0	<0.05	<0.01	0	<0.5	<0.5	0
	b-BHC	mg/kg	0.01	<0.5	<0.5	0	<0.5	<0.01	0	<0.05	<0.01	0	<0.5	<0.5	0
	d-BHC	mg/kg	0.01	<0.5	<0.5	0	<0.5	<0.01	0	<0.05	<0.01	0	<0.5	<0.5	0
	DDD	mg/kg	0.01	<0.5	<0.5	0	<0.5	<0.01	0	<0.05	<0.01	0	<0.5	<0.5	0
	DDT	mg/kg	0.01	<1.0	<1.0	0	<1.0	<0.01	0	<0.2	<0.01	0	<1.0	<1.0	0
	Dieldrin	mg/kg	0.01	<0.5	<0.5	0	<0.5	<0.01	0	<0.05	<0.01	0	<0.5	<0.5	0
	Endosulfan I	mg/kg	0.01	<0.5	<0.5	0	<0.5	<0.01	0	<0.05	<0.01	0	<0.5	<0.5	0
	Endosulfan II	mg/kg	0.01	<0.5	<0.5	0	<0.5	<0.01	0	<0.05	<0.01	0	<0.5	<0.5	0
	Endosulfan sulphate	mg/kg	0.01	<0.5	<0.5	0	<0.5	<0.01	0	<0.05	<0.01	0	<0.5	<0.5	0
	g-BHC (Lindane)	mg/kg	0.01	<0.5	<0.5	0	<0.5	<0.01	0	<0.05	<0.01	0	<0.5	<0.5	0
	Heptachlor	mg/kg	0.01	<0.5	<0.5	0	<0.5	<0.01	0	<0.05	<0.01	0	<0.5	<0.5	0
	Heptachlor epoxide	mg/kg	0.01	<0.5	<0.5	0	<0.5	<0.01	0	<0.05	<0.01	0	<0.5	<0.5	0
Organophosphorous Pesticides															
	Chlorfenvinphos	mg/kg	0.05	<0.5	<0.5	0	<0.5			<0.05			<0.5	<0.5	0
	Chlorpyrifos	mg/kg	0.02	<0.5	<0.5	0	<0.5	<0.02	0	<0.05	<0.02	0	<0.5	<0.5	0
	Chlorpyrifos-methyl	mg/kg	0.05	<0.5	<0.5	0	<0.5			<0.05			<0.5	<0.5	0
	Diazinon	mg/kg	0.05	<0.5	<0.5	0	<0.5	<0.2	0	<0.05	<0.2	0	<0.5	<0.5	0
	Dichlorvos	mg/kg	0.05	<0.5	<0.5	0	<0.5			<0.05			<0.5	<0.5	0
	Dimethoate	mg/kg	0.05	<0.5	<0.5	0	<0.5			<0.05			<0.5	<0.5	0
	Ethion	mg/kg	0.05	<0.5	<0.5	0	<0.5	<0.05	0	<0.05	<0.05	0	<0.5	<0.5	0
	Fenthion	mg/kg	0.05	<0.5	<0.5	0	<0.5			<0.05			<0.5	<0.5	0
	Malathion	mg/kg	0.05	<0.5	<0.5	0	<0.5	<0.1	0	<0.05	<0.1	0	<0.5	<0.5	0

Lot 3 Baldivis Road, Baldivis Detailed Site Investigation

Table 25
QA/QC Analytcal Results - Soil Duplicates

Field or Interlab Duplicates

				Lab Report Number	EP2309599	EP2309599		EP2309599	1009147		EP2309599	1009147		EP2309599	EP2309599	
				Field ID	TP08_0-0.15	Dup01		TP08_0-0.15	TRIP01		TP15_0-0.15	TRIP02		TP02_0-0.15	Dup03	
				Matrix Type	Soil	Soil		Soil	Soil		Soil	Soil		Soil	Soil	
				Date	13 Jul 2023	13 Jul 2023	RPD	13 Jul 2023	13 Jul 2023	RPD	13 Jul 2023	13 Jul 2023	RPD	14 Jul 2023	14 Jul 2023	RPD
		Unit	EQL													
PAH																
	Benzo(b+j+k)fluoranthene	mg/kg	0.2		<1	<1	0	<1						<1	<1	0
	2-chloronaphthalene	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	2-methylnaphthalene	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	3-methylcholanthrene	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	7,12-dimethylbenz(a)anthracene	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Acenaphthene	mg/kg	0.1		<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Acenaphthylene	mg/kg	0.1		<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Anthracene	mg/kg	0.1		<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Benzo(a)anthracene	mg/kg	0.1		<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Benzo(a) pyrene	mg/kg	0.05		<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Benzo(b+j)fluoranthene	mg/kg	0.5						<0.5		<0.5	<0.5	0			
	Benzo(g,h,i)perylene	mg/kg	0.1		<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Benzo(k)fluoranthene	mg/kg	0.5						<0.5		<0.5	<0.5	0			
	Chrysene	mg/kg	0.1		<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Dibenz(a,h)anthracene	mg/kg	0.1		<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Fluoranthene	mg/kg	0.1		<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Fluorene	mg/kg	0.1		<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1		<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Naphthalene	mg/kg	0.1		<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Phenanthrene	mg/kg	0.1		<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Pyrene	mg/kg	0.1		<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	PAHs (Sum of total)	mg/kg	0.5		<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	PAHs (Sum of positives)	mg/kg	0.05													
Pesticides																
	Chlorobenzilate	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Carbazole	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Pirimphos-ethyl	mg/kg	0.05		<0.5	<0.5	0	<0.5			<0.05			<0.5	<0.5	0
Phthalates																
	Bis(2-ethylhexyl) phthalate	mg/kg	5		<5.0	<5.0	0	<5.0						<5.0	<5.0	0
	Butyl benzyl phthalate	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Diethylphthalate	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Dimethyl phthalate	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Di-n-butyl phthalate	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Di-n-octyl phthalate	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
Solvents																
	Methyl Ethyl Ketone	mg/kg	5		<5	<5	0	<5						<5	<5	0
	2-hexanone (MBK)	mg/kg	5		<5	<5	0	<5						<5	<5	0
	4-Methyl-2-pentanone	mg/kg	5		<5	<5	0	<5						<5	<5	0
	Carbon disulfide	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Isophorone	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Vinyl acetate	mg/kg	5		<5	<5	0	<5						<5	<5	0
SVOCs																
	2-(acetylamino) fluorene	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	3,3-Dichlorobenzidine	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	4-(dimethylamino) azobenzene	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	4-bromophenyl phenyl ether	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	4-chlorophenyl phenyl ether	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	4-Nitroquinoline-N-oxide	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Azobenzene	mg/kg	1		<1	<1	0	<1						<1	<1	0
	Bis(2-chloroethoxy) methane	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Bis(2-chloroethyl)ether	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Dibenzofuran	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Hexachloropropene	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Methapyrilene	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	N-nitrosomorpholine	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	N-nitrosopiperidine	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	N-nitrosopyrrolidine	mg/kg	1		<1.0	<1.0	0	<1.0						<1.0	<1.0	0
	Phenacetin	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
TPH																
	C6-C9 Fraction	mg/kg	10		<10	<10	0	<10	<20	0	<10	<20	0	<10	<10	0
	C10-C14 Fraction	mg/kg	20		<50	<50	0	<50	<20	0	<50	<20	0	<50	<50	0
	C15-C28 Fraction	mg/kg	50		<100	<100	0	<100	<50	0	<100	<50	0	<100	<100	0
	C29-C36 Fraction	mg/kg	50		<100	<100	0	<100	<50	0	<100	<50	0	<100	<100	0
	C10-C36 Fraction (Sum)	mg/kg	50		<50	<50	0	<50	<50	0	<50	<50	0	<50	<50	0
VOCs																
	cis-1,4-Dichloro-2-butene	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	trans-1,4-Dichloro-2-butene	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0
	Pentachloroethane	mg/kg	0.5		<0.5	<0.5	0	<0.5						<0.5	<0.5	0

Table 26
QA/QC Analyitcal Results - Groundwater Duplicate Results

Field or Interlab Duplicates

		Lab Report Number	EP2309684	EP2309684		EP2309684	1009258	
		Field ID	GW01	DUP_01		GW01	TRIP01	
		Matrix Type	Water	Water		Water	Water	
		Date	19 Jul 2023	19 Jul 2023	RPD	19 Jul 2023	19 Jul 2023	RPD
	Unit	EQL						
NA								
tert-Amyl ethyl ether (TAEE)	µg/L	1	<1	<1	0	<1		
Ethyl tert-Butyl Ether (ETBE)	µg/L	1	<1	<1	0	<1		
tert-Butyl alcohol	µg/L	5	<5	<5	0	<5		
BTEX								
Naphthalene (VOC)	mg/L	0.005	<0.005	<0.005	0	<0.005	<0.01	0
Benzene	µg/L	1	<1	<1	0	<1	<1	0
Toluene	µg/L	1	<2	<2	0	<2	<1	0
Ethylbenzene	µg/L	1	<2	<2	0	<2	<1	0
Xylene (m & p)	µg/L	2	<2	<2	0	<2	<2	0
Xylene (o)	µg/L	1	<2	<2	0	<2	<1	0
Xylene Total	µg/L	2	<2	<2	0	<2	<3	0
Total BTEX	µg/L	1	<1	<1	0	<1		
TRH								
C6-C10 Fraction (F1)	µg/L	20	<20	<20	0	<20	<20	0
C6-C10 (F1 minus BTEX)	µg/L	20	<20	<20	0	<20	<20	0
>C10-C16 Fraction (F2)	µg/L	50	<100	<100	0	<100	<50	0
>C10-C16 Fraction (F2 minus Naphthalene)	µg/L	50	<100	<100	0	<100	<50	0
>C16-C34 Fraction (F3)	µg/L	100	<100	<100	0	<100	<100	0
>C34-C40 Fraction (F4)	µg/L	100	<100	<100	0	<100	<100	0
>C10-C40 Fraction (Sum)	µg/L	100	<100	<100	0	<100	<100	0
Phenols								
3&4-Methylphenol (m&p-cresol)	µg/L	4	<4	<4	0	<4	<6	0
2,3,4,6-Tetrachlorophenol	µg/L	10					<10	
2,4,5-Trichlorophenol	µg/L	2	<2	<2	0	<2	<10	0
2,4,6-Trichlorophenol	µg/L	2	<2	<2	0	<2	<10	0
2,4-Dichlorophenol	µg/L	2	<2	<2	0	<2	<3	0
2,4-Dimethylphenol	µg/L	2	<2	<2	0	<2	<3	0
2,4-Dinitrophenol	mg/L	0.03					<0.03	
2,6-Dichlorophenol	µg/L	2	<2	<2	0	<2	<3	0
2-Chlorophenol	µg/L	2	<2	<2	0	<2	<3	0
2-Methylphenol	µg/L	2	<2	<2	0	<2	<3	0
2-Nitrophenol	µg/L	2	<2	<2	0	<2	<10	0
4,6-Dinitro-2-methylphenol	µg/L	30					<30	
4-chloro-3-methylphenol	µg/L	2	<2	<2	0	<2	<10	0
4-Nitrophenol	µg/L	30					<30	
Pentachlorophenol	µg/L	4	<4	<4	0	<4	<10	0
Phenol	µg/L	2	<2	<2	0	<2	<3	0
Amino Aliphatics								
N-nitrosodiethylamine	µg/L	2	<2	<2	0	<2		
N-nitrosodi-n-butylamine	µg/L	2	<2	<2	0	<2	<5	0
N-nitrosodi-n-propylamine	µg/L	2	<2	<2	0	<2	<5	0
N-Nitrosomethylethylamine	µg/L	2	<2	<2	0	<2		
Amino Aromatics								
1-naphthylamine	µg/L	2	<2	<2	0	<2	<5	0
2-naphthylamine	µg/L	5					<5	
Diphenylamine	µg/L	5					<5	
N-Nitrosodiphenyl & Diphenylamine	µg/L	4	<4	<4	0	<4		
Other								
Acetophenone	µg/L	2	<2	<2	0	<2	<5	0
Anilines								
2-nitroaniline	µg/L	4	<4	<4	0	<4	<5	0
3-nitroaniline	µg/L	4	<4	<4	0	<4		
4-chloroaniline	µg/L	2	<2	<2	0	<2		
4-nitroaniline	µg/L	2	<2	<2	0	<2		
2-methyl-5-nitroaniline	µg/L	2	<2	<2	0	<2		
Aniline	µg/L	2	<2	<2	0	<2	<5	0
Biological								
Faecal Coliforms	CFU/100mL	1	2	1	N/A	2		
E. Coli	cfu/100 ml	1	<1	<1	0	<1	<1	0
Coliform	cfu/100 ml	1	15	16	6	15		
Chlorinated Hydrocarbons								
1,1,1,2-tetrachloroethane	µg/L	1	<5	<5	0	<5	<1	0
1,1,1-trichloroethane	µg/L	1	<5	<5	0	<5	<1	0
1,1,2,2-tetrachloroethane	µg/L	1	<5	<5	0	<5	<1	0
1,1,2-trichloroethane	µg/L	1	<5	<5	0	<5	<1	0
1,1-dichloroethane	µg/L	1	<5	<5	0	<5	<1	0
1,1-dichloroethene	µg/L	1	<5	<5	0	<5	<1	0
1,1-dichloropropene	µg/L	5	<5	<5	0	<5		
1,2,3-trichloropropane	µg/L	1	<5	<5	0	<5	<1	0
1,2-dibromo-3-chloropropane	µg/L	5	<5	<5	0	<5		
1,2-dichloroethane	µg/L	1	<5	<5	0	<5	<1	0
1,2-dichloropropane	µg/L	1	<5	<5	0	<5	<1	0
1,3-dichloropropane	µg/L	1	<5	<5	0	<5	<1	0
2,2-dichloropropane	µg/L	5	<5	<5	0	<5		
Bromodichloromethane	µg/L	1	<5	<5	0	<5	<1	0
Bromoform	µg/L	1	<5	<5	0	<5	<1	0
Carbon tetrachloride	µg/L	1	<5	<5	0	<5	<1	0
Chlorodibromomethane	µg/L	1	<5	<5	0	<5	<1	0
Chloroethane	µg/L	5	<50	<50	0	<50	<5	0
Chloroform	µg/L	5	<5	<5	0	<5	<5	0
Chloromethane	µg/L	5	<50	<50	0	<50	<5	0
cis-1,2-dichloroethene	µg/L	1	<5	<5	0	<5	<1	0

Table 26
QA/QC Analyitcal Results - Groundwater Duplicate Results

Field or Interlab Duplicates

		Lab Report Number	EP2309684	EP2309684		EP2309684	1009258	
		Field ID	GW01	DUP_01		GW01	TRIP01	
		Matrix Type	Water	Water		Water	Water	
		Date	19 Jul 2023	19 Jul 2023	RPD	19 Jul 2023	19 Jul 2023	RPD
	Unit	EQL						
cis-1,3-dichloropropene	µg/L	1	<5	<5	0	<5	<1	0
Dibromomethane	µg/L	1	<5	<5	0	<5	<1	0
Dichloromethane	µg/L	5					<5	
Hexachlorobutadiene	µg/L	2	<2	<2	0	<2	<5	0
Hexachlorocyclopentadiene	µg/L	5	<10	<10	0	<10	<5	0
Hexachloroethane	µg/L	2	<2	<2	0	<2	<5	0
Tetrachloroethene	µg/L	1	<5	<5	0	<5	<1	0
trans-1,2-dichloroethene	µg/L	1	<5	<5	0	<5	<1	0
trans-1,3-dichloropropene	µg/L	1	<5	<5	0	<5	<1	0
Vinyl chloride	µg/L	5	<50	<50	0	<50	<5	0
Explosives								
1,3,5-Trinitrobenzene	mg/L	0.002	<0.002	<0.002	0	<0.002		
2,4-Dinitrotoluene	µg/L	4	<4	<4	0	<4	<5	0
2,6-dinitrotoluene	µg/L	4	<4	<4	0	<4	<5	0
Nitrobenzene	µg/L	2	<2	<2	0	<2	<50	0
Halogenated Benzenes								
1,2,3-trichlorobenzene	µg/L	5	<5	<5	0	<5	<5	0
1,2,4,5-tetrachlorobenzene	µg/L	5					<5	
1,2,4-trichlorobenzene	µg/L	2	<2	<2	0	<2	<5	0
1,2-dichlorobenzene	µg/L	1	<2	<2	0	<2	<1	0
1,3-dichlorobenzene	µg/L	1	<2	<2	0	<2	<1	0
1,4-dichlorobenzene	µg/L	1	<2	<2	0	<2	<1	0
2-chlorotoluene	µg/L	5	<5	<5	0	<5		
4-chlorotoluene	µg/L	1	<5	<5	0	<5	<1	0
Bromobenzene	µg/L	1	<5	<5	0	<5	<1	0
Chlorobenzene	µg/L	1	<5	<5	0	<5	<1	0
Hexachlorobenzene	µg/L	4	<4	<4	0	<4	<5	0
Pentachlorobenzene	µg/L	2	<2	<2	0	<2	<5	0
Halogenated Hydrocarbons								
1,2-dibromoethane	µg/L	1	<5	<5	0	<5	<1	0
Bromomethane	µg/L	5	<50	<50	0	<50	<5	0
Dichlorodifluoromethane	µg/L	5	<50	<50	0	<50	<5	0
Iodomethane	µg/L	1	<5	<5	0	<5	<1	0
Trichlorofluoromethane	µg/L	5	<50	<50	0	<50	<5	0
Herbicides								
Pronamide	µg/L	2	<2	<2	0	<2	<5	0
Trifluralin	mg/L	0.005					<0.005	
Inorganics								
Total Phosphorus as P (Organic Phosphate as P)	mg/L	0.01	0.05	0.04	22	0.05		
Sulfate as SO4 - Turbidimetric (filtered)	mg/L	1	66	65	2	66		
Nitrite + Nitrate as N	mg/L	0.01	7.35	7.56	3	7.35	8.2	11
Alkalinity (Bicarbonate as CaCO3)	mg/L	1	47	47	0	47		
Alkalinity (Carbonate as CaCO3)	mg/L	1	<1	<1	0	<1		
Alkalinity (Hydroxide) as CaCO3	mg/L	1	<1	<1	0	<1		
Alkalinity (total) as CaCO3	mg/L	1	47	47	0	47	51	8
Ammonia as N	mg/L	0.01	0.09	0.01	N/A	0.09	0.05	N/A
Anions Total	meq/L	0.01	6.88	6.75	2	6.88		
Biochemical Oxygen Demand	mg/L	2	<2	<2	0	<2		
Cations Total	meq/L	0.01	6.78	6.65	2	6.78		
Chloride	mg/L	1	162	158	2	162		
Chloride (filtered)	mg/L	1					160	
Electrical Conductivity (Lab)	µS/cm	1	752	768	2	752	800	6
Hydroxide	µg/L	5,000					<5,000	
Ionic Balance	%	0.01	0.72	0.75	4	0.72		
Kjeldahl Nitrogen Total	mg/L	0.1	1.0	1.1	10	1.0		
Nitrate (as N)	mg/L	0.01	7.33	7.54	3	7.33	8.1	10
Nitrite (as N)	mg/L	0.01	0.02	0.02	0	0.02	0.02	0
Organic Nitrogen as N	mg/L	0.1	0.9	1.1	20	0.9		
Nitrogen (Total)	mg/L	0.1	8.4	8.7	4	8.4	6.5	26
pH (Lab)	-	0.01	6.55	6.60	1	6.55	7.0	7
Reactive Phosphorus as P (Orthophosphate as P)	mg/L	0.01	<0.01	<0.01	0	<0.01		
MAH								
1,2,4-trimethylbenzene	µg/L	1	<5	<5	0	<5	<1	0
1,3,5-trimethylbenzene	µg/L	1	<5	<5	0	<5	<1	0
Isopropylbenzene	µg/L	1	<5	<5	0	<5	<1	0
n-butylbenzene	µg/L	5	<5	<5	0	<5		
n-propylbenzene	µg/L	5	<5	<5	0	<5		
p-isopropyltoluene	µg/L	5	<5	<5	0	<5		
sec-butylbenzene	µg/L	5	<5	<5	0	<5		
Styrene	µg/L	1	<5	<5	0	<5	<1	0
tert-butylbenzene	µg/L	5	<5	<5	0	<5		
Metals								
Arsenic (filtered)	mg/L	0.001	<0.001	<0.001	0	<0.001	<0.001	0
Cadmium (filtered)	mg/L	0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	0
Calcium	mg/L	0.5					15	
Calcium (filtered)	mg/L	0.5	18	17	6	18		
Chromium (III+VI) (filtered)	mg/L	0.001	0.001	<0.001	0	0.001	<0.001	0

Table 26
QA/QC Analyitcal Results - Groundwater Duplicate Results

Field or Interlab Duplicates

		Lab Report Number	EP2309684	EP2309684		EP2309684	1009258	
		Field ID	GW01	DUP_01		GW01	TRIP01	
		Matrix Type	Water	Water		Water	Water	
		Date	19 Jul 2023	19 Jul 2023	RPD	19 Jul 2023	19 Jul 2023	RPD
	Unit	EQL						
Copper (filtered)	mg/L	0.001	<0.001	<0.001	0	<0.001	<0.001	0
Lead (filtered)	mg/L	0.001	<0.001	<0.001	0	<0.001	<0.001	0
Magnesium	mg/L	0.5					13	
Magnesium (filtered)	mg/L	0.5	11	11	0	11		
Mercury (filtered)	mg/L	0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	0
Nickel (filtered)	mg/L	0.001	0.002	0.002	0	0.002	0.002	0
Potassium	mg/L	0.5					6.0	
Potassium (filtered)	mg/L	0.5	6	6	0	6		
Zinc (filtered)	mg/L	0.005	0.016	0.016	0	0.016	0.013	21
Nitroaromatics								
2-Picoline	µg/L	2	<2	<2	0	<2	<5	0
4-aminobiphenyl	µg/L	2	<2	<2	0	<2	<5	0
Pentachloronitrobenzene	µg/L	2	<2	<2	0	<2	<5	0
Organochlorine Pesticides								
4,4-DDE	µg/L	2	<2	<2	0	<2	<5	0
a-BHC	µg/L	2	<2	<2	0	<2	<5	0
Aldrin	µg/L	2	<2	<2	0	<2	<5	0
Aldrin + Dieldrin	µg/L	0.1	<4	<4	0	<4	<5	0
b-BHC	µg/L	2	<2	<2	0	<2	<5	0
d-BHC	µg/L	2	<2	<2	0	<2	<5	0
DDD	µg/L	2	<2	<2	0	<2	<5	0
DDT	µg/L	4	<4	<4	0	<4	<5	0
DDT+DDE+DDD	µg/L	0.1	<4	<4	0	<4	<5	0
Dieldrin	µg/L	2	<2	<2	0	<2	<5	0
Endosulfan I	µg/L	2	<2	<2	0	<2	<5	0
Endosulfan II	µg/L	2	<2	<2	0	<2	<5	0
Endosulfan sulphate	µg/L	2	<2	<2	0	<2	<5	0
Endrin	µg/L	2	<2	<2	0	<2	<5	0
Endrin aldehyde	µg/L	5					<5	
Endrin ketone	µg/L	5					<5	
g-BHC (Lindane)	µg/L	2	<2	<2	0	<2	<5	0
Heptachlor	µg/L	2	<2	<2	0	<2	<5	0
Heptachlor epoxide	µg/L	2	<2	<2	0	<2	<5	0
Methoxychlor	µg/L	5					<5	
Organophosphorous Pesticides								
Chlorfenvinphos	µg/L	2	<2	<2	0	<2		
Chlorpyrifos	µg/L	2	<2	<2	0	<2		
Chlorpyrifos-methyl	mg/L	0.002	<0.002	<0.002	0	<0.002		
Diazinon	µg/L	2	<2	<2	0	<2		
Dichlorvos	µg/L	2	<2	<2	0	<2		
Dimethoate	µg/L	2	<2	<2	0	<2		
Ethion	µg/L	2	<2	<2	0	<2		
Fenthion	µg/L	2	<2	<2	0	<2		
Malathion	µg/L	2	<2	<2	0	<2		
Prothiofos	µg/L	2	<2	<2	0	<2		
PAH								
Benzo(b+j+k)fluoranthene	mg/L	0.004	<0.004	<0.004	0	<0.004		
1-Chloronaphthalene	µg/L	5					<5	
2-chloronaphthalene	µg/L	2	<2	<2	0	<2	<5	0
2-methylnaphthalene	µg/L	2	<2	<2	0	<2	<5	0
3-methylcholanthrene	µg/L	2	<2	<2	0	<2	<5	0
7,12-dimethylbenz(a)anthracene	µg/L	2	<2	<2	0	<2	<5	0
Acenaphthene	µg/L	1	<2	<2	0	<2	<1	0
Acenaphthylene	µg/L	1	<2	<2	0	<2	<1	0
Anthracene	µg/L	1	<2	<2	0	<2	<1	0
Benzo(a)anthracene	µg/L	1	<2	<2	0	<2	<1	0
Benzo(a) pyrene	µg/L	1	<2	<2	0	<2	<1	0
Benzo(b+j)fluoranthene	mg/L	0.001					<0.001	
Benzo(g,h,i)perylene	µg/L	1	<2	<2	0	<2	<1	0
Benzo(k)fluoranthene	µg/L	1					<1	
Chrysene	µg/L	1	<2	<2	0	<2	<1	0
Dibenz(a,h)anthracene	µg/L	1	<2	<2	0	<2	<1	0
Fluoranthene	µg/L	1	<2	<2	0	<2	<1	0
Fluorene	µg/L	1	<2	<2	0	<2	<1	0
Indeno(1,2,3-c,d)pyrene	µg/L	1	<2	<2	0	<2	<1	0
Naphthalene	µg/L	1	<2	<2	0	<2	<1	0
Phenanthrene	µg/L	1	<2	<2	0	<2	<1	0
Pyrene	µg/L	1	<2	<2	0	<2	<1	0
PAHs (Sum of total)	µg/L	1	<2	<2	0	<2	<1	0

Table 26
QA/QC Analyitcal Results - Groundwater Duplicate Results

Field or Interlab Duplicates

			Lab Report Number	EP2309684	EP2309684		EP2309684	1009258	
			Field ID	GW01	DUP_01		GW01	TRIP01	
			Matrix Type	Water	Water		Water	Water	
			Date	19 Jul 2023	19 Jul 2023	RPD	19 Jul 2023	19 Jul 2023	RPD
	Unit	EQL							
Pesticides									
Chlorobenzilate	µg/L	2	<2	<2	0	<2		
Carbazole	µg/L	2	<2	<2	0	<2		
Pirimphos-ethyl	µg/L	2	<2	<2	0	<2		
Phthalates									
Bis(2-ethylhexyl) phthalate	µg/L	5	<10	<10	0	<10	<5	0
Butyl benzyl phthalate	µg/L	2	<2	<2	0	<2	<5	0
Diethylphthalate	µg/L	2	<2	<2	0	<2	<5	0
Dimethyl phthalate	µg/L	2	<2	<2	0	<2	<5	0
Di-n-butyl phthalate	µg/L	2	<2	<2	0	<2	<5	0
Di-n-octyl phthalate	µg/L	2	<2	<2	0	<2	<5	0
Solvents									
tert-Amyl Methyl Ether (TAME)	µg/L	1	<1	<1	0	<1		
Methyl Ethyl Ketone	µg/L	5	<50	<50	0	<50	<5	0
2-hexanone (MBK)	µg/L	50	<50	<50	0	<50		
4-Methyl-2-pentanone	µg/L	5	<50	<50	0	<50	<5	0
Acetone	mg/L	0.005					<0.005	
Allyl chloride	mg/L	0.001					<0.001	
Carbon disulfide	µg/L	1	<5	<5	0	<5	<1	0
Isophorone	µg/L	2	<2	<2	0	<2		
MTBE	mg/L	0.001	<0.001	<0.001	0	<0.001	<0.001	0
Vinyl acetate	µg/L	50	<50	<50	0	<50		
SVOCs									
2-(acetylamino) fluorene	µg/L	2	<2	<2	0	<2		
3,3-Dichlorobenzidine	µg/L	2	<2	<2	0	<2	<5	0
4-(dimethylamino) azobenzene	µg/L	2	<2	<2	0	<2	<5	0
4-bromophenyl phenyl ether	µg/L	2	<2	<2	0	<2	<5	0
4-chlorophenyl phenyl ether	µg/L	2	<2	<2	0	<2	<5	0
4-Nitroquinoline-N-oxide	µg/L	2	<2	<2	0	<2		
Azobenzene	µg/L	2	<2	<2	0	<2		
Bis(2-chloroethoxy) methane	µg/L	2	<2	<2	0	<2	<5	0
Bis(2-chloroethyl)ether	µg/L	2	<2	<2	0	<2		
Bis(2-chloroisopropyl) ether	µg/L	5					<5	
Dibenzofuran	µg/L	2	<2	<2	0	<2	<5	0
Hexachloropropene	µg/L	2	<2	<2	0	<2		
Methapyrilene	µg/L	2	<2	<2	0	<2		
N-nitrosomorpholine	µg/L	2	<2	<2	0	<2		
N-nitrosopiperidine	µg/L	2	<2	<2	0	<2	<5	0
N-nitrosopyrrolidine	µg/L	4	<4	<4	0	<4		
Phenacetin	µg/L	2	<2	<2	0	<2		
TPH									
C6-C9 Fraction	µg/L	20	<20	<20	0	<20	<20	0
C10-C14 Fraction	µg/L	50	<50	<50	0	<50	<50	0
C15-C28 Fraction	µg/L	100	<100	<100	0	<100	<100	0
C29-C36 Fraction	µg/L	50	<50	<50	0	<50	<100	0
C10-C36 Fraction (Sum)	µg/L	50	<50	<50	0	<50	<100	0
VOCs									
cis-1,4-Dichloro-2-butene	µg/L	5	<5	<5	0	<5		
trans-1,4-Dichloro-2-butene	µg/L	5	<5	<5	0	<5		
Dibenz(a,j)acridine	mg/L	0.005					<0.005	
Diisopropyl ether	mg/L	0.001	<0.001	<0.001	0	<0.001		
Pentachloroethane	µg/L	5	<5	<5	0	<5		

***RPDs have only been considered where a concentration is greater than 1 times the EQL.**
****Elevated RPDs are highlighted as per QAQC Profile settings (Acceptable RPDs for each EQL multiplier range are: 1000 (1 - 5 x EQL); 30 (5 - 30 x EQL); 30 (> 30 x EQL))**
*****Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory**

Table 27
QA/QC Analyitcal Results - Filed Blank Soil

Field Blanks

		Lab Report Number	**EP2309599**
		Matrix Type	**Soil**
		Date	**13 Jul 2023**
	Unit	EQL	
BTEX			
Naphthalene (VOC)	**mg/kg**	1	<1
Benzene	**mg/kg**	0.2	<0.2
Toluene	**mg/kg**	0.5	<0.5
Ethylbenzene	**mg/kg**	0.5	<0.5
Xylene (m & p)	**mg/kg**	0.5	<0.5
Xylene (o)	**mg/kg**	0.5	<0.5
Xylene Total	**mg/kg**	0.5	<0.5
Total BTEX	**mg/kg**	0.2	<0.2
TRH			
C6-C10 Fraction (F1)	**mg/kg**	10	<10
C6-C10 (F1 minus BTEX)	**mg/kg**	10	<10
Inorganics			
Moisture Content	**%**	1	<1.0
TPH			
C6-C9 Fraction	**mg/kg**	10	<10

Table 28
QA/QC Analyitcal Results - Filed Blanks Water

Field Blanks

		Lab Report Number	EP2309599	EP2309599	EP2309684	EP2309684	EP2309684
		Matrix Type	Water	Water	Water	Water	Water
		Date	13 Jul 2023	14 Jul 2023	19 Jul 2023	19 Jul 2023	19 Jul 2023
	Unit	EQL					
NA							
tert-Amyl ethyl ether (TAEE)	µg/L	1			<1		<1
Ethyl tert-Butyl Ether (ETBE)	µg/L	1			<1		<1
tert-Butyl alcohol	µg/L	5			<5		<5
BTEX							
Naphthalene (VOC)	mg/L	0.001	<0.005	<0.005	<0.005	<0.005	
Benzene	µg/L	1	<1	<1	<1	<1	<1
Toluene	µg/L	1	<2	<2	<2	<2	<2
Ethylbenzene	µg/L	1	<2	<2	<2	<2	<2
Xylene (m & p)	µg/L	2	<2	<2	<2	<2	<2
Xylene (o)	µg/L	1	<2	<2	<2	<2	<2
Xylene Total	µg/L	2	<2	<2	<2	<2	
Total BTEX	µg/L	1	<1	<1	<1	<1	
TRH							
C6-C10 Fraction (F1)	µg/L	10			<20	<20	
C6-C10 (F1 minus BTEX)	µg/L	10			<20	<20	
>C10-C16 Fraction (F2)	µg/L	50			<100		
>C10-C16 Fraction (F2 minus Naphthalene)	µg/L	50			<100		
>C16-C34 Fraction (F3)	µg/L	100			<100		
>C34-C40 Fraction (F4)	µg/L	100			<100		
>C10-C40 Fraction (Sum)	µg/L	100			<100		
Phenols							
3&4-Methylphenol (m&p-cresol)	µg/L	2	<4	<4	<4		<4
2,3,4,6-Tetrachlorophenol	µg/L	1					
2,4,5-Trichlorophenol	µg/L	1	<2	<2	<2		<2
2,4,6-Trichlorophenol	µg/L	1	<2	<2	<2		<2
2,4-Dichlorophenol	µg/L	1	<2	<2	<2		<2
2,4-Dimethylphenol	µg/L	1	<2	<2	<2		<2
2,4-Dinitrophenol	mg/L	0.02					
2,6-Dichlorophenol	µg/L	1	<2	<2	<2		<2
2-Chlorophenol	µg/L	1	<2	<2	<2		<2
2-Methylphenol	µg/L	1	<2	<2	<2		<2
2-Nitrophenol	µg/L	1	<2	<2	<2		<2
4,6-Dinitro-2-methylphenol	µg/L	20					
4-chloro-3-methylphenol	µg/L	2	<2	<2	<2		<2
4-Nitrophenol	µg/L	20					
Pentachlorophenol	µg/L	4	<4	<4	<4		<4
Phenol	µg/L	1	<2	<2	<2		<2
Amino Aliphatics							
N-nitrosodiethylamine	µg/L	2	<2	<2	<2		<2
N-nitrosodi-n-butylamine	µg/L	2	<2	<2	<2		<2
N-nitrosodi-n-propylamine	µg/L	2	<2	<2	<2		<2
N-Nitrosomethylethylamine	µg/L	2	<2	<2	<2		<2
Amino Aromatics							
1-naphthylamine	µg/L	2	<2	<2	<2		<2
2-naphthylamine	µg/L	5					
Diphenylamine	µg/L	5					
N-Nitrosodiphenyl & Diphenylamine	µg/L	4	<4	<4	<4		<4
Other							
Acetophenone	µg/L	2	<2	<2	<2		<2
Phosalone	mg/L	0.002					
Anilines							
2-nitroaniline	µg/L	4	<4	<4	<4		<4
3-nitroaniline	µg/L	4	<4	<4	<4		<4
4-chloroaniline	µg/L	2	<2	<2	<2		<2
4-nitroaniline	µg/L	2	<2	<2	<2		<2
2-methyl-5-nitroaniline	µg/L	2	<2	<2	<2		<2
Aniline	µg/L	2	<2	<2	<2		<2
Biological							
Faecal Coliforms	CFU/100mL	1			<1		
E. Coli	cfu/100 ml	1			<1		
Coliform	cfu/100 ml	1			<1		
Chlorinated Hydrocarbons							
1,1,1,2-tetrachloroethane	µg/L	1	<5	<5	<5		<5
1,1,1-trichloroethane	µg/L	1	<5	<5	<5		<5
1,1,2,2-tetrachloroethane	µg/L	1	<5	<5	<5		<5
1,1,2-trichloroethane	µg/L	1	<5	<5	<5		<5
1,1-dichloroethane	µg/L	1	<5	<5	<5		<5
1,1-dichloroethene	µg/L	1	<5	<5	<5		<5
1,1-dichloropropene	µg/L	1	<5	<5	<5		<5
1,2,3-trichloropropane	µg/L	1	<5	<5	<5		<5
1,2-dibromo-3-chloropropane	µg/L	1	<5	<5	<5		<5
1,2-dichloroethane	µg/L	1	<5	<5	<5		<5
1,2-dichloropropane	µg/L	1	<5	<5	<5		<5
1,3-dichloropropane	µg/L	1	<5	<5	<5		<5
2,2-dichloropropane	µg/L	1	<5	<5	<5		<5
Bromochloromethane	µg/L	1					
Bromodichloromethane	µg/L	1	<5	<5	<5		<5
Bromoform	µg/L	1	<5	<5	<5		<5
Carbon tetrachloride	µg/L	1	<5	<5	<5		<5
Chlorodibromomethane	µg/L	1	<5	<5	<5		<5
Chloroethane	µg/L	10	<50	<50	<50		<50
Chloroform	µg/L	1	<5	<5	<5		<5
Chloromethane	µg/L	10	<50	<50	<50		<50
cis-1,2-dichloroethene	µg/L	1	<5	<5	<5		<5
cis-1,3-dichloropropene	µg/L	1	<5	<5	<5		<5
Dibromomethane	µg/L	1	<5	<5	<5		<5
Hexachlorobutadiene	µg/L	1	<2	<2	<2		<2
Hexachlorocyclopentadiene	µg/L	5	<10	<10	<10		<10
Hexachloroethane	µg/L	2	<2	<2	<2		<2
Trichloroethene	µg/L	1	<5	<5	<5		<5
Tetrachloroethene	µg/L	1	<5	<5	<5		<5
trans-1,2-dichloroethene	µg/L	1	<5	<5	<5		<5
trans-1,3-dichloropropene	µg/L	1	<5	<5	<5		<5
Vinyl chloride	µg/L	10	<50	<50	<50		<50

Table 28
QA/QC Analyitcal Results - Filed Blanks Water

Field Blanks

		Lab Report Number	EP2309599	EP2309599	EP2309684	EP2309684	EP2309684
		Matrix Type	Water	Water	Water	Water	Water
		Date	13 Jul 2023	14 Jul 2023	19 Jul 2023	19 Jul 2023	19 Jul 2023
	Unit	EQL					
Explosives							
1,3,5-Trinitrobenzene	mg/L	0.002	<0.002	<0.002	<0.002		<0.002
1,3-Dinitrobenzene	mg/L	0.005					
2,4-Dinitrotoluene	µg/L	4	<4	<4	<4		<4
2,6-dinitrotoluene	µg/L	4	<4	<4	<4		<4
Nitrobenzene	µg/L	2	<2	<2	<2		<2
Halogenated Benzenes							
1,2,3-trichlorobenzene	µg/L	1	<5	<5	<5		<5
1,2,4,5-tetrachlorobenzene	µg/L	2					
1,2,4-trichlorobenzene	µg/L	1	<2	<2	<2		<2
1,2-dichlorobenzene	µg/L	1	<2	<2	<2		<2
1,3-dichlorobenzene	µg/L	1	<2	<2	<2		<2
1,4-dichlorobenzene	µg/L	1	<2	<2	<2		<2
2-chlorotoluene	µg/L	1	<5	<5	<5		<5
4-chlorotoluene	µg/L	1	<5	<5	<5		<5
Bromobenzene	µg/L	1	<5	<5	<5		<5
Chlorobenzene	µg/L	1	<5	<5	<5		<5
Hexachlorobenzene	µg/L	0.2	<4	<4	<4		<4
Pentachlorobenzene	µg/L	2	<2	<2	<2		<2
Halogenated Hydrocarbons							
1,2-dibromoethane	µg/L	1	<5	<5	<5		<5
Bromomethane	µg/L	10	<50	<50	<50		<50
Dichlorodifluoromethane	µg/L	10	<50	<50	<50		<50
Iodomethane	µg/L	5	<5	<5	<5		<5
Trichlorofluoromethane	µg/L	10	<50	<50	<50		<50
Herbicides							
Dinoseb	µg/L	20					
Pronamide	µg/L	2	<2	<2	<2		<2
Inorganics							
Total Phosphorus as P (Organic Phosphate as P)	mg/L	0.01			<0.01		
Sulfate as SO4 - Turbidimetric (filtered)	mg/L	1			<1		
Nitrite + Nitrate as N	mg/L	0.01			<0.01		
Alkalinity (Bicarbonate as CaCO3)	mg/L	1			<1		
Alkalinity (Carbonate as CaCO3)	mg/L	1			<1		
Alkalinity (Hydroxide) as CaCO3	mg/L	1			<1		
Alkalinity (total) as CaCO3	mg/L	1			<1		
Ammonia as N	mg/L	0.01			<0.01		
Anions Total	meq/L	0.01			<0.01		
Biochemical Oxygen Demand	mg/L	2			<2		
Cations Total	meq/L	0.01			<0.01		
Chloride	mg/L	1			<1		
Electrical Conductivity (Lab)	µS/cm	1			<1		
Ionic Balance	%	0.01			<0.01		
Kjeldahl Nitrogen Total	mg/L	0.1			<0.1		
Nitrate (as N)	mg/L	0.01			<0.01		
Nitrite (as N)	mg/L	0.01			<0.01		
Organic Nitrogen as N	mg/L	0.1			<0.1		
Nitrogen (Total)	mg/L	0.1			<0.1		
pH (Lab)	-	0.01			5.38		
Reactive Phosphorus as P (Orthophosphate as P)	mg/L	0.01			<0.01		
Sodium (filtered)	mg/L	1			<1		
MAH							
1,2,4-trimethylbenzene	µg/L	1	<5	<5	<5		<5
1,3,5-trimethylbenzene	µg/L	1	<5	<5	<5		<5
Isopropylbenzene	µg/L	1	<5	<5	<5		<5
n-butylbenzene	µg/L	1	<5	<5	<5		<5
n-propylbenzene	µg/L	1	<5	<5	<5		<5
p-isopropyltoluene	µg/L	1	<5	<5	<5		<5
sec-butylbenzene	µg/L	1	<5	<5	<5		<5
Styrene	µg/L	1	<5	<5	<5		<5
tert-butylbenzene	µg/L	1	<5	<5	<5		<5
Metals							
Antimony	mg/L	0.001					
Antimony (filtered)	mg/L	0.001	<0.001	<0.001			
Arsenic	mg/L	0.001					
Arsenic (filtered)	mg/L	0.001	<0.001	<0.001	<0.001		<0.001
Barium	mg/L	0.001					
Barium (filtered)	mg/L	0.001	<0.001	<0.001			
Beryllium	mg/L	0.0005					
Beryllium (filtered)	mg/L	0.0005	<0.001	<0.001			
Boron	mg/L	0.02					
Boron (filtered)	mg/L	0.02	<0.05	<0.05			
Cadmium	mg/L	0.0001					
Cadmium (filtered)	mg/L	0.0001	<0.0001	<0.0001	<0.0001		<0.0001
Calcium (filtered)	mg/L	1			<1		
Chromium (III+VI)	mg/L	0.001					
Chromium (III+VI) (filtered)	mg/L	0.001	<0.001	<0.001	<0.001		<0.001
Cobalt	mg/L	0.001					
Cobalt (filtered)	mg/L	0.001	<0.001	<0.001			
Copper	mg/L	0.001					
Copper (filtered)	mg/L	0.001	<0.001	<0.001	<0.001		<0.001
Lead	mg/L	0.001					
Lead (filtered)	mg/L	0.001	<0.001	<0.001	<0.001		<0.001
Magnesium (filtered)	mg/L	1			<1		
Manganese	mg/L	0.001					
Manganese (filtered)	mg/L	0.001	<0.001	<0.001			
Mercury	mg/L	0.00005					
Mercury (filtered)	mg/L	0.00005			<0.0001		<0.0001
Molybdenum	mg/L	0.001					
Molybdenum (filtered)	mg/L	0.001	<0.001	<0.001			
Nickel	mg/L	0.001					
Nickel (filtered)	mg/L	0.001	<0.001	<0.001	<0.001		<0.001
Potassium (filtered)	mg/L	1			<1		
Selenium	mg/L	0.001					
Selenium (filtered)	mg/L	0.001	<0.01	<0.01			
Tin	mg/L	0.001					
Tin (filtered)	mg/L	0.001	<0.001	<0.001			
Zinc	mg/L	0.001					
Zinc (filtered)	mg/L	0.001	<0.005	<0.005	<0.005		<0.005
Nitroaromatics							
2-Picoline	µg/L	2	<2	<2	<2		<2
4-aminobiphenyl	µg/L	2	<2	<2	<2		<2
Pentachloronitrobenzene	µg/L	2	<2	<2	<2		<2

Table 28
QA/QC Analyitcal Results - Filed Blanks Water

Field Blanks

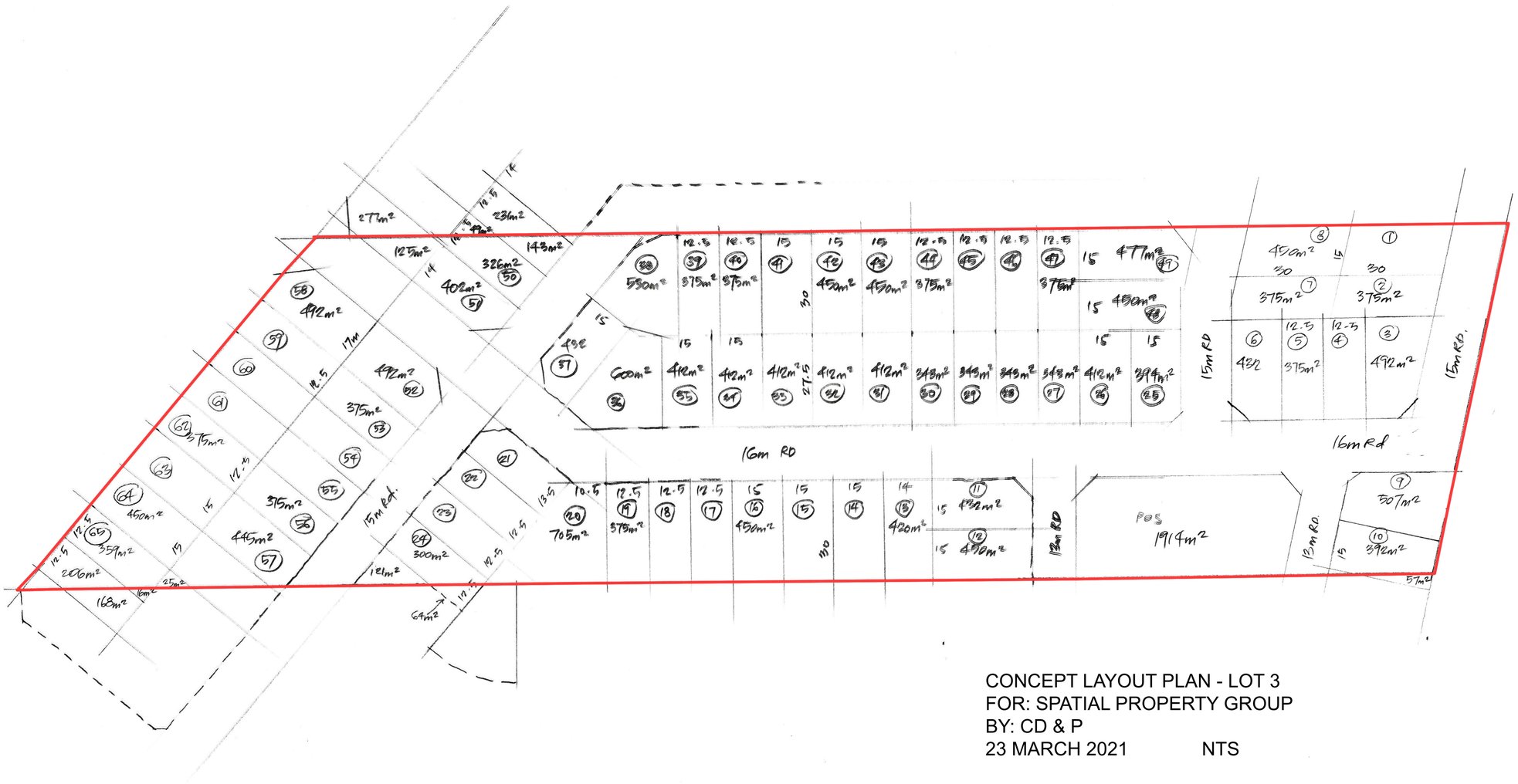
			Lab Report Number	EP2309599	EP2309599	EP2309684	EP2309684	EP2309684
			Matrix Type	Water	Water	Water	Water	Water
			Date	13 Jul 2023	14 Jul 2023	19 Jul 2023	19 Jul 2023	19 Jul 2023
	Unit	EQL						
Organochlorine Pesticides								
4,4-DDE	µg/L	0.2	<2	<2	<2		<2
a-BHC	µg/L	0.2	<2	<2	<2		<2
Aldrin	µg/L	0.2	<2	<2	<2		<2
Aldrin + Dieldrin	µg/L	4	<4	<4	<4		<4
b-BHC	µg/L	0.2	<2	<2	<2		<2
Chlordane (cis)	µg/L	0.2					
Chlordane (trans)	µg/L	0.2					
d-BHC	µg/L	0.2	<2	<2	<2		<2
DDD	µg/L	0.2	<2	<2	<2		<2
DDT	µg/L	0.2	<4	<4	<4		<4
DDT+DDE+DDD	µg/L	4	<4	<4	<4		<4
Dieldrin	µg/L	0.2	<2	<2	<2		<2
Endosulfan I	µg/L	0.2	<2	<2	<2		<2
Endosulfan II	µg/L	0.2	<2	<2	<2		<2
Endosulfan sulphate	µg/L	0.2	<2	<2	<2		<2
Endrin	µg/L	0.2	<2	<2	<2		<2
Endrin aldehyde	µg/L	0.2					
Endrin ketone	µg/L	0.2					
g-BHC (Lindane)	µg/L	0.2	<2	<2	<2		<2
Heptachlor	µg/L	0.2	<2	<2	<2		<2
Heptachlor epoxide	µg/L	0.2	<2	<2	<2		<2
Methoxychlor	µg/L	0.2					
Organophosphorous Pesticides								
Azinophos methyl	µg/L	0.2					
Bromophos-ethyl	µg/L	0.2					
Chlorfenvinphos	µg/L	2	<2	<2	<2		<2
Chlorpyrifos	µg/L	0.2	<2	<2	<2		<2
Chlorpyrifos-methyl	mg/L	0.0002	<0.002	<0.002	<0.002		<0.002
Diazinon	µg/L	0.2	<2	<2	<2		<2
Dichlorvos	µg/L	0.2	<2	<2	<2		<2
Dimethoate	µg/L	0.2	<2	<2	<2		<2
Disulfoton	µg/L	2					
Ethion	µg/L	0.2	<2	<2	<2		<2
Ethyl methanesulfonate	µg/L	5					
Fenitrothion	µg/L	0.2					
Fenthion	µg/L	2	<2	<2	<2		<2
Malathion	µg/L	0.2	<2	<2	<2		<2
Methidathion	µg/L	2					
Methyl parathion	µg/L	2					
Mevinphos (Phosdrin)	µg/L	2					
Phorate	µg/L	2					
Prothiofos	µg/L	2	<2	<2	<2		<2
Ronnel	µg/L	0.2					
Safrole	µg/L	5					
PAH								
Benzo(b+j+k)fluoranthene	mg/L	0.0002	<0.004	<0.004	<0.004		<0.004
1-Chloronaphthalene	µg/L	2					
2-chloronaphthalene	µg/L	2	<2	<2	<2		<2
2-methylnaphthalene	µg/L	2	<2	<2	<2		<2
3-methylcholanthrene	µg/L	2	<2	<2	<2		<2
7,12-dimethylbenz(a)anthracene	µg/L	2	<2	<2	<2		<2
Acenaphthene	µg/L	0.1	<2	<2	<2		<2
Acenaphthylene	µg/L	0.1	<2	<2	<2		<2
Anthracene	µg/L	0.1	<2	<2	<2		<2
Benzo(a)anthracene	µg/L	0.1	<2	<2	<2		<2
Benzo(a) pyrene	µg/L	0.1	<2	<2	<2		<2
Benzo(b+k)fluoranthene	µg/L	4					
Benzo(g,h,i)perylene	µg/L	0.1	<2	<2	<2		<2
Chrysene	µg/L	0.1	<2	<2	<2		<2
Dibenz(a,h)anthracene	µg/L	0.1	<2	<2	<2		<2
Fluoranthene	µg/L	0.1	<2	<2	<2		<2
Fluorene	µg/L	0.1	<2	<2	<2		<2
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	<2	<2	<2		<2
Naphthalene	µg/L	0.1	<2	<2	<2		<2
Phenanthrene	µg/L	0.1	<2	<2	<2		<2
Pyrene	µg/L	0.1	<2	<2	<2		<2
Benzo(a)pyrene TEQ	mg/L	0.0005					
PAHs (Sum of total)	µg/L	2	<2	<2	<2		<2
PAHs (Sum of positives)	mg/L	0.0001					
Pesticides								
Chlorobenzilate	µg/L	2	<2	<2	<2		<2
Carbazole	µg/L	2	<2	<2	<2		<2
Fenamiphos	µg/L	2					
Parathion	µg/L	0.2					
Pirimphos-ethyl	µg/L	2	<2	<2	<2		<2
Phthalates								
Bis(2-ethylhexyl) phthalate	µg/L	10	<10	<10	<10		<10
Butyl benzyl phthalate	µg/L	2	<2	<2	<2		<2
Diethylphthalate	µg/L	2	<2	<2	<2		<2
Dimethyl phthalate	µg/L	2	<2	<2	<2		<2
Di-n-butyl phthalate	µg/L	2	<2	<2	<2		<2
Di-n-octyl phthalate	µg/L	2	<2	<2	<2		<2
Solvents								
tert-Amyl Methyl Ether (TAME)	µg/L	1			<1		<1
Methyl Ethyl Ketone	µg/L	50	<50	<50	<50		<50
2-hexanone (MBK)	µg/L	50	<50	<50	<50		<50
4-Methyl-2-pentanone	µg/L	50	<50	<50	<50		<50
Carbon disulfide	µg/L	5	<5	<5	<5		<5
Cyclohexane	mg/L	0.001					
Isophorone	µg/L	2	<2	<2	<2		<2
MTBE	mg/L	0.001			<0.001		<0.001
Vinyl acetate	µg/L	50	<50	<50	<50		<50

Table 28
QA/QC Analyitcal Results - Filed Blanks Water

Field Blanks

		Lab Report Number	EP2309599	EP2309599	EP2309684	EP2309684	EP2309684
		Matrix Type	Water	Water	Water	Water	Water
		Date	13 Jul 2023	14 Jul 2023	19 Jul 2023	19 Jul 2023	19 Jul 2023
	Unit	EQL					
SVOCs							
2-(acetylamino) fluorene	µg/L	2	<2	<2	<2		<2
3,3-Dichlorobenzidine	µg/L	2	<2	<2	<2		<2
4-(dimethylamino) azobenzene	µg/L	2	<2	<2	<2		<2
4-bromophenyl phenyl ether	µg/L	2	<2	<2	<2		<2
4-chlorophenyl phenyl ether	µg/L	2	<2	<2	<2		<2
4-Nitroquinoline-N-oxide	µg/L	2	<2	<2	<2		<2
Azobenzene	µg/L	2	<2	<2	<2		<2
Benzyl alcohol	µg/L	5					
Bis(2-chloroethoxy) methane	µg/L	2	<2	<2	<2		<2
Bis(2-chloroethyl)ether	µg/L	2	<2	<2	<2		<2
Bis(2-chloroisopropyl) ether	µg/L	5					
Dibenzofuran	µg/L	2	<2	<2	<2		<2
Hexachloropropene	µg/L	2	<2	<2	<2		<2
Isosafrole	µg/L	10					
Methapyrilene	µg/L	2	<2	<2	<2		<2
N-nitrosomorpholine	µg/L	2	<2	<2	<2		<2
N-nitrosopiperidine	µg/L	2	<2	<2	<2		<2
N-nitrosopyrrolidine	µg/L	4	<4	<4	<4		<4
Phenacetin	µg/L	2	<2	<2	<2		<2
TPH							
C6-C9 Fraction	µg/L	10			<20	<20	
C10-C14 Fraction	µg/L	50			<50		
C15-C28 Fraction	µg/L	100			<100		
C29-C36 Fraction	µg/L	50			<50		
C10-C36 Fraction (Sum)	µg/L	50			<50		
VOCs							
cis-1,4-Dichloro-2-butene	µg/L	5	<5	<5	<5		<5
trans-1,4-Dichloro-2-butene	µg/L	5	<5	<5	<5		<5
Diisopropyl ether	mg/L	0.001			<0.001		<0.001
Pentachloroethane	µg/L	2	<5	<5	<5		<5

Appendix A
Concept Layout Plan



CONCEPT LAYOUT PLAN - LOT 3
FOR: SPATIAL PROPERTY GROUP
BY: CD & P
23 MARCH 2021 NTS

Appendix B
Certificate of Title

WESTERN AUSTRALIA

REGISTER NUMBER	
3/D29589	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
N/A	N/A

VOLUME 382 FOLIO 138A

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

BGRoberts

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 3 ON DIAGRAM 29589

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

VYSELL PTY LTD OF 392 BALDIVIS ROAD, BALDIVIS

(T E000794) REGISTERED 24/1/1989

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. *N800948 MORTGAGE TO WESTPAC BANKING CORPORATION REGISTERED 3/1/2018.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND:	382-138A (3/D29589)
PREVIOUS TITLE:	1282-474
PROPERTY STREET ADDRESS:	392 BALDIVIS RD, BALDIVIS.
LOCAL GOVERNMENT AUTHORITY:	CITY OF ROCKINGHAM

NOTE 1: DUPLICATE CERTIFICATE OF TITLE NOT ISSUED AS REQUESTED BY DEALING K794313

LANDGATE COPY OF ORIGINAL NOT TO SCALE 29/11/2021 02:07 PM Request number: 62887571

Landgate
www.landgate.wa.gov.au

INDEXED JT

1633/74 Transfer A302793
2600/74 Volume 1282 Folio 474

WESTERN AUSTRALIA

ORIGINAL REGISTER BOOK

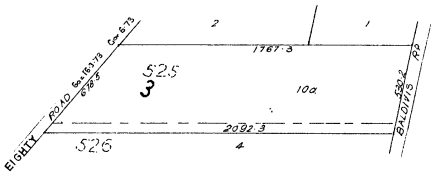
VOL. 382 FOL. 138 A

CT 0382 0138A F

Certificate of Title

UNDER THE "TRANSFER OF LAND ACT, 1893" AS AMENDED

Rodney Francis Treadgold, Farmer, and Patricia Ann Treadgold, Married Woman, both of 120 Princess Road, Claremont, are now the proprietors as joint tenants of an estate in fee simple subject to the easements and encumbrances notified hereunder in the natural surface and therefrom to a depth of two hundred feet of all that piece of land delineated and coloured green on the map hereon containing ten acres or thereabouts, being portion of each of Peel Estate Lots 525 and 526 and being Lot 3 on Diagram 29589.



Scale: 6 chains to an inch

Dated the 1st day of July, 1970.

ASSISTANT REGISTRAR OF TITLES.

Transfer B794110 to Fry & Oakley Pty. Ltd., of 194 Star Street, Carlisle. Registered 5th October 1979 at 2.52o'c.

Application C307602 On 16-7-1981 the proprietor changed its name to Carrabee Pty. Ltd.

19th February 1982

Transfer C718286 to John Alssema, Glazier and Nancy Wells Alssema, his Wife, both of 20 Milne Street, Bicton, as joint tenants. Registered 27th February 1984 at 2.44 o'c.

Transfer E000794 to Vysell Pty Ltd, of 1st Floor, 113A Rokeby Road, Subiaco. Registered 24th January 1989 at 15.42 hrs

The correct address of the registered proprietor is now Lot 3 Baldivis Road, Baldivis. By F832879. Dated 20th March 1995 at 9.18 hrs.

67221/12/89—12M—O/FAL

For encumbrances and other matters affecting the land see back

Superseded - Copy for Sketch Only

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EASEMENTS AND ENCUMBRANCES REFERRED TO

Mortgage A302794 to Bank of New South Wales. Registered 1st July 1970 at 9.58o'c. DISCHARGED

Mortgage A393288 to Wesfeeds Pty Ltd. Registered 23rd April 1971 at 10.20o'c. DISCHARGED

Mortgage A574593 to N S Rose Poultry Pty Ltd. Registered 3rd December 1974 at 11.48 o'c DISCHARGED

Discharge A804586 of Mortgage A 393288. Registered 2nd April 1974 at 2.58 o'c.

Dup C.T. not produced. (Share Produced)

Discharge A907821. of Mortgage A574593. Registered 24th December 1974 at 9.02o'c.

Discharge B794109 of Mortgage A302794. Registered 5th October 1979 at 2.52o'c.

Mortgage E000795 to Citibank Savings Ltd. Registered 24th January 1989 at 15.42 hrs. DISCHARGED

Mortgage E000796 to Australia & New Zealand Banking Group Ltd. Registered 24th January 1989 at 15.35 hrs. DISCHARGED

Discharge F621538 of Mortgage E000795. Registered 22nd July 1994 at 8.11 hrs.

Discharge F832878 of Mortgage E000796. Registered 20th March 1995 at 9.18 hrs.

Mortgage F832879 to National Australia Bank Ltd. Registered 20th March 1995 at 9.18 hrs. DISCHARGED

Discharge G868179 of Mortgage F832879. Registered 5th August 1998 at 8.58 hrs.

Mortgage G868180 to Bank of Western Australia Ltd. Registered 5th August 1998 at 8.58 hrs.

Caveat H369566 by Laurie Anne Marshall. Lodged 22.2.00 at 15.35 hrs.

CERTIFICATE OF TITLE

VOL. 382 FOL. 138A

CT 0382 0138A B

Superseded - Copy for Sketch Only

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Landgate
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27891/62

INDEXED. LANDS.

S. 287M.

CLERK OF TITLES PAID 16/3 3/8/23

ORIGINAL

WESTERN AUSTRALIA

INDEXED
Land
Permit
Lease
Name

REGISTER BOOK
Vol. 1245 Fol. 892

047345
Diagram 29589
D. 47065

Elizabeth the Second, by the Grace of God, of the United Kingdom, Australia and Her other Realms and Territories, Queen, Head of the Commonwealth, Defender of the Faith. To all to whom these Presents shall come, GREETING: Know ye that We, of Our especial Grace, certain knowledge, and mere motion, have given and granted, and We do these Presents, for Us, Our heirs and successors, in consideration of the payment of the sum of £150. 0. 0. and the fulfilment of the prescribed conditions to the satisfaction of Our Governor of Our State of Western Australia, Give and Grant unto

Frederick Roy Williams of Wellard Dairy Farmer

(hereinafter called the Grantee), the natural surface and so much of the land as is below the natural surface to a depth of 200 feet of ALL THAT Tract or Parcel of Land situate and being in the District of Cockburn Sound in Our said State, containing 110 acres 1 rood 26 perches more or less, and marked and distinguished in the Maps and Books of the Department of Lands and Surveys of Our said State as Peel Estate Lots 524, 525, 526, 527, 528, 529, 530 and 531

and as the same is delineated and coloured green in the plan drawn hereon; TOGETHER with all Profits, Commodities, Hereditaments, and Appurtenances whatsoever thereunto belonging, or in anywise appertaining: TO HAVE AND TO HOLD the said Tract or Parcel of Land to the depth aforesaid, and all and singular the Premises hereby granted, with their appurtenances, unto the said Grantee, in fee simple; YIELDING AND PAYING for the same to Us, Our heirs and successors, one peppercorn of yearly rent on the twenty-fifth day of March in each year, or so soon thereafter as the same shall be lawfully demanded: PROVIDED, NEVERTHELESS, that subject to section 141 of the Land Act, 1933, it shall at all times be lawful for Us, Our heirs and successors, or for any person or persons acting in that behalf by Our or their authority, to resume and enter upon possession of any part of the said land which it may at any time by Us, Our heirs and successors, be deemed necessary to resume for roads, tramways, railways, railway stations, bridges, canals, towing paths, harbour or river improvement works, drainage, or irrigation works, or quarries, and generally for any other works or purposes of public use, utility, or convenience, and for the purpose of exercising the power to search for minerals hereinafter reserved, and such lands so resumed to hold to Us, Our heirs and successors, as of Our or their former estate without making to the said Grantee, or any person lawfully claiming under him, any compensation in respect thereof, so nevertheless, that the land so to be resumed shall not exceed one-twentieth part in the whole of the lands aforesaid, and that no such resumption be made of the part of any lands upon which any buildings may have been erected, or which may be in use as gardens, or otherwise, for the more convenient occupation of any such buildings, or on which any other improvements as defined by the Land Act, 1933, have been made, without compensation: AND PROVIDED, ALSO, that it shall be lawful at all times for Us, Our heirs and successors, or for any person or persons acting in that behalf, by Our or their authority, to cut and take away any such indigenous timber, and to search and dig for and carry away any stones or other materials which may be required for making or keeping in repair any roads, tramways, railways, railway stations, bridges, canals, towing paths, harbour works, breakwaters, river improvements, drainage or irrigation works, and generally for any other works or purposes of public use, utility, or convenience, without making to the said Grantee, or any person claiming under him, any compensation in respect thereof; and we do hereby save and reserve to Us, Our heirs and successors, all Mines of Gold, Silver, Copper, Tin, or other Metals, Ores, and Minerals, or other substances containing Metals, and all Gems or Precious Stones and Coal or Mineral Oil and all Phosphatic Substances in and under the said land, with full liberty at all times to search and dig for and carry away the same, and for that purpose to enter upon the said land or any part thereof; and all marketable indigenous timber including all Sandalwood and Mallet trees on the said lands is reserved to the Crown save that the grantee may ringbark, fell or otherwise destroy any marketable indigenous timber other than Sandalwood and Mallet trees in the ordinary course of bona fide clearing and use any of the timber so felled for his own reasonable requirements in connection with farming operations on the said lands with full liberty to Us, Our heirs and successors and persons authorised by Us or by any person or corporation in whom the control of forests is for the time being vested, to enter, obtain and remove any of the marketable indigenous timber and for that purpose or for the purpose of extracting any marketable indigenous timber from any other land in the locality, full liberty for Us and any of the persons aforesaid to pass and re-pass over the said lands with or without workmen, machinery, horses and cattle and to take water from any spring, stream, well or water hole and to lay down and construct pipe lines for conveying the water and to make roads and ways and construct and maintain timber tramways on the said lands subject however (where the road, way, tramway or pipeline is for the purpose of extracting any marketable indigenous timber or conveying water from any other land in the locality) to no other direct and satisfactory route being available through Crown lands, reserves or State forests without making to the grantee or transferees or assigns of the grantee fair compensation in respect of any of the matters aforesaid: Provided that We, Our heirs and successors will make good the actual amount of any structural damage done to any buildings, erections or fences by the exercise of those rights and where a fence forming part of a cattle or sheep-proof enclosure is opened, provide and maintain cattle-pits and other efficient means to prevent the escape therefrom of cattle and sheep. The timber restrictions hereinbefore mentioned shall apply to the land for a period of twenty years and no longer from the date of issue of this Grant.

CANCELLED

IN WITNESS whereof We have caused Our trusty and well-beloved LIEUTENANT-GENERAL SIR CHARLES HENRY GAIRDNER, Knight Commander of the Most Distinguished Order of Saint Michael and Saint George, Knight Commander of the Royal Victorian Order, Knight Commander of the Most Excellent Order of the British Empire, Companion of the Most Honourable Order of the Bath, Governor in and over the State of Western Australia and its Dependencies, in the Commonwealth of Australia, to affix to these presents the Public Seal of the said State.

Sealed this twenty sixth *day of* July, *One thousand nine hundred and sixty-two*

Charles Gairdner
GOVERNOR

Grant under the Land Act, 1933

Edward Bunce
Minister for Lands.

ENTERED ON RECORD this 26th day of July 1962.

for Minister for Lands.

CT 1245 0892 F

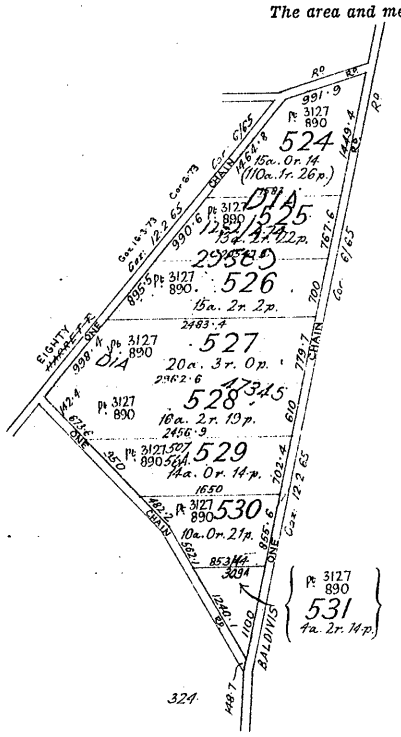
CERTIFICATE OF TITLE UNDER THE TRANSFER OF LAND ACT, 1893

The abovenamed Grantee is now the registered proprietor of an estate in fee simple subject to the easements and encumbrances notified hereunder in all the land described in this grant.
Dated the twenty eighth day of July, One thousand nine hundred and sixty-two

L. J. Lyons
ASSISTANT REGISTRAR OF TITLES.

The area and measurements on the Plan below are more or less, and a post has been placed at each corner of the lots.

PLAN HEREIN REFERRED TO:



Scale: 16 chains to an inch.
Surveyed by J. A. Nunn.
Corr.: 1820/51. O.P. 2744.
341%40. 8.1. N.M. Ex'd:
3

CANCELLED

TOTALLY CANCELLED
APPLICATION A 869453
Registered 5th September 1974 at 11.46 o'c.
The portion the subject of Dia 47345
Lot 5 to Vol. 1388 fol. 918
Lot 100 to Vol. 1388 fol. 919.
Registrar of Titles, Western Australia

V. Kelleaue
acting Surveyor General

For encumbrances and other matters affecting the land see back.

43249/1/61—1m—11/0

EASEMENTS AND ENCUMBRANCES REFERRED TO

APPLICATION 21906/64 a separate certificate

Issued for Lots 524, 525 and 526 the subject of Diagram 29589.

Registered 8th April 1964 at 9.49 am

L 182.474

Registrar of Titles

TRANSFER 3767/67

Registered 20th January 1967 at 9.14 a.m.

LOTS 530 and 531

To Vol. 14 Fol. 309A.

REGISTRAR OF TITLES

TRANSFER A408089

Registered 11th June 1971 at 12.38 p.m.

Lot 529

To Vol. 507 Fol. 56A

OFFICE OF TITLES Western Australia

CT 1245 0892 B

CROWN GRANT

Vol.....Fol.....

Application 21906/64 (62713)
Volume 1245 Folio 892

ORIGINAL

INDEXED

REGISTER BOOK.

Vol. **1282** *Fol.* Nº 474

WESTERN AUSTRALIA.

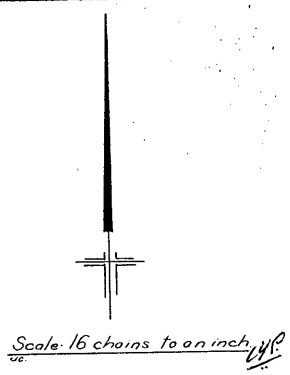
CT 1282 0474 F

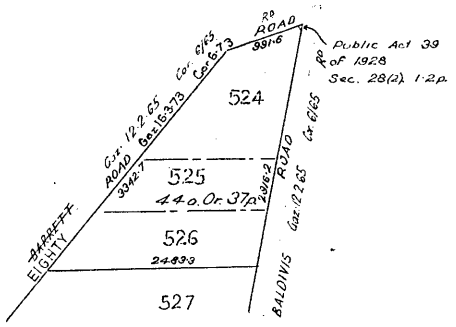
Certificate of Title

under "The Transfer of Land Act, 1893" (56 Vic., 14. Sch. 5).

CANCELLED

Frederick Roy Williams of Wellard, Dairy Farmer, is now the proprietor of an estate in fee simple subject to the easements and encumbrances notified hereunder in the natural surface and therefrom to a depth of two hundred feet of all that piece of land delineated and coloured green on the map hereon containing forty-four acres and thirty-seven perches or thereabouts, being Peel Estate Lots 524, 525, and 526 the subject of Diagram 29589.





Dated the eighth day of April One thousand nine hundred and sixty-four.

Registrar of Titles.

A302793
A302794

TOTALLY CANCELLED

~~WITHDRAWAL/S~~
~~CAVEAT~~/S
APPLICATION G990344
BALANCE (LOT 1)
To Vol. 2129 Fol. 899

LODGED/REGISTERED
29.12.98 at
11.19 hrs

CANCELLED

66191/12/62—48,500—11/C

For encumbrances and other matters affecting the land see back.

EASEMENTS AND ENCUMBRANCES REFERRED TO

TRANSFER 21907/64 Lot 2
to
Bernice Kay Mathews
Registered 8th April 1964 at 9.49 o'c
1282 · 474
Registrar of Titles

As to Lot 4 only
Caveat 3474/69 WITHDRAWN Lodged 21-8-1969 at 9.11 o'c.
ASSISTANT REGISTRAR OF TITLES

TRANSFER A 302793
Registered 1st July 1970 at 9.58 o'c.
Lot 3
To Vol. 382 Fol. 138A

Withdrawal A526443 of Caveat 3474/69.
Lodged 29-5-1972 at 11.34 o'c.

TRANSFER A526444
Registered 29th May 1972 at 11.34 o'c
Lot 4
To Vol. 1324 Fol. 476.

CT 1282 0474 B

CERTIFICATE OF TITLE

Vol. 1282 *Fol.* N° 474

Appendix C
Asbestos Removal Documentation

Capital Asbestos Removal Control Plan (ARCP)

392 Baldivis Rd BALDIVIS, 6171

Capital Asbestos Removal Control Plan (ARCP)

MAXBAY PTY LTD Class B Licence Number WARA 507 (T/A Capital)	
Prepared by	Chris Farrar
Abbreviations	
ACM	Asbestos containing Material
SWMS	Safe Work Method Statement
JSA	Job Safety Analysis
FA	Friable Asbestos
BA	Bonded/Non Friable asbestos
PPE	Personnel Protective Equipment
This ARCP has been prepared using the following Code of Practice and Regulations	CODE OF PRACTICE FOR THE SAFE REMOVAL OF ASBESTOS 2ND Edition [NOHSC:2002(2005)] Work Health and Safety (General) Regulations 2022 Work Health and Safety Act 2020
ARCP Date	21-3-2023

Capital Asbestos Removal Control Plan (ARCP)

Site Location	392 Baldivis Rd BALDIVIS, 6171	
Licenced Contractor	Capital (Maxbay Pty Ltd) WARA 507	
Name & Signature of Responsible Persons		
Capital supervisor	Chris Farrar	
	0400 422 841	
Client: Carcione Group	Robert Carcione	
	robert@carcione.com.au	
Environmental Consultant: Environmental Site Services (ESS)	John Breed	
	9355 4010	
Training: All persons involved with removal of ACM will be trained in the removal of ACM CPCCDE 3014 Remove non-friable asbestos CPCCDE 4008 Supervise asbestos removal	Removalists	
	Alan Aird Andrew Kelly Mitch Chandler Jordan Falzon Matthew Roche	Tardis Mackay Graeme Gumbleton Clae Matthews Ian Hollingsworth

CAPITAL DEMOLITION CIVIL CONCRETE RECYCLING
GROUNDWORKS DEMOLITION PTY LTD Specialising in Residential and Commercial Demolition

Capital Asbestos Removal Control Plan (ARCP)

1	Type of ACM to be removed: Friable (F) ***Description of ACM taken from the Worksafe WA website;*** *Friable asbestos is asbestos in the form of a powder, or which is soft and crumbles under hand pressure. Examples include asbestos pipe insulation and the backing on asbestos backed vinyl sheet flooring. Non-friable asbestos containing material, such as asbestos cement sheet, can become friable in some circumstances (e.g. if involved in a severe fire).* Bonded/Non Friable *(products that are made using a bonding agent e.g. cement and are solid or rigid in construction. Typical products are: eaves lining, vinyl floor tiles, bitumen based mastic.*	Bonded
2	Location, quantity & condition See Report ID: HL2223-1873	Wall cladding: 160m² - good condition

Capital Asbestos Removal Control Plan (ARCP)

3	Air Monitoring Requirements	Air monitoring will not be required at this site due to the asbestos being bonded and in good condition
4	Preparation work required	Develop site specific SWMS to outline additional risks. SWMS to be read, understood and signed by all persons involved with the task. Review of ARCP at pre start meeting. Create a clear work space with good access and egress routes. Review equipment required for removal.
5	Consultation with client	Capital will co-ordinate works with the client whilst ACM work is carried out Where the need to carry out other tasks within the exclusion area (e.g. where unknown services are located) all removal work will cease and an addition to the SWMS may be required to outline additional risks.

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6	ACM removal equipment including (PPE) PPE should not be worn outside of the removal or exclusion area	1. P2 mask (single use disposable) 2. P2 Respirator (Reusable with disposable filters) follow manufactures instruction regarding filter replacement intervals. 3. Disposable coveralls 4. Safety glasses or goggles 5. 200um plastic 6. Labelled plastic bags 7. Adhesive tape 8. Asbestos Removal signage, to be placed at the boundary and also adjacent to the removal area 9. Barrier/flagging tape 10. Portable scaffold 11. Water hose 12. PVA Adhesive and sprayer 13. Various hand tools 14. Air monitoring equipment (where required)`
7	Expected duration of removal	1 day
8	Emergency Plan:	A site specific induction may be carried out which will as a minimum establish emergency routes and muster points along with emergency notification procedures and contact details of notifiable persons Should an emergency situation arise within the removal area, any persons entering to provide assistance must wear full asbestos removal PPE or where practicable, the area made safe so as to eliminate the risk of fibres being released Emergency services should be notified of asbestos being present at the time of contact and also on arrival at site, additional PPE should be on hand for emergency personnel use as required
9	Exclusion Zones	Prior to commencement of removal, asbestos removal signage must be erected at the site boundary and all access points to prevent unauthorised access. Barriers or flagging will be erected to create and exclusion zone area. Where possible this should be at least 10m beyond the removal area. Pre start meetings should include any ACM removal planned for that day, making other site personnel aware of the removal.

CAPITAL DEMOLITION CIVIL CONCRETE RECYCLING
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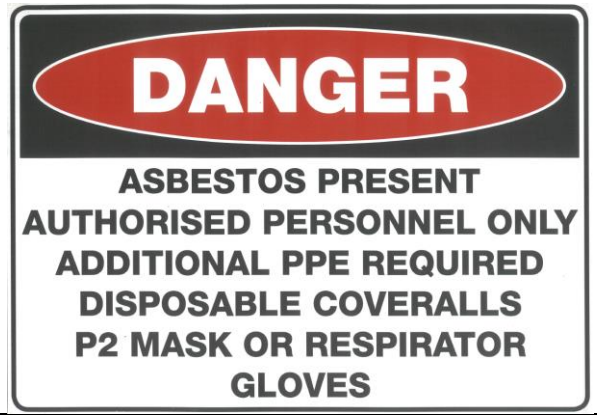
Specialising in Residential and Commercial Demolition

		SIGNAGE TO BE DISPLAYED AT SITE BOUNDARY (SHOWN AS THE BLUE BOUNDARY LINE ON THE IMAGE BELOW  SIGNAGE TO BE DISPLAYED AT THE REMOVAL AREA (SHOWN AS THE RED ZONE ON THE IMAGE BELOW)
10	Cleaning of Equipment and PPE See section 13 below also	A decontamination area must be set up at a suitable location, consisting of a drop down sheet, HEPA vacuum or water spray bottle, wet wipes and an asbestos disposal bag Prior to removing any PPE, all tools and equipment should be wiped down with a damp cloth and placed into a toolbox or tray, all plastic sheeting should be removed and folded in such a way that any potential fragments or fibres are contained within the sheet.
11	Working with power or lighting within the exclusion area	All electrical tools to have current tags. Generators should be placed in a well-ventilated place outside of the work area with cable strung on stands with cables running between. Use of water for wetting down and the risk of fire should be considered when positioning lighting.

CAPITAL DEMOLITION CIVIL CONCRETE RECYCLING
GROUNDWORKS DEMOLITION PTY LTD ABN: 45 106 969 377 Specialising in Residential and Commercial Demolition

12	Method for removing asbestos. (Updating of the SWMS may be required for changing conditions) See item 15 for disposal procedure	<u>Wall Cladding</u> The use of mobile platforms will be utilised where additional height is required. Where necessary seal doors and windows with plastic and tape. Place drop sheets below all removal areas as required Wetting down of the sheets is the preferred removal method, where this is not practical due to the risk of slip hazards, PVA adhesive should be applied. Working from the mobile scaffold, whilst one person supports the sheet a second person using a hammer to drive the nail puller under the head of the nail, remove the fixings from each sheet Once the fixings are removed from individual sheets lift the sheet from its position, the sheets should then be lifted out as a whole sheet utilising a 2 man lift where required. Pass the sheet to a person at ground level to place into the pack for wrapping and sealing or place the sheets directly into a lined bin, as each sheet is removed, the next sheet should be sprayed from above with PVA to contain any dust that may be present on the sheet. Where a pipe or cable passes through the sheet, the cable or pipe should be cut allowing the sheet to be lifted free of the obstruction, without breaking the sheet. As the sheets are removed any small fragments should be collected and placed into a marked asbestos disposal bag The area must be methodically cleaned by either washing down with a low pressure hose or vacuumed using a HEPA filtered cleaner Drop sheets should be removed as the final step, by folding or rolling the sheet into itself before placing into bags with asbestos markings and dispose of as asbestos waste

CAPITAL DEMOLITION CIVIL CONCRETE RECYCLING
GROUNDWORKS DEMOLITION PTY LTD ABN: 45 106 969 377
Specialising in Residential and Commercial Demolition

13	Decontamination of the area, personnel and equipment.	PPE should not be worn outside of the exclusion area. Disposable PPE must be bagged and sealed prior to disposal. Re-usable PPE must be cleaned and stored as per any manufacturers recommendations A decontamination area set up within the removal area, as a minimum this should include a plastic drop sheet approximately 2m x 2m, water to wash down with (bucket and cloths or a small spray bottle), wet wipes Decontamination should include all tools, equipment and personal items (e.g. boots). The work area can be either wet cleaned (hosed down) or vacuumed using a HEPA filtered machine. Tools and equipment should be wiped down with a damp cloth. All disposable PPE and equipment should be disposed of as per ACM waste by either bagging or rolling into the plastic drop sheet PERSONNAL DECONTAMINATION • If possible carry out the following in pairs rather than large groups • Stand in the centre of the decontamination drop sheet whilst the second person either vacuums your coveralls to remove any potential fibres or sprays a mist from a pressurised bottle over the coveralls to contain any fibres, repeat the process for the second person. • The next step is to remove the suit by unzipping and outwardly rolling the suit from the top to contain any potential fibres before removing each leg and then placing the suit into an asbestos marked bag, alternatively wrap the suits into the drop sheet as it is rolled/folded up • Clean your boots using a wet wipe or damp cloth to remove potential fibres. • Once finished with the, drop sheet must then be carefully folded or rolled and placed into the same bag. • The next step is to wipe your face around and over the mask prior to removing the pre filter and disposing of it into a sealed bag • The respirator can now be removed and given a final wipe with the wet wipes and storing correctly ready for re use
14	<u>HOLD POINT</u> Clearance Inspection	All areas will have a visual inspection carried out by ESS to ensure no fragments are left in situ, prior to other works commencing

CAPITAL DEMOLITION CIVIL CONCRETE RECYCLING
GROUNDWORKS DEMOLITION PTY LTD ABN: 45 106 969 377 Specialising in Residential and Commercial Demolition

15	Disposal	All ACM products and PPE will be disposed of at a registered Class 1 landfill site. ACM products will be sealed in 200um plastic and labelled as ACM The packs must be no larger in size than 400mm high Where the ACM is being directly deposited into a skip bin or small truck the sheets must be placed in layers 400mm deep, then wrapped and sealed prior to a second layer being created
16	Unexpected Finds Worksafe must be informed by phone immediately and then followed up in writing within 24 hours	All works in the area are to cease. The area must become an exclusion zone with appropriate signage, this must remain in place until any sample results or visual confirmations/assumptions are confirmed. Capital management must be notified as soon as practicable. A sample of the find must be taken in a sealed sample bag for off-site sampling or it is assumed to be asbestos and removed under asbestos conditions If the sample is positive a work order for removal must be obtained. The ACM must be removed as previously noted in section 12

CAPITAL DEMOLITION CIVIL CONCRETE RECYCLING
GROUNDWORKS DEMOLITION PTY LTD ABN: 45 106 969 377 Specialising in Residential and Commercial Demolition

Capital Asbestos Removal Control Plan (ARCP)

BLUE LINE: Shows the site boundary

RED ZONE: Shows the Asbestos Removal Work Area (ASBESTOS PPE MUST BE WORN IN THIS AREA DURING REMOVAL WORKS)

GREEN ZONE: Shows the loading area for the asbestos within the removal zone

CAPITAL DEMOLITION CIVIL CONCRETE RECYCLING
GROUNDWORKS DEMOLITION PTY LTD ABN: 45 106 969 377
Specialising in Residential and Commercial Demolition

Capital Asbestos Removal Control Plan (ARCP)

ONSITE CHANGES TO THE ARCP MUST BE NOTED BELOW ALL PERSONNEL MUST RE-SIGN AFTER ANY AMENDMENTS ARE MADE

CAPITAL DEMOLITION CIVIL CONCRETE RECYCLING
GROUNDWORKS DEMOLITION PTY LTD ABN: 45 106 969 377 Specialising in Residential and Commercial Demolition

Capital Asbestos Removal Control Plan (ARCP)

Name	Company	Sign	Date

CAPITAL DEMOLITION CIVIL CONCRETE RECYCLING
GROUNDWORKS DEMOLITION PTY LTD ABN: 45 106 969 377
Specialising in Residential and Commercial Demolition

Environmental Site Services (AUS)
T/A Environmental Site Services
ABN: 33590521277
ACN: 168142247
Office: 43 Stiles Avenue, Burswood WA 6100
Postal: PO Box 440, Wembley WA 6913
P: (08) 9355 4010
Email: admin@envss.com.au
Web: www.environmentalsiteservices.com.au

Environmental Site Services

Wednesday April 5, 2023
Reference: ENVSS_0013553_HAZ_VCC_01_2023405

Chris Farrar

Capital Recycling
P: 0400422841
E: chris@capitalperth.com.au

Subject: Asbestos Clearance at 392 Baldivis Rd Baldivis WA 6171

Dear Chris,

This is to certify that Jack Dacheff (Environmental Technician) of Environmental Site Services (ENVSS) was engaged by Capital Recycling (Client) to attend the subject site on April 5, 2023 at 9:00 am to conduct a Visual Clearance Inspection, post Asbestos Containing Material (ACM) removal works. The inspection was conducted at 392 Baldivis Rd Baldivis WA 6171.

The Client's scope, as explained to ENVSS, was to conduct the following works:

- Removal of approximately 250m2 of ACM wall cladding from a house at rear of property

On inspection of the site, the materials within the scope had been removed satisfactorily and no visible ACM or debris associated with the scope was identified within or adjacent to these areas.

The inspection was conducted in the form of a visual inspection, as required under the national code and the accepted method for clearance certification purposes, where safe to do so.

No surface sampling was undertaken at this time.

The visual inspection was undertaken to locate asbestos debris associated with above scope only and is not a clearance of the site as having:

- No microscopic fibres still present; or
- Further works required or asbestos materials that are not associated with the removal work.

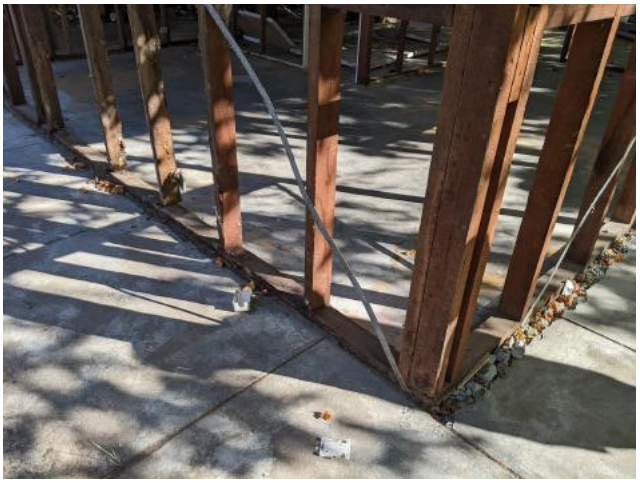
The inspection was completed in a thorough and conscientious manner, with no warranty expressed or implied. This certificate should only be presented in full and may not be used to support any other objective other than that agreed between Capital Recycling and Environmental Site Services.

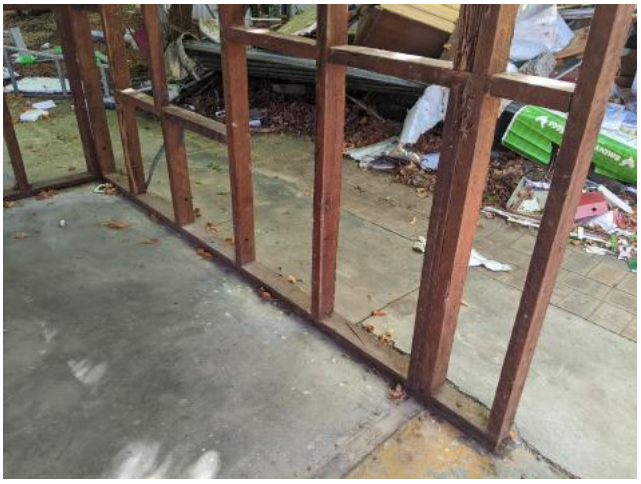
If you have any questions or require any further information, please do not hesitate to contact me.

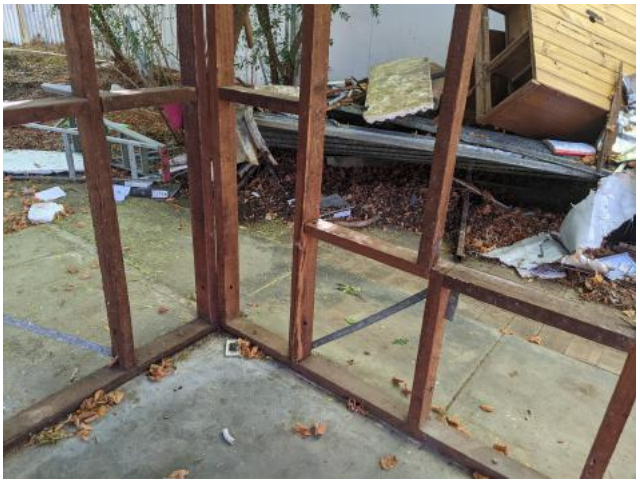
For and on behalf of Environmental Site Services.

Jack Dacheff
Environmental Technician
Environmental Site Services

Appendix A – Photographs







Definitions

Accredited Laboratory	means a testing laboratory accredited by the National Association of Testing Authorities (NATA), Australia or similar accredited laboratory, or otherwise granted recognition by NATA solely or in conjunction with one or more other persons.
Air Monitoring	means airborne asbestos fibre sampling to assist in assessing exposure to a hazardous substance and the effectiveness of implemented control measures. Air monitoring includes exposure monitoring and control monitoring. Note: Air monitoring should be undertaken in accordance with the Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC:3003 (2005)] .
Airborne Asbestos Fibres	means any fibres of asbestos small enough to be made airborne. For the purposes of monitoring airborne asbestos fibres, only respirable asbestos fibres (those fibres less than 3 µm wide, more than 5 µm long and with a length to width ratio of more than 3 to 1) are counted. Note: Airborne asbestos fibres are generated by the mechanical disintegration of Asbestos-Containing Materials (ACM) and subsequent dispersion of the fibres into the air from activities such as mining and the use, removal and disposal of asbestos and ACM. Airborne dust has the potential to contain respirable asbestos fibres.
ALARP	means As Low As Reasonably Practicable. The exposure of workers and others to asbestos must be eliminated or otherwise kept as low as reasonably practicable, and in all circumstances must be kept below the NES.
Asbestos	means the asbestiform varieties of mineral silicates belonging to the serpentine or amphibole groups of rock-forming minerals, including actinolite asbestos, grunerite (or amosite) asbestos (brown), anthophyllite asbestos, chrysotile asbestos (white), crocidolite asbestos (blue) and tremolite asbestos, or a mixture that contains one or more of these.
Asbestos Cement (AC)	means products consisting of sand aggregate and cement reinforced with asbestos fibres (e.g. asbestos cement pipes and flat or corrugated asbestos cement sheets).
Asbestos contaminated dust (ACD)	means dust that has settled and is (or is assumed to be) contaminated with asbestos.
Asbestos-Containing Material (ACM)	means any material, object, product or debris that as part of its design contains asbestos.
Asbestos Removalist	means a person conducting business or undertaking who carries out asbestos removal work Note: An asbestos removal licence is required in all State and Territory jurisdictions for the removal of friable ACM. Some States and Territories also require a licence for removal of specified quantities of ACM, regardless of whether they are friable, and relevant OHS authorities should be consulted prior to any removal work.
Asbestos Vacuum Cleaner	means a H Class vacuum that conforms to the requirements of AS/NZS 60335.2.69:2017 Household and similar electrical appliances – Safety – Particular requirements for wet and dry vacuum cleaners, including power brush, for industrial and commercial use or its equivalent. Filters for these vacuum cleaners must conform to the requirements of AS 4260-1997 High efficiency particulate air (HEPA) filters – Classification, construction and performance or its equivalent.
Asbestos Removal Work	means work involving the removal of asbestos or ACM.

	note: Class A asbestos removal work or Class B asbestos removal work as outlined in Part 8.10 of the WHS Regulations.
Asbestos Waste	means all removed ACM and disposable items used during asbestos related work, such as plastic sheeting used to cover surfaces in the asbestos work area, disposable coveralls, disposable respirators, rags used for cleaning
Debris	means material, large and heavy enough to have settled in the work area, that is likely to have originated from ACM.
Bonded (Asbestos)	means material containing asbestos that is not friable asbestos, including material containing asbestos fibres reinforced with a bonding compound. Note: Bonded ACM may become friable due to weathering, mechanical action such as a result of removal methods. ds. Example: highly weathered asbestos cement roofing, the grinding of waterproof membranes and adhesives.
Friable (Asbestos)	means material that is in a powder form or that can be crumbled, pulverised or reduced to a powder by hand pressure when dry, and contains asbestos. Note: This may include ACM that have been subjected to conditions that leave them in a state where they meet the above definition, such as weathering, physical damage, water damage etc.
Inaccessible Areas	means areas cannot be accessed during normal daily activities or routine maintenance, areas such as locked rooms, ceiling spaces, wall cavities and the interiors of plant and equipment.
Hazard	means a situation or thing that has the potential to harm a person. Hazards at work may include: noisy machinery, a moving forklift, chemicals, electricity, working at heights, a repetitive job, bullying and violence at the workplace.
In situ asbestos	means asbestos or ACM fixed or installed in a structure, equipment or plant but does not include naturally occurring asbestos.
Membrane Filter Method (MFM)	means the technique outlined in the NOHSC Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC:3003 (2005)]
National Exposure Standard (NES)	means for asbestos a respirable fibre level of 0.1 fibres/mL of air measured in a person's breathing zone and expressed as a time-weighted average fibre concentration calculated over an eight-hour working day and measured over a minimum period of four hours in accordance with the membrane filter method. means an airborne concentration of a particular substance, within the worker's breathing zone, which according to current knowledge, should not cause adverse health effects or undue discomfort to nearly all workers. NES are established, from time to time, by the National Occupational Health and Safety Commission (NOHSC) and are published on the NOHSC website (see Appendix J). Note: The NES for all forms of asbestos is 0.1 fibres/mL of air, measured using the Membrane Filter Method (MFM).
Organic Fibres	means fibres which ash at approximately 400±300C. These include natural organic fibres such as cellulose, hemp, cotton, flax, jute and wool; man-made organic fibres such as polypropylene, polyester, nylon, kevlar and acrylics.
Person with management or Control of a workplace	means a person conducting a business or undertaking to the extent that the business or undertaking involves the management or control, in whole or in part, of the workplace but does not include — (a) the occupier of a residence, unless the residence is occupied for the purposes of, or as part of, the conduct of a business or undertaking; or (b) a prescribed person.

Personal Protective Equipment (PPE)	means equipment and clothing that provides protection against fibre penetration that is used, or worn by an individual person to protect themselves against, or minimise their exposure to, workplace risks. It includes items such as respiratory protective equipment (RPE), coveralls, goggles, helmets, gloves and footwear
Respirable Asbestos Fibre	means a fibre of asbestos small enough to penetrate into the gas exchange regions of the lungs. Respirable asbestos fibres are technically defined as fibres that are less than 3 µm wide, more than 5 µm in length and have a length to width ratio of more than 3 to 1.
Risk	means the possibility that harm (death, injury or illness) might occur when exposed to a hazard. Note: In this code of practice, Risk relates to illness or disease arising from exposure to Airborne Asbestos Fibres.
Settled Dust Sampling	means the sampling and analysis of settled surface dust to provide an indication of cleanliness following disturbance of ACM. Settled dust sampling does not provide an indication of risk to health. Sampling techniques include the use of adhesive tape, wipe or micro-vacuum (using an air sampling pump and filter). Analysis can be by polarised light microscopy (PLM) or transmission electron microscopy (TEM). Note: Contamination may occur as a result of deterioration of, or work processes involving ACM.
Synthetic Mineral Fibre (SFM)	means a generic term used to collectively describe a number of amorphous (non-crystalline) fibrous materials including glassfibre, mineral wool and ceramic fibre.
Worker	means any person who carries out work for a person conducting a business or undertaking, including work as an employee, contractor or subcontractor (or their employee), self-employed person, outworker, apprentice or trainee, work experience student, employee of a labour hire company placed with a ‘host employer’ or a volunteer.
Workplace	means any place where work is carried out for a business or undertaking and includes any place where a worker goes, or is likely to be, while at work. This may include offices, factories, shops, construction sites, vehicles, ships, aircraft or other mobile structures on land or water.

Appendix D
EIL Workbooks

Inputs
Select contaminant from list below
n
elow needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/ g dwt)
3.2
Enter soil pH (calcium chloride method) (values from 1 to 14)
6.4
elow needed to calculate fresh and aged A Cs
Measured bac ground concentration (mg/ g). Leave blan if no measured value
2
or for fresh A Cs only
Enter iron content (a ua regia method) (values from 0 to 50) to obtain estimate of bac ground concentration
0.06
or for aged A Cs only
Enter State (or closest State)
SA
Enter traffic volume (high or low)
low

Outputs		
Land use	n soil-specific EILs (mg contaminant/ g dry soil)	
	Fresh	Aged
National par s and areas of high conservation value	20	40
Urban residential and open public spaces	65	170
Commercial and industrial	100	260

Inputs
Select contaminant from list below
Cu
elow needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/ g dwt)
3.2
Enter soil pH (calcium chloride method) (values from 1 to 14)
6.4
Enter organic carbon content (OC) (values from 0 to 50)
1.3
elow needed to calculate fresh and aged A Cs
Measured bac ground concentration (mg/ g). Leave blan if no measured value
4
or for fresh A Cs only
Enter iron content (a ua regia method) (values from 0 to 50) to obtain estimate of bac ground concentration
6 0
or for aged A Cs only
Enter State (or closest State)
SA
Enter traffic volume (high or low)
low

Outputs		
Land use	Cu soil-specific EILs (mg contaminant/ g dry soil)	
	Fresh	Aged
National par s and areas of high conservation value	20	25
Urban residential and open public spaces	35	60
Commercial and industrial	50	0

Inputs
Select contaminant from list below
Ni
elow needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/ g dwt)
3.2
elow needed to calculate fresh and aged A Cs
Measured bac ground concentration (mg/ g). Leave blan if no measured value
1
or for fresh A Cs only
Enter iron content (a ua regia method) (values from 0 to 50) to obtain estimate of bac ground concentration
50
or for aged A Cs only
Enter State (or closest State)
SA
Enter traffic volume (high or low)
low

Outputs		
Land use	Ni soil-specific EILs (mg contaminant/ g dry soil)	
	Fresh	Aged
National par s and areas of high conservation value	1	3
Urban residential and open public spaces	4	10
Commercial and industrial	8	20

Inputs
Select contaminant from list below
n
elow needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/ g dwt)
3.2
Enter soil pH (calcium chloride method) (values from 1 to 14)
6.4
elow needed to calculate fresh and aged A Cs
Measured bac ground concentration (mg/ g). Leave blan if no measured value
26
or for fresh A Cs only
Enter iron content (a ua regia method) (values from 0 to 50) to obtain estimate of bac ground concentration
6 0
or for aged A Cs only
Enter State (or closest State)
SA
Enter traffic volume (high or low)
low

Outputs		
Land use	n soil-specific EILs (mg contaminant/ g dry soil)	
	Fresh	Aged
National par s and areas of high conservation value	40	60
Urban residential and open public spaces	0	1 0
Commercial and industrial	130	280

Appendix E
Test Pit Logs and Monitoring Well Logs

Western Environmental
25 Prowse Street
West Perth, WA, 6005.
Telephone: 08 6162 8980

GROUNDWATER WELL MW01

CLIENT Spatial Property Grounp **PROJECT NAME** Lot 3 Baldivis Road - Detailed Site Investigation

PROJECT NUMBER 22.142 **PROJECT LOCATION** Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 29/6/23 **R.L. SURFACE** 10.997 **CASING HEIGHT** 0.62

DRILLING CONTRACTOR DPP **COORDINATES** (MGA94 Zone 50) 388695.50 m E 624482.60 m N

METHOD / HOLE SIZE Geoprobe **HOLE LOCATION**

NOTES **LOGGED BY** RM **CHECKED BY** LG

Depth (m)	RL (m)	Water	Well Diagram	Classification Symbol	Graphic Log	Material Description	Additional Observations	PID (ppm)	Samples
0	11								
				TOPSOIL		TOPSOIL- SAND - grey/dark grey, fine to coarse grained, moderately sorted, abundant organics (roots and tuff).			
				SW		NATURAL - SAND - Orange/dark grey, coarse grained, moist.			
1	10								
2	9								
3	8								
				SW		NATURAL - SAND - Orange, coarse grained, well sorted, dry.			
4	7								
5	6	8.5 mBGL							
6	5			SW		NATURAL - SAND - Pale orange, coarse grained, well sorted, dry.			
				SW					
				SW		NATURAL - SAND - Pale brown/white, coarse grained, moderately sorted, dry.			
						NATURAL - SAND - White, coarse grained, well sorted, dry.			
7	4								
				SW		NATURAL - SAND - Grey, coarse grained, well sorted, moist.			
				SW		NATURAL - SAND - White, coarse grained, well sorted, moist.			
8	3								
		▽		SW		NATURAL - SAND - White, coarse grained, well sorted, wet.			
9	2								
10	1								

Borehole MW01 terminated at 10.5m

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West Perth, WA, 6005.
Telephone: 08 6162 8980

GROUNDWATER WELL MW02

CLIENT Spatial Property Grounp **PROJECT NAME** Lot 3 Baldivis Road - Detailed Site Investigation

PROJECT NUMBER 22.142 **PROJECT LOCATION** Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 29/6/23 **R.L. SURFACE** 12.708 **CASING HEIGHT** 0.6

DRILLING CONTRACTOR DPP **COORDINATES** (MGA94 Zone 50) 388815.77 m E 6424493.16 m N

METHOD / HOLE SIZE Geoprobe **HOLE LOCATION**

NOTES **LOGGED BY** RM **CHECKED BY** LG

Depth (m)	RL (m)	Water	Well Diagram	Classification Symbol	Graphic Log	Material Description	Additional Observations	PID (ppm)	Samples
0									
				FILL		FILL - Gravelly SAND - Pale orange, medium grained, poorly sorted, abundant sub-angular gravels (limestone), moist.			
	12			FILL		FILL - SAND - Black, coarse grained, well sorted, moist.			
2				SW		NATURAL - SAND - Orange, coarse grained, well sorted, trace organics (roots) moist.			
	10								
4				SW		NATURAL - SAND - Pale orange, coarse grained, well sorted, dry.			
	8								
6		9.28 mBGL		SW		NATURAL - SAND - Orange, coarse grained, well sorted, dry.			
				SW		NATURAL - SAND - Orange, coarse grained, well sorted, dry.			
	6								
8				SW		NATURAL - SAND - White, coarse grained, well sorted, moist.			
	4								
				SW		NATURAL - SAND - Pale orange, coarse grained, well sorted, moist.			
10		▽		SP		NATURAL - SAND - White/pale orange, coarse grained, moderately sorted, wet.			
	2								
12									

Borehole MW02 terminated at 12m

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

Western Environmental
25 Prowse Street
West Perth, WA, 6005.
Telephone: 08 6162 8980

GROUNDWATER WELL MW03

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
PROJECT NUMBER 22.142
PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 29/6/23
R.L. SURFACE 11.534
CASING HEIGHT 0.6
DRILLING CONTRACTOR DPP
COORDINATES (MGA94 Zone 50) 388842.81 m E 6424438.20 m N
METHOD / HOLE SIZE Geoprobe
HOLE LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Well Diagram	Classification Symbol	Graphic Log	Material Description	Additional Observations	PID (ppm)	Samples
0									
				TOPSOIL		TOPSOIL- SAND - Black/dark grey, fine to coarse grained, moderately sorted, trace organics (roots and tuff).			
				SW		NATURAL - SAND - Pale orange, coarse grained, well sorted, moist.			
2	10			SW		NATURAL - SAND - Orange, coarse grained, well sorted, moist.			
4	8			SW		NATURAL - SAND - Orange, coarse grained, well sorted, dry.			
		8 mBGL		SW		NATURAL - SAND - White, coarse grained, well sorted, dry.			
6	6			SW		NATURAL - SAND - Pale orange, coarse grained, well sorted, moist.			
8	4	▽		SW		NATURAL - SAND - Orange, medium grained, well sorted, wet.			
				SW		NATURAL - SAND - White, medium grained, well sorted, wet.			
10	2			SP		NATURAL - SAND - Dark grey, medium to coarse grained, moderately sorted, wet.			
				SP		NATURAL - SAND - White/pale grey, coarse grained, moderately sorted, wet.			
						Borehole MW03 terminated at 10.5m			

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

Western Environmental
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West Perth, WA, 6005.
Telephone: 08 6162 8980

GROUNDWATER WELL MW04

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
PROJECT NUMBER 22.142
PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 29/6/23
R.L. SURFACE 7.376
CASING HEIGHT 0.6
DRILLING CONTRACTOR DPP
COORDINATES (MGA94 Zone 50) 389053.28 m E 6424478.14 m N
METHOD / HOLE SIZE Geoprobe
HOLE LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Well Diagram	Classification Symbol	Graphic Log	Material Description	Additional Observations	PID (ppm)	Samples
0				TOPSOIL		TOPSOIL- SAND - Black/dark grey, fine to coarse grained, moderately sorted, trace organics (roots and tuff).			
	7			SW		NATURAL - SAND - Orange, coarse grained, well sorted, moist.			
1									
	6								
2									
	5								
		3.5 mBGL		SP		NATURAL - SAND - White/pale orange, coarse grained, moderately sorted, moist.			
3				SW		NATURAL - SAND - Orange, coarse grained, well sorted, moist.			
	4								
		▽		SP		NATURAL - SAND - Pale brown/white, coarse grained, moderately sorted, wet.			
4									
	3			SW		NATURAL - SAND - Pale orange, coarse grained, well sorted, wet.			
5									
	2								

Borehole MW04 terminated at 5.5m

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Western Environmental
25 Prowse Street
West Perth, WA, 6005.
Telephone: 08 6162 8980

TEST PIT TP01

CLIENT Spatial Property Grounp **PROJECT NAME** Lot 3 Baldivis Road - Detailed Site Investigation

PROJECT NUMBER 22.142 **PROJECT LOCATION** Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23 **R.L. SURFACE** _____ **CASING HEIGHT** _____

EXCAVATION CONTRACTOR West Coast Mini **COORDINATES** _____

METHOD / HOLE SIZE Excavator 0.3 **TEST PIT LOCATION** _____

NOTES _____ **LOGGED BY** RM **CHECKED BY** LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					Gravelly SAND - Grey, fine grained, abundant organics (roots), some gravels (limestone and concrete), poorly sorted.	TP01_0-0.15*		
					Gravelly SAND -Grey, fine to coarse grained, some organics (roots), some gravels (limestone), poorly sorted.			
0.5						TP01_0.5 Sieve Sample TP01_0-1.0		
					SAND -pale yellow, fine to coarse grained, well sorted.			
1.0								
					Borehole TP01 terminated at 1m	TP01_1.0		

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

Western Environmental
25 Prowse Street
West Perth, WA, 6005.
Telephone: 08 6162 8980

TEST PIT TP02

CLIENT Spatial Property Grounp **PROJECT NAME** Lot 3 Baldivis Road - Detailed Site Investigation

PROJECT NUMBER 22.142 **PROJECT LOCATION** Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 14/7/23 **R.L. SURFACE** _____ **CASING HEIGHT** _____

EXCAVATION CONTRACTOR West Coast Mini **COORDINATES** _____

METHOD / HOLE SIZE Excavator 0.3 **TEST PIT LOCATION** _____

NOTES _____ **LOGGED BY** JD **CHECKED BY** LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark brown, fine grained, abundant organics (roots), moderately sorted.	TP02_0-0.15*/DUP03/TRIP03		
					SAND -pale grey, fine to coarse grained, trace organics (roots) well sorted.			
0.5					SAND -pale grey, fine to coarse grained, well sorted.	TP02_0.5 TP02_0-1.0		
1.0					Borehole TP02 terminated at 1m	TP02_1.0		

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

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West Perth, WA, 6005.
Telephone: 08 6162 8980

TEST PIT TP03

CLIENT Spatial Property Grounp **PROJECT NAME** Lot 3 Baldivis Road - Detailed Site Investigation

PROJECT NUMBER 22.142 **PROJECT LOCATION** Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 14/7/23 **R.L. SURFACE** _____ **CASING HEIGHT** _____

EXCAVATION CONTRACTOR West Coast Mini **COORDINATES** _____

METHOD / HOLE SIZE Excavator 0.3 **TEST PIT LOCATION** _____

NOTES _____ **LOGGED BY** JD **CHECKED BY** LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark grey, fine grained, abundant organics (roots), some gravels (limestone) moderately sorted.	TP03_0-0.15*		
					SAND -pale yellow, fine to coarse grained, trace organics (roots), some gravel (limestone) well sorted.			
0.5					SAND -pale yellow, fine to coarse grained, trace gravels (limestone) moderately sorted.	TP03_0.5 Sieve Sample TP03_0-1.0		
1.0					Borehole TP03 terminated at 1m	TP03_1.0		

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

Western Environmental
25 Prowse Street
West Perth, WA, 6005.
Telephone: 08 6162 8980

TEST PIT TP04

CLIENT Spatial Property Grounp **PROJECT NAME** Lot 3 Baldivis Road - Detailed Site Investigation

PROJECT NUMBER 22.142 **PROJECT LOCATION** Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 14/7/23 **R.L. SURFACE** _____ **CASING HEIGHT** _____

EXCAVATION CONTRACTOR West Coast Mini **COORDINATES** _____

METHOD / HOLE SIZE Excavator 0.3 **TEST PIT LOCATION** _____

NOTES _____ **LOGGED BY** JD **CHECKED BY** LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark grey, fine grained, some organics (roots), some gravels (limestone) moderately sorted.	TP04_0-0.15*		Sieve Sample TP04_0-0.1 bucket weight 16.32 kg, 1 fragment bonded ACM (20g).
					SAND -Grey, fine to coarse grained, some organics (roots), some gravel (limestone) well sorted.			
0.5					SAND -pale yellow, fine to coarse grained, trace gravels (limestone) moderately sorted.	TP04_0.5 Sieve Sample TP04_0-1.0		
1.0					Borehole TP04 terminated at 1m	TP04_1.0		

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

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25 Prowse Street
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TEST PIT TP05

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
PROJECT NUMBER 22.142
PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 14/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY JD
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark brown, fine grained, abundant organics (roots), trace gravels (limestone) moderately sorted.	TP05_0-0.15*		
					Gravelly SAND -Grey, fine to coarse grained, trace organics (roots), abundant gravels (limestone and brick), poorly sorted.			
0.5					SAND -pale yellow, fine to coarse grained, well sorted.	TP05_0.5 Sieve Sample TP05_0-1.0		
1.0					Borehole TP05 terminated at 1m	TP05_1.0		

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

Western Environmental
25 Prowse Street
West Perth, WA, 6005.
Telephone: 08 6162 8980

TEST PIT TP06

CLIENT Spatial Property Grounp **PROJECT NAME** Lot 3 Baldivis Road - Detailed Site Investigation

PROJECT NUMBER 22.142 **PROJECT LOCATION** Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 14/7/23 **R.L. SURFACE** _____ **CASING HEIGHT** _____

EXCAVATION CONTRACTOR West Coast Mini **COORDINATES** _____

METHOD / HOLE SIZE Excavator 0.3 **TEST PIT LOCATION** _____

NOTES _____ **LOGGED BY** JD **CHECKED BY** LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark grey, fine grained, abundant organics (roots), trace gravels (limestone) moderately sorted.	TP06_0-0.15*		
					SAND -Grey, fine to coarse grained, some organics (roots), well sorted.			
0.5					SAND -pale yellow, fine to coarse grained, trace gravels (limestone) moderately sorted.	TP06_0.5 Sieve Sample TP06_0-1.0		
1.0					Borehole TP06 terminated at 1m	TP06_1.0		

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

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TEST PIT TP07

CLIENT Spatial Property Grounp **PROJECT NAME** Lot 3 Baldivis Road - Detailed Site Investigation

PROJECT NUMBER 22.142 **PROJECT LOCATION** Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23 **R.L. SURFACE** **CASING HEIGHT**

EXCAVATION CONTRACTOR West Coast Mini **COORDINATES**

METHOD / HOLE SIZE Excavator 0.3 **TEST PIT LOCATION**

NOTES **LOGGED BY** RM **CHECKED BY** LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					Gravelly SAND -Pale yellow/grey, coarse grained, trace organics (roots), abundant gravels (limestone and concrete), poorly sorted.	TP07_0-0.15*		
0.5					SAND - Dark grey, medium grained, abundant organics (roots) well sorted.	TP07_0.5 Sieve Sample TP07_0-1.0		
1.0					Borehole TP07 terminated at 1m	TP07_1.0		

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TEST PIT TP08

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
PROJECT NUMBER 22.142
PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					Gravelly SAND -Dark brown/grey, coarse grained, some organics (roots), abundant gravels (limestone, blue metal and concrete), poorly sorted.	TP08_0-0.15*		
0.5					SAND -Pale yellow, coarse grained, well sorted.	TP08_0.5 Sieve Sample TP08_0-1.0		
1.0					Borehole TP08 terminated at 1m	TP08_1.0		

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TEST PIT TP09

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
PROJECT NUMBER 22.142
PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark brown, fine grained, abundant organics (roots), moderately sorted.	TP09_0-0.15*		
0.5					SAND -Pale yellow, fine to coarse grained, trace gravels (limestone) moderately sorted.	TP09_0.5 Sieve Sample TP09_0-1.0		
1.0					Borehole TP09 terminated at 1m	TP09_1.0		

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TEST PIT TP10

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
PROJECT NUMBER 22.142
PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					Gravelly SAND -Pale yellow/grey, coarse grained, abundant organics (roots), abundant gravels (limestone), trace blue metal gravels, poorly sorted.	TP10_0-0.15*		
0.5					NATURAL - SAND -Pale yellow, coarse grained, well sorted.	TP10_0.5 Sieve Sample TP10_0-1.0		
1.0					Borehole TP10 terminated at 1m	TP10_1.0		

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TEST PIT TP11

CLIENT Spatial Property Grounp
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PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					SAND - Dark grey, coarse grained, well sorted.	TP11_0-0.15*		
					SAND - Pale yellow, coarse grained, well sorted.			
0.5						TP11_0.5 Sieve Sample TP11_0-1.0		
1.0					Borehole TP11 terminated at 1m	TP11_1.0		

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TEST PIT TP12

CLIENT Spatial Property Grounp **PROJECT NAME** Lot 3 Baldivis Road - Detailed Site Investigation

PROJECT NUMBER 22.142 **PROJECT LOCATION** Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23 **R.L. SURFACE** _____ **CASING HEIGHT** _____

EXCAVATION CONTRACTOR West Coast Mini **COORDINATES** _____

METHOD / HOLE SIZE Excavator 0.3 **TEST PIT LOCATION** _____

NOTES _____ **LOGGED BY** RM **CHECKED BY** LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					SAND - Dark grey, coarse grained, well sorted.	TP12_0-0.15*		
					SAND - Pale yellow, coarse grained, well sorted.			
0.5						TP12_0.5 Sieve Sample TP12_0-1.0		
1.0					Borehole TP12 terminated at 1m	TP12_1.0		

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TEST PIT TP13

CLIENT Spatial Property Grounp **PROJECT NAME** Lot 3 Baldivis Road - Detailed Site Investigation

PROJECT NUMBER 22.142 **PROJECT LOCATION** Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23 **R.L. SURFACE** _____ **CASING HEIGHT** _____

EXCAVATION CONTRACTOR West Coast Mini **COORDINATES** _____

METHOD / HOLE SIZE Excavator 0.3 **TEST PIT LOCATION** _____

NOTES _____ **LOGGED BY** RM **CHECKED BY** LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark brown, fine grained, abundant organics (roots), trace waste (plastic fragments) moderately sorted.	TP13_0-0.15*		
					SAND -Pale brown, coarse grained, trace organics (roots), well sorted.			
					SAND -Grey, coarse grained, well sorted.			
0.5					SAND - Pale yellow, coarse grained, well sorted.	TP13_0.5 Sieve Sample TP13_0-1.0		
1.0					Borehole TP13 terminated at 1m	TP13_1.0		

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TEST PIT TP14

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
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PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					SAND - Brown, fine grained, trace organics (roots), contains trace gravels (concrete) moderately sorted.	TP14_0-0.15*		
0.5					SAND - Pale yellow, coarse grained, well sorted.	TP14_0.5 Sieve Sample TP14_0-1.0		
1.0					Borehole TP14 terminated at 1m	TP14_1.0		

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TEST PIT TP15

CLIENT Spatial Property Grounp **PROJECT NAME** Lot 3 Baldivis Road - Detailed Site Investigation

PROJECT NUMBER 22.142 **PROJECT LOCATION** Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23 **R.L. SURFACE** _____ **CASING HEIGHT** _____

EXCAVATION CONTRACTOR West Coast Mini **COORDINATES** _____

METHOD / HOLE SIZE Excavator 0.3 **TEST PIT LOCATION** _____

NOTES _____ **LOGGED BY** RM **CHECKED BY** LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					SAND - yellow/grey, coarse grained, trace organics (roots), moderately sorted.	TP15_0-0.15*/DUP01/TRIP01		Sieve Sample TP15_0-0.1 bucket weight 14.79 kg, 1 fragment bonded ACM (9g).
					Silty SAND - Black, fine to coarse grained, trace organics (roots), moderately sorted.			
0.5					SAND - Brown grey/pale yellow, coarse grained, trace organics (roots), well sorted.	TP15_0.5 Sieve Sample TP15_0-1.0		
1.0					Borehole TP15 terminated at 1m	TP15_1.0		

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TEST PIT TP16

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
PROJECT NUMBER 22.142
PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					SAND - Dark grey/orange, coarse grained, some organics (roots), moderately sorted.	TP16_0-0.15*		
					SAND - Dark grey, coarse grained, trace organics (roots), well sorted.			
0.5					Natural - SAND - Pale grey, coarse grained, well sorted.	TP16_0.5 Sieve Sample TP16_0-1.0		
					Natural - SAND - Grey, coarse grained, well sorted.			
1.0					Borehole TP16 terminated at 1m	TP16_1.0		

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TEST PIT TP17

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
PROJECT NUMBER 22.142
PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark brown, fine grained, abundant organics (roots), moderately sorted.	TP17_0-0.15*		
0.5					SAND, orange, coarse grained, well sorted.	TP17_0.5 Sieve Sample TP17_0-1		
1.0					Borehole TP17 terminated at 1m	TP17_1.0		

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

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TEST PIT TP18

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
PROJECT NUMBER 22.142
PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					SAND - Brown, coarse grained, trace organics (roots), moderately sorted.	TP18_0-0.15*		
0.5					SAND - Orange, coarse grained, well sorted.	TP18_0.5 Sieve Sample TP18_0-1		
1.0					Borehole TP18 terminated at 1m	TP18_1.0		

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

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TEST PIT TP19

CLIENT Spatial Property Grounp **PROJECT NAME** Lot 3 Baldivis Road - Detailed Site Investigation

PROJECT NUMBER 22.142 **PROJECT LOCATION** Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23 **R.L. SURFACE** _____ **CASING HEIGHT** _____

EXCAVATION CONTRACTOR West Coast Mini **COORDINATES** _____

METHOD / HOLE SIZE Excavator 0.3 **TEST PIT LOCATION** _____

NOTES _____ **LOGGED BY** RM **CHECKED BY** LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					SAND - Dark brown/grey, coarse grained, trace waste (plastic), moderaterly sorted.	TP19_0-0.15*		
					SAND - Brown, coarse grained, well sorted, trace organics (roots).			
0.5					SAND - Orange, coarse grained, well sorted.	TP19_0.5 Sieve Sample TP19_0-1		
1.0					Borehole TP19 terminated at 1m	TP19_1.0		

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

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TEST PIT TP20

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
PROJECT NUMBER 22.142
PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark brown, fine grained, abundant organics (roots), moderately sorted.	TP20_0-0.15*		
0.5					SAND - Pale yellow, coarse grained, some gravels (limestone), trace organics (roots). moderately sorted.	TP20_0.5 Sieve Sample TP20_0-1		
1.0					Borehole TP20 terminated at 1m	TP20_1.0		

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

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TEST PIT TP21

CLIENT Spatial Property Grounp **PROJECT NAME** Lot 3 Baldivis Road - Detailed Site Investigation

PROJECT NUMBER 22.142 **PROJECT LOCATION** Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23 **R.L. SURFACE** _____ **CASING HEIGHT** _____

EXCAVATION CONTRACTOR West Coast Mini **COORDINATES** _____

METHOD / HOLE SIZE Excavator 0.3 **TEST PIT LOCATION** _____

NOTES _____ **LOGGED BY** RM **CHECKED BY** LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark grey, fine grained, trace organics (roots), moderately sorted.			
					SAND - Pale yellow, coarse grained, well sorted.	TP21_0-0.15*		
0.5						TP21_0.5 Sieve Sample TP21_0-1.0		
1.0					Borehole TP21 terminated at 1m	TP21_1.0		

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TEST PIT TP22

CLIENT Spatial Property Grounp **PROJECT NAME** Lot 3 Baldivis Road - Detailed Site Investigation

PROJECT NUMBER 22.142 **PROJECT LOCATION** Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23 **R.L. SURFACE** _____ **CASING HEIGHT** _____

EXCAVATION CONTRACTOR West Coast Mini **COORDINATES** _____

METHOD / HOLE SIZE Excavator 0.3 **TEST PIT LOCATION** _____

NOTES _____ **LOGGED BY** RM **CHECKED BY** LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					SAND - Grey, coarse grained, some gravel (blue metal), poorly sorted.			
					SAND - Pale yellow, coarse grained, well sorted.	TP22_0-0.15*		
0.5						TP22_0.5 Sieve Sample TP22_0-1.0		
1.0					Borehole TP22 terminated at 1m	TP22_1.0		

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TEST PIT TP23

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
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PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 14/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY JD
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark grey, fine grained, abundant organics (roots), well sorted.	TP22_0-0.15*		
					SAND -grey, coarse grained, well sorted.			
0.5						TP22_0.5 Sieve Sample TP22_0-1.0		
1.0					Borehole TP23 terminated at 1m	TP22_1.0		

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

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TEST PIT TP24

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
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PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 14/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY JD
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					SAND - Dark Grey, fine grained, abundant organics (roots), some gravels (limestone and concrete), poorly sorted.	TP24_0-0.15*		
0.5						TP24_0.5 Sieve Sample TP24_0-1.0		
					SAND -pale yellow, fine to coarse grained, well sorted.			
1.0					Borehole TP24 terminated at 1m	TP24_1.0		

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TEST PIT TP25

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
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PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark brown, fine grained, abundant organics (roots), moderately sorted.	TP25_0-0.15*		
0.5					SAND -Pale yellow/orange, fine to coarse grained, well sorted.	TP25_0.5 Sieve Sample TP25_0-1.0		
1.0					Borehole TP25 terminated at 1m	TP25_1.0		

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TEST PIT TP26

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
PROJECT NUMBER 22.142
PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark brown, fine grained, some organics (roots), moderately sorted.	TP26_0-0.15*		
0.5					SAND - Pale yellow, coarse grained, well sorted.	TP26_0.5 Sieve Sample TP26_0-1.0		
1.0					Borehole TP26 terminated at 1m	TP26_1.0		

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TEST PIT TP27

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
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PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark brown, fine grained, abundant organics (roots), moderately sorted.	TP27_0-0.15*		
0.5					SAND - Pale yellow, coarse grained, well sorted.	TP27_0.5 Sieve Sample TP27_0-1.0		
1.0					Borehole TP27 terminated at 1m	TP27_1.0		

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TEST PIT TP28

CLIENT Spatial Property Grounp **PROJECT NAME** Lot 3 Baldivis Road - Detailed Site Investigation

PROJECT NUMBER 22.142 **PROJECT LOCATION** Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23 **R.L. SURFACE** _____ **CASING HEIGHT** _____

EXCAVATION CONTRACTOR West Coast Mini **COORDINATES** _____

METHOD / HOLE SIZE Excavator 0.3 **TEST PIT LOCATION** _____

NOTES _____ **LOGGED BY** RM **CHECKED BY** LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark brown, fine grained, abundant roots, moderately sorted.	TP28_0-0.15*/DUP02/TRIP02		
0.5					SAND, orange, fine to coarse grained, some organics (roots), well sorted.	TP28_0.5 Sieve Sample TP28_0-1.0		
1.0					Borehole TP28 terminated at 1m	TP28_1.0		

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TEST PIT TP29

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
PROJECT NUMBER 22.142
PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark brown, fine grained, abundant roots, moderately sorted.	TP29_0-0.15*		
0.5					SAND, orange, fine to coarse grained, some organics (roots), well sorted.	TP29_0.5 Sieve Sample TP29_0-1.0		
1.0					Borehole TP29 terminated at 1m	TP29_1.0		

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

Western Environmental
25 Prowse Street
West Perth, WA, 6005.
Telephone: 08 6162 8980

TEST PIT TP30

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
PROJECT NUMBER 22.142
PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark brown, fine grained, abundant roots, moderately sorted.	TP30_0-0.15*		
0.5					SAND, orange, fine to coarse grained, some organics (roots), well sorted.	TP30_0.5 Sieve Sample TP30_0-1.0		
1.0					Borehole TP30 terminated at 1m	TP30_1.0		

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

Western Environmental
25 Prowse Street
West Perth, WA, 6005.
Telephone: 08 6162 8980

TEST PIT TP31

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
PROJECT NUMBER 22.142
PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					SAND, brown, coarse grained, abundant organics (leaves & roots), well sorted.	TP31_0-0.15*		
0.5					SAND, orange, fine to coarse grained, some organics (roots), well sorted.	TP31_0.5 Sieve Sample TP31_0-1.0		
1.0					Borehole TP31 terminated at 1m	TP31_1.0		

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

Western Environmental
25 Prowse Street
West Perth, WA, 6005.
Telephone: 08 6162 8980

TEST PIT TP32

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
PROJECT NUMBER 22.142
PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					SAND, brown, coarse grained, abundent organics (leaves & roots), well sorted.	TP32_0-0.15*		
0.5					SAND, orange, fine to coarse grained, some organics (roots), well sorted.	TP32_0.5 Sieve Sample TP32_0-1.0		
1.0					Borehole TP32 terminated at 1m	TP32_1.0		

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

Western Environmental
25 Prowse Street
West Perth, WA, 6005.
Telephone: 08 6162 8980

TEST PIT TP33

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
PROJECT NUMBER 22.142
PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark brown, fine grained, abundant organics (roots), moderately sorted.	TP33_0-0.15*		
					SAND - Pale yellow, coarse grained, well sorted.			
0.5						TP33_0.5 Sieve Sample TP33_0-1		
1.0					Borehole TP33 terminated at 1m	TP33_1.0		

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

Western Environmental
25 Prowse Street
West Perth, WA, 6005.
Telephone: 08 6162 8980

TEST PIT TP34

CLIENT Spatial Property Grounp
PROJECT NAME Lot 3 Baldivis Road - Detailed Site Investigation
PROJECT NUMBER 22.142
PROJECT LOCATION Lot 3 (No. 392) Baldivis Road, Baldivis

DATE 13/7/23
R.L. SURFACE
CASING HEIGHT
EXCAVATION CONTRACTOR West Coast Mini
COORDINATES
METHOD / HOLE SIZE Excavator 0.3
TEST PIT LOCATION
NOTES
LOGGED BY RM
CHECKED BY LG

Depth (m)	RL (m)	Water	Classification Symbol	Graphic Log	Material Description	Samples	PID (ppm)	Additional Observations
					TOPSOIL - Silty SAND - Dark brown, fine grained, some organics (roots), moderately sorted.	TP34_0-0.15*		
0.5					SAND - Pale yellow, coarse grained, well sorted.	TP34_0.5 Sieve Sample TP34_0-1.0		
1.0					Borehole TP34 terminated at 1m	TP34_1.0		

WEPL BOREHOLE / TEST PIT / GW WELL 22.142.GPJ GINT STD AUSTRALIA.GDT 26/9/23

Appendix F
Laboratory Documentation

CHAIN OF CUSTODY RECORD

WESTERN ENVIRONMENTAL

Company Name :	WESTERN ENVIRONMENTAL PTY LTD WA	Project Number / Purchase Order :	22.142
Office Address :	Unit 5, 162 Colin St, West Perth WA 6005	Contact Name : Louis Grogan	Project Manager: Louis Grogan
Quote ID :	#N/A		

Laboratory Address :

ALS Pty Ltd
26 Rigali Way
Wangara WA 6065
Contact: David Brennan 0409 355 212
Email: David.Brennan@alsglobal.com, samples.perth@alsglobal.com

Email for results: louis.g@westenv.com.au
CC1: robin.a@westenv.com.au
CC2: jade.d@westenv.com.au
westenv@esdat.com.au

Special Directions & Comments :

#	Sample ID	Type	Sample Date	Matrix	Analytes: Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn)	S-23	S-27	S-2	S-12	S-24	W-23	TRH (C6-C10) & BTEXN			HOLD	Container: Glass Jar	ACM Bag	Amber glass	Vial	100 ml Red Plastic	Plastic Bag		
3	TB01	Trip_B	13/07/2023	Soil								X				1							
4	DUP01	Field_D	13/07/2023	Soil	X	X										1							
2	SED01	Normal	13/07/2023	Sediment			X									1							
6	TP33_0-0.15	Normal	13/07/2023	Soil				X	X							1							
7	TP33_0.5	Normal	13/07/2023	Soil											✓	1							
8	TP33_1.0	Normal	13/07/2023	Soil											✓	1							
9	TP20_0-0.15	Normal	13/07/2023	Soil		X		X								1							
10	TP20_0.5	Normal	13/07/2023	Soil											✓	1							
11	TP20_1.0	Normal	13/07/2023	Soil											✓	1							
12	TP34_0.15	Normal	13/07/2023	Soil				X	X							1							
13	TP34_0.5	Normal	13/07/2023	Soil											✓	1							
14	TP34_1.0	Normal	13/07/2023	Soil											✓	1							
15	TP26_0-0.5	Normal	13/07/2023	Soil				X	X							1							
16	TP26_0.5	Normal	13/07/2023	Soil											✓	1							
17	TP26_1.0	Normal	13/07/2023	Soil											✓	1							

Environmental Division
Perth
Work Order Reference
EP2309599

Telephone -- 61-8-9406 1301

Relinquished By:	Louis Grogan	Received By:	JS
Date & Time:	14/07/2023	Date & Time :	19/7 11:20AM
Signature:	Louis	Signature:	
		Report Number :	

Turn around Time :

Comments :

Method Of Shipment : Hand Delivered

CHAIN OF CUSTODY RECORD

WESTERN ENVIRONMENTAL

Company Name :	WESTERN ENVIRONMENTAL PTY LTD WA	Project Number / Purchase Order :	22.142
Office Address :	Unit 5, 162 Colin St, West Perth WA 6005	Contact Name : Louis Grogan	Project Manager: Louis Grogan
Laboratory Address :		Email for results: louis.g@westenv.com.au	CC1: robin.a@westenv.com.au
ALS Pty Ltd			CC2: jade.d@westenv.com.au
26 Rigali Way			westenv@esdat.com.au
Wangara WA 6065			Quote ID : #N/A
Contact: David Brennan 0409 355 212			
Email: David.Brennan@alsglobal.com, samples.perth@alsglobal.com			

#	Sample ID	Type	Sample Date	Matrix	Analytes: Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn)	S-23	S-27	S-2	S-12	S-24	W-23				HOLD	Special Directions & Comments :	Container: Glass Jar	ACM Bag	Amber glass	Vial	100 ml Red Plastic			
18	TP27_0-0.15	Normal	13/07/2023	Soil				X	X								1							
19	TP27_0.5	Normal	13/07/2023	Soil											✓		1							
20	TP27_1.0	Normal	13/07/2023	Soil											✓		1							
21	TP12_0-0.15	Normal	13/07/2023	Soil	X				X	X							1							
22	TP12_0.5	Normal	13/07/2023	Soil											✓		1							
23	TP12_1.0	Normal	13/07/2023	Soil											✓		1							
24	TP11_0-0.15	Normal	13/07/2023	Soil	X				X	X							1							
25	TP11_0.5	Normal	13/07/2023	Soil											✓		1							
26	TP11_1.0	Normal	13/07/2023	Soil											✓		1							
27	TP13_0-0.15	Normal	13/07/2023	Soil		X		X									1							
28	TP13_0.5	Normal	13/07/2023	Soil											✓		1							
29	TP13_1.0	Normal	13/07/2023	Soil											✓		1							
30	TP07_0-0.15	Normal	13/07/2023	Soil				X	X								1							
31	TP07_0.5	Normal	13/07/2023	Soil											✓		1							
32	TP07_1.0	Normal	13/07/2023	Soil											✓		1							

Relinquished By:	Louis Grogan	Received By:	Turn around Time :
Date & Time:	14/07/2023	Date & Time :	Method Of Shipment : Hand Delivered
Signature:	Louis	Signature:	Comments :
		Report Number :	

CHAIN OF CUSTODY RECORD

Company Name :	WESTERN ENVIRONMENTAL PTY LTD WA	Project Number / Purchase Order :	22.142
Office Address :	Unit 5, 162 Colin St, West Perth WA 6005	Contact Name :	Louis Grogan
Project Manager:	Louis Grogan	Quote ID :	#N/A
Email for results:	louis.g@westenv.com.au	CC1:	robin.a@westenv.com.au
CC2:	jade.d@westenv.com.au		westenv@esdat.com.au

Laboratory Address :
ALS Pty Ltd
26 Rigali Way
Wangara WA 6065
Contact: David Brennan 0409 355 212
Email: David.Brennan@alsglobal.com, samples.perth@alsglobal.com

Special Directions & Comments :

#	Sample ID	Type	Sample Date	Matrix	Analytes: Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn)	S-23	S-27	S-2	S-12	S-24	W-23				HOLD	Container: Glass Jar	ACM Bag	Amber glass	Vial	100 ml Red Plastic			
34 33	TP10_0-0.15	Normal	13/07/2023	Soil		X		X								1							
34 34	TP10_0.5	Normal	13/07/2023	Soil											✓	1							
35 35	TP10_1.0	Normal	13/07/2023	Soil											✓	1							
36 36	TP08_0-0.15	Normal	13/07/2023	Soil		X		X								1							
37 37	TP08_0.5	Normal	13/07/2023	Soil											✓	1							
38 38	TP08_1.0	Normal	13/07/2023	Soil											✓	1							
39 39	TP09_0-0.15	Normal	13/07/2023	Soil				X	X							1							
40 40	TP09_0.5	Normal	13/07/2023	Soil											✓	1							
41 41	TP09_1.0	Normal	13/07/2023	Soil											✓	1							
42 42	TP25_0-0.15	Normal	13/07/2023	Soil				X	X							1							
43 43	TP25_0.5	Normal	13/07/2023	Soil											✓	1							
44 44	TP25_1.0	Normal	13/07/2023	Soil											✓	1							
47 47	TP01_0-0.15	Normal	14/07/2023	Soil	X				X	X						1							
48 49	TP01_0.5	Normal	14/07/2023	Soil											✓	1							
45 49	TP01_1.0	Normal	14/07/2023	Soil											✓	1							

Relinquished By: Louis Grogan
Date & Time: 14/07/2023
Signature:

Received By:
Date & Time :
Signature:
Report Number :

Turn around Time :
Comments :

Method Of Shipment : Hand Delivered

CHAIN OF CUSTODY RECORD

Company Name :	WESTERN ENVIRONMENTAL PTY LTD WA	Project Number / Purchase Order :	22.142
Office Address :	Unit 5, 162 Colin St, West Perth WA 6005	Contact Name :	Louis Grogan
Project Manager:	Louis Grogan	Quote ID :	#N/A

Laboratory Address :

ALS Pty Ltd
26 Rigali Way
Wangara WA 6065
Contact: David Brennan 0409 355 212
Email: David.Brennan@alsglobal.com, samples.perth@alsglobal.com

Email for results:	louis.g@westenv.com.au	CC1:	robin.a@westenv.com.au
		CC2:	jade.d@westenv.com.au

westenv@esdat.com.au

Special Directions & Comments :

#	Sample ID	Type	Sample Date	Matrix	Analytes: Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn)	S-23	S-27	S-2	S-12	S-24	W-23				HOLD	Container: Glass Jar	ACM Bag	Amber glass	Vial	100 ml Red Plastic	Plastic bag		
46	50	TP02_0-0.15	Normal	14/07/2023	Soil		X		X								1							
47	51	TP02_0.5	Normal	14/07/2023	Soil										✓		1							
48	52	TP02_1.0	Normal	14/07/2023	Soil										✓		1					1		
49	53	TP03_0-0.15	Normal	14/07/2023	Soil		X		X								1							
50	54	TP03_0.5	Normal	14/07/2023	Soil										✓		1							
51	55	TP03_1.0	Normal	14/07/2023	Soil										✓		1							
52	56	TP04_0-0.15	Normal	14/07/2023	Soil				X	X							1	1						
53	57	TP04_0.5	Normal	14/07/2023	Soil										✓		1							
54	58	TP04_1.0	Normal	14/07/2023	Soil										✓		1							
55	59	TP05_0-0.15	Normal	14/07/2023	Soil		X		X								1							
56	60	TP05_0.5	Normal	14/07/2023	Soil										✓		1							
57	61	TP05_1.0	Normal	14/07/2023	Soil										✓		1							
58	62	TP06_0-0.15	Normal	14/07/2023	Soil		X		X								1							
59	63	TP06_0.5	Normal	14/07/2023	Soil										✓		1							
60	64	TP06_1.0	Normal	14/07/2023	Soil										✓		1							

Relinquished By:	Louis Grogan	Received By:	
Date & Time:	14/07/2023	Date & Time :	
Signature:	Louis	Signature:	
		Report Number :	

Turn around Time :

Comments :

Method Of Shipment : Hand Delivered

CHAIN OF CUSTODY RECORD

Company Name :	WESTERN ENVIRONMENTAL PTY LTD WA	Project Number / Purchase Order :	22.142
Office Address :	Unit 5, 162 Colin St, West Perth WA 6005	Contact Name :	Louis Grogan
Project Manager:	Louis Grogan	Quote ID :	#N/A

Laboratory Address :

ALS Pty Ltd
26 Rigali Way
Wangara WA 6065
Contact: David Brennan 0409 355 212
Email: David.Brennan@alsglobal.com, samples.perth@alsglobal.com

Email for results:	louis.g@westenv.com.au	CC1:	robin.a@westenv.com.au
		CC2:	jade.d@westenv.com.au

westenv@esdat.com.au

Special Directions & Comments :

#	Sample ID	Type	Sample Date	Matrix	Analytes: Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn)	S-23	S-27	S-2	S-12	S-24	W-23				HOLD	Container: Glass Jar	ACM Bag	Amber glass	Vial	100 ml Red Plastic			
64 65	TP23_0-0.15	Normal	14/07/2023	Soil				X	X							1							
65 66	TP23_0.5	Normal	14/07/2023	Soil											✓	1							
66 67	TP23_1.0	Normal	14/07/2023	Soil											✓	1							
67 68	TP24_0-0.15	Normal	14/07/2023	Soil				X	X							1							
68 69	TP24_0.5	Normal	14/07/2023	Soil											✓	1							
69 70	TP24_1.0	Normal	14/07/2023	Soil											✓	1							
70 75	TP14_0-0.15	Normal	13/07/2023	Soil	X				X	X						1							
71 76	TP14_0.5	Normal	13/07/2023	Soil											✓	1							
72 77	TP14_1.0	Normal	13/07/2023	Soil											✓	1							
73 78	TP15_0-0.15	Normal	13/07/2023	Soil	X				X	X						1							
74 79	TP15_0.5	Normal	13/07/2023	Soil											✓	1							
75 80	TP15_1.0	Normal	13/07/2023	Soil											✓	1							
76 81	TP16_0-0.15	Normal	13/07/2023	Soil		X		X								1							
77 82	TP16_0.5	Normal	13/07/2023	Soil											✓	1							
78 83	TP16_1.0	Normal	13/07/2023	Soil											✓	1							

Relinquished By:	Louis Grogan	Received By:	
Date & Time:	14/07/2023	Date & Time :	
Signature:	Louis	Signature:	
		Report Number :	

Turn around Time :

Comments :

Method Of Shipment : Hand Delivered

WESTERN ENVIRONMENTAL

CHAIN OF CUSTODY RECORD

Company Name :	WESTERN ENVIRONMENTAL PTY LTD WA	Project Number / Purchase Order :	22.142
Office Address : Unit 5, 162 Colin St, West Perth WA 6005	Contact Name : Louis Grogan	Project Manager: Louis Grogan	Quote ID : #N/A
Laboratory Address : ALS Pty Ltd, 26 Rigali Way, Wangara WA 6065, Contact: David Brennan 0409 355 212, Email: David.Brennan@alsglobal.com, samples.perth@alsglobal.com	Email for results: louis.g@westenv.com.au	CC1: robin.a@westenv.com.au CC2: jade.d@westenv.com.au	westenv@esdat.com.au

#	Sample ID	Type	Sample Date	Matrix	Analytes: Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn)	S-23	S-27	S-2	S-12	S-24	W-23				HOLD	Special Directions & Comments :	Container: Glass Jar	ACM Bag	Amber glass	Vial	100 ml Red Plastic			
76 84	TP17_0-0.15	Normal	13/07/2023	Soil				X	X								1							
77 85	TP17_0.5	Normal	13/07/2023	Soil											✓		1							
78 86	TP17_1.0	Normal	13/07/2023	Soil											✓		1							
79 87	TP18_0-0.15	Normal	13/07/2023	Soil	X				X	X							1							
80 88	TP18_0.5	Normal	13/07/2023	Soil											✓		1							
81 89	TP18_1.0	Normal	13/07/2023	Soil											✓		1							
82 90	TP19_0-0.15	Normal	13/07/2023	Soil	X				X	X							1							
83 91	TP19_0.5	Normal	13/07/2023	Soil											✓		1							
84 92	TP19_1.0	Normal	13/07/2023	Soil											✓		1							
85 93	TP21_0-0.15	Normal	13/07/2023	Soil	X				X	X							1							
86 94	TP21_0.5	Normal	13/07/2023	Soil											✓		1							
87 95	TP21_1.0	Normal	13/07/2023	Soil											✓		1							
88 96	TP22_0-0.15	Normal	13/07/2023	Soil	X				X	X							1							
89 97	TP22_0.5	Normal	13/07/2023	Soil											✓		1							
90 98	TP22_1.0	Normal	13/07/2023	Soil											✓		1							

Container: Glass Jar | ACM Bag | Amber glass | Vial | 100 ml Red Plastic

Relinquished By: Louis Grogan	Received By:	Turn around Time :	Method Of Shipment : Hand Delivered
Date & Time: 14/07/2023	Date & Time :		
Signature: Louis	Signature:	Comments :	
	Report Number :		

CHAIN OF CUSTODY RECORD

Company Name :	WESTERN ENVIRONMENTAL PTY LTD WA	Project Number / Purchase Order :	22.142
Office Address :	Unit 5, 162 Colin St, West Perth WA 6005	Contact Name : Louis Grogan	Project Manager: Louis Grogan
Quote ID :	#N/A		

Laboratory Address :

ALS Pty Ltd
26 Rigali Way
Wangara WA 6065
Contact: David Brennan 0409 355 212
Email: David.Brennan@alsglobal.com, samples.perth@alsglobal.com

Email for results:	louis.g@westenv.com.au	CC1:	robin.a@westenv.com.au
		CC2:	jade.d@westenv.com.au

westenv@esdat.com.au

Special Directions & Comments :

#	Sample ID	Type	Sample Date	Matrix	Analytes: Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn)	S-23	S-27	S-2	S-12	S-24	W-23				HOLD	Container: Glass Jar	ACM Bag	Amber glass	Vial	100 ml Red Plastic			
99	TP28_0-0.15	Normal	13/07/2023	Soil				X	X													
100	TP28_0.5	Normal	13/07/2023	Soil											✓							
101	TP28_1.0	Normal	13/07/2023	Soil											✓							
102	TP29_0-0.15	Normal	13/07/2023	Soil				X	X													
103	TP29_0.5	Normal	13/07/2023	Soil											✓							
104	TP29_1.0	Normal	13/07/2023	Soil											✓							
105	TP30_0-0.15	Normal	13/07/2023	Soil				X	X													
106	TP30_0.5	Normal	13/07/2023	Soil											✓							
107	TP30_1.0	Normal	13/07/2023	Soil											✓							
108	TP31_0-0.15	Normal	13/07/2023	Soil				X	X													
109	TP31_0.5	Normal	13/07/2023	Soil											✓							
110	TP31_1.0	Normal	13/07/2023	Soil											✓							
111	TP32_0-0.15	Normal	13/07/2023	Soil				X	X													
112	TP32_0.5	Normal	13/07/2023	Soil											✓							
113	TP32_1.0	Normal	13/07/2023	Soil											✓							

Relinquished By:	Louis Grogan	Received By:		Turn around Time :	Method Of Shipment :
Date & Time:	14/07/2023	Date & Time :			Hand Delivered
Signature:	Louis	Signature:		Comments :	
		Report Number :			

CHAIN OF CUSTODY RECORD

Company Name :	WESTERN ENVIRONMENTAL PTY LTD WA	Project Number / Purchase Order :	22.142
Office Address :	Unit 5, 162 Colin St, West Perth WA 6005	Contact Name :	Louis Grogan
Project Manager:	Louis Grogan	Quote ID :	#N/A
Email for results:	louis.g@westenv.com.au	CC1:	robin.a@westenv.com.au
CC2:	jade.d@westenv.com.au		westenv@esdat.com.au

Laboratory Address :

ALS Pty Ltd
26 Rigali Way
Wangara WA 6065
Contact: David Brennan 0409 355 212
Email: David.Brennan@alsglobal.com, samples.perth@alsglobal.com

Special Directions & Comments :

#	Sample ID	Type	Sample Date	Matrix	Analytes: Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn)	S-23	S-27	S-2	S-12	S-24	W-23	EIL Soil Characteristics (CEC, TOC, % Clay, pH and Iron)	Please send to Eurofins with sent COC		HOLD	Container: Glass Jar	ACM Bag	Amber glass	Vial	100 ml Red Plastic			
106 46	BG01	Normal	13/07/2023	Soil																			
107 72	DUP03	Field_D	14/07/2023	Soil	X	X						X				1							
108 1	RN/FB01	Rinsate	13/07/2023	Soil	X											1							
109 71	RN/FB02	Rinsate	14/07/2023	Soil	X						X							3	2	1			
110 5	DUP02	Field_D	13/07/2023	Soil							X							1	2	1			
111 114	TB02	Trip_B	14/07/2023	Soil											✓	1							
112 —	Trip01	Interlab_D	13/07/2023	Soil											✓	1							
113 —	Trip02	Interlab_D	13/07/2023	Soil									X			1							
114 —	Trip03	Interlab_D	14/07/2023	Soil									X			1							
													X			1							

Relinquished By:	Louis Grogan	Received By:	
Date & Time:	14/07/2023	Date & Time :	
Signature:	Louis	Signature:	
		Report Number :	

Turn around Time :

Comments :

Method Of Shipment : Hand Delivered

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EP2309599**

Client	: **WESTERN ENVIRONMENTAL P/L**	Laboratory	: Environmental Division Perth
Contact	: Louis Grogan	Contact	: Customer Services EP
Address	: Unit 5, 162 Colin Street West Perth 6005	Address	: 26 Rigali Way Wangara WA Australia 6065
E-mail	: louis.g@westenv.com.au	E-mail	: ALSEnviro.Perth@alsglobal.com
Telephone	: ----	Telephone	: +61-8-9406 1301
Facsimile	: ----	Facsimile	: +61-8-9406 1399
Project	: P22.142	Page	: 1 of 7
Order number	: P22.114	Quote number	: EP2020WESENV0004 (EN/110)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: JADE DENNIS, Louis Grogan		

Dates

Date Samples Received	: 14-Jul-2023 16:20	Issue Date	: 19-Jul-2023
Client Requested Due Date	: 31-Jul-2023	Scheduled Reporting Date	: **31-Jul-2023**

Delivery Details

Mode of Delivery	: Client Drop Off	Security Seal	: Intact.
No. of coolers/boxes	: 3	Temperature	: 1.9 - Ice present
Receipt Detail	:	No. of samples received / analysed	: 113 / 41

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- Please see scanned COC for sample discrepencies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	SOIL - EA055-103 Moisture Content	SOIL - S-18 TRH(C6-C9)/BTEXN	SOIL - S-23 SVOC/VOC	SOIL - S-27 TRH/BTEXN/PAH/Phenols/8Metals
EP2309599-002	13-Jul-2023 00:00	SED01	✓			✓
EP2309599-003	13-Jul-2023 00:00	TB01	✓	✓		
EP2309599-004	13-Jul-2023 00:00	Dup01	✓		✓	
EP2309599-006	13-Jul-2023 00:00	TP33_0-0.15	✓			
EP2309599-009	13-Jul-2023 00:00	TP20_0-0.15	✓		✓	
EP2309599-012	13-Jul-2023 00:00	TP34_0-0.15	✓			
EP2309599-015	13-Jul-2023 00:00	TP26_0-0.15	✓			
EP2309599-018	13-Jul-2023 00:00	TP27_0-0.15	✓			
EP2309599-021	13-Jul-2023 00:00	TP12_0-0.15	✓			
EP2309599-024	13-Jul-2023 00:00	TP11_0-0.15	✓			
EP2309599-027	13-Jul-2023 00:00	TP13_0-0.15	✓		✓	
EP2309599-030	13-Jul-2023 00:00	TP07_0-0.15	✓			
EP2309599-033	13-Jul-2023 00:00	TP10_0-0.15	✓		✓	
EP2309599-036	13-Jul-2023 00:00	TP08_0-0.15	✓		✓	
EP2309599-039	13-Jul-2023 00:00	TP09_0-0.15	✓			
EP2309599-042	13-Jul-2023 00:00	TP25_0-0.15	✓			
EP2309599-046	13-Jul-2023 00:00	BG01	✓			
EP2309599-047	14-Jul-2023 00:00	TP01_0-0.15	✓			
EP2309599-050	14-Jul-2023 00:00	TP02_0-0.15	✓		✓	
EP2309599-053	14-Jul-2023 00:00	TP03_0-0.15	✓		✓	
EP2309599-056	14-Jul-2023 00:00	TP04_0-0.15	✓			
EP2309599-059	14-Jul-2023 00:00	TP05_0-0.15	✓		✓	
EP2309599-062	14-Jul-2023 00:00	TP06_0-0.15	✓		✓	
EP2309599-065	14-Jul-2023 00:00	TP23_0-0.15	✓			
EP2309599-068	14-Jul-2023 00:00	TP24_0-0.15	✓			
EP2309599-072	14-Jul-2023 00:00	Dup03	✓		✓	
EP2309599-075	13-Jul-2023 00:00	TP14_0-0.15	✓			
EP2309599-078	13-Jul-2023 00:00	TP15_0-0.15	✓			
EP2309599-081	13-Jul-2023 00:00	TP16_0-0.15	✓		✓	
EP2309599-084	13-Jul-2023 00:00	TP17_0-0.15	✓			
EP2309599-087	13-Jul-2023 00:00	TP18_0-0.15	✓			
EP2309599-090	13-Jul-2023 00:00	TP19_0-0.15	✓			
EP2309599-093	13-Jul-2023 00:00	TP21_0-0.15	✓			
EP2309599-096	13-Jul-2023 00:00	TP22_0-0.15	✓			
EP2309599-099	13-Jul-2023 00:00	TP28_0-0.15	✓			

			SOIL - EA055-103 Moisture Content	SOIL - S-18 TRH(C6-C9)/BTEXN	SOIL - S-23 SVOC/VOC	SOIL - S-27 TRH/BTEXN/PAH/Phenols/8Metals
EP2309599-102	13-Jul-2023 00:00	TP29_0-0.15	✓			
EP2309599-105	13-Jul-2023 00:00	TP30_0-0.15	✓			
EP2309599-108	13-Jul-2023 00:00	TP31_0-0.15	✓			
EP2309599-111	13-Jul-2023 00:00	TP32_0-0.15	✓			

Matrix: **SOIL**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	(On Hold) SOIL No analysis requested	SOIL - EA002 pH (1:5)	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EP004 (Carbon) Organic Matter & Total Organic Carbon (Calc.)	SOIL - S-02 8 Metals (incl. Digestion)	SOIL - S-12 OC/OP Pesticides	SOIL - S-24 TRH/BTEXN/PAH + Phenols
EP2309599-004	13-Jul-2023 00:00	Dup01			✓				
EP2309599-005	13-Jul-2023 00:00	Dup02	✓						
EP2309599-006	13-Jul-2023 00:00	TP33_0-0.15					✓	✓	
EP2309599-007	13-Jul-2023 00:00	TP33_0.5	✓						
EP2309599-008	13-Jul-2023 00:00	TP33_1.0	✓						
EP2309599-009	13-Jul-2023 00:00	TP20_0-0.15					✓		
EP2309599-010	13-Jul-2023 00:00	TP20_0.5	✓						
EP2309599-011	13-Jul-2023 00:00	TP20_1.0	✓						
EP2309599-012	13-Jul-2023 00:00	TP34_0-0.15					✓	✓	
EP2309599-013	13-Jul-2023 00:00	TP34_0.5	✓						
EP2309599-014	13-Jul-2023 00:00	TP34_1.0	✓						
EP2309599-015	13-Jul-2023 00:00	TP26_0-0.15					✓	✓	
EP2309599-016	13-Jul-2023 00:00	TP26_0.5	✓						
EP2309599-017	13-Jul-2023 00:00	TP26_1.0	✓						
EP2309599-018	13-Jul-2023 00:00	TP27_0-0.15					✓	✓	
EP2309599-019	13-Jul-2023 00:00	TP27_0.5	✓						
EP2309599-020	13-Jul-2023 00:00	TP27_1.0	✓						
EP2309599-021	13-Jul-2023 00:00	TP12_0-0.15			✓			✓	✓
EP2309599-022	13-Jul-2023 00:00	TP12_0.5	✓						
EP2309599-023	13-Jul-2023 00:00	TP12_1.0	✓						
EP2309599-024	13-Jul-2023 00:00	TP11_0-0.15			✓			✓	✓
EP2309599-025	13-Jul-2023 00:00	TP11_0.5	✓						
EP2309599-026	13-Jul-2023 00:00	TP11_1.0	✓						
EP2309599-027	13-Jul-2023 00:00	TP13_0-0.15					✓		
EP2309599-028	13-Jul-2023 00:00	TP13_0.5	✓						

			(On Hold) SOIL No analysis requested	SOIL - EA002 pH (1:5)	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EP004 (Carbon) Organic Matter & Total Organic Carbon (Calc.)	SOIL - S-02 8 Metals (incl. Digestion)	SOIL - S-12 OC/OP Pesticides	SOIL - S-24 TRH/BTEXN/PAH + Phenols
EP2309599-029	13-Jul-2023 00:00	TP13_1.0	✓						
EP2309599-030	13-Jul-2023 00:00	TP07_0-0.15					✓	✓	
EP2309599-031	13-Jul-2023 00:00	TP07_0.5	✓						
EP2309599-032	13-Jul-2023 00:00	TP07_1.0	✓						
EP2309599-033	13-Jul-2023 00:00	TP10_0-0.15					✓		
EP2309599-034	13-Jul-2023 00:00	TP10_0.5	✓						
EP2309599-035	13-Jul-2023 00:00	TP10_1.0	✓						
EP2309599-036	13-Jul-2023 00:00	TP08_0-0.15					✓		
EP2309599-037	13-Jul-2023 00:00	TP08_0.5	✓						
EP2309599-038	13-Jul-2023 00:00	TP08_1.0	✓						
EP2309599-039	13-Jul-2023 00:00	TP09_0-0.15					✓	✓	
EP2309599-040	13-Jul-2023 00:00	TP09_0.5	✓						
EP2309599-041	13-Jul-2023 00:00	TP09_1.0	✓						
EP2309599-042	13-Jul-2023 00:00	TP25_0-0.15					✓	✓	
EP2309599-043	13-Jul-2023 00:00	TP25_0.5	✓						
EP2309599-044	13-Jul-2023 00:00	TP25_1.0	✓						
EP2309599-045	13-Jul-2023 00:00	TP28	✓						
EP2309599-046	13-Jul-2023 00:00	BG01		✓	✓	✓			
EP2309599-047	14-Jul-2023 00:00	TP01_0-0.15			✓			✓	✓
EP2309599-048	14-Jul-2023 00:00	TP01_0.5	✓						
EP2309599-049	14-Jul-2023 00:00	TP01_1.0	✓						
EP2309599-050	14-Jul-2023 00:00	TP02_0-0.15					✓		
EP2309599-051	14-Jul-2023 00:00	TP02_0.5	✓						
EP2309599-052	14-Jul-2023 00:00	TP02_1.0	✓						
EP2309599-053	14-Jul-2023 00:00	TP03_0-0.15					✓		
EP2309599-054	14-Jul-2023 00:00	TP03_0.5	✓						
EP2309599-055	14-Jul-2023 00:00	TP03_1.0	✓						
EP2309599-056	14-Jul-2023 00:00	TP04_0-0.15					✓	✓	
EP2309599-057	14-Jul-2023 00:00	TP04_0.5	✓						
EP2309599-058	14-Jul-2023 00:00	TP04_1.0	✓						
EP2309599-059	14-Jul-2023 00:00	TP05_0-0.15					✓		
EP2309599-060	14-Jul-2023 00:00	TP05_0.5	✓						
EP2309599-061	14-Jul-2023 00:00	TP05_1.0	✓						
EP2309599-062	14-Jul-2023 00:00	TP06_0-0.15					✓		
EP2309599-063	14-Jul-2023 00:00	TP06_0.5	✓						
EP2309599-064	14-Jul-2023 00:00	TP06_1.0	✓						
EP2309599-065	14-Jul-2023 00:00	TP23_0-0.15					✓	✓	
EP2309599-066	14-Jul-2023 00:00	TP23_0.5	✓						
EP2309599-067	14-Jul-2023 00:00	TP23_1.0	✓						
EP2309599-068	14-Jul-2023 00:00	TP24_0-0.15					✓	✓	
EP2309599-069	14-Jul-2023 00:00	TP24_0.5	✓						

			(On Hold) SOIL No analysis requested	SOIL - EA002 pH (1:5)	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EP004 (Carbon) Organic Matter & Total Organic Carbon (Calc.)	SOIL - S-02 8 Metals (incl. Digestion)	SOIL - S-12 OC/OP Pesticides	SOIL - S-24 TRH/BTEXN/PAH + Phenols
EP2309599-070	14-Jul-2023 00:00	TP24_1.0	✓						
EP2309599-072	14-Jul-2023 00:00	Dup03			✓				
EP2309599-074	14-Jul-2023 00:00	TP04	✓						
EP2309599-075	13-Jul-2023 00:00	TP14_0-0.15			✓			✓	✓
EP2309599-076	13-Jul-2023 00:00	TP14_0.5	✓						
EP2309599-077	13-Jul-2023 00:00	TP14_1.0	✓						
EP2309599-078	13-Jul-2023 00:00	TP15_0-0.15			✓			✓	✓
EP2309599-079	13-Jul-2023 00:00	TP15_0.5	✓						
EP2309599-080	13-Jul-2023 00:00	TP15_1.0	✓						
EP2309599-081	13-Jul-2023 00:00	TP16_0-0.15					✓		
EP2309599-082	13-Jul-2023 00:00	TP16_0.5	✓						
EP2309599-083	13-Jul-2023 00:00	TP16_1.0	✓						
EP2309599-084	13-Jul-2023 00:00	TP17_0-0.15					✓	✓	
EP2309599-085	13-Jul-2023 00:00	TP17_0.5	✓						
EP2309599-086	13-Jul-2023 00:00	TP17_1.0	✓						
EP2309599-087	13-Jul-2023 00:00	TP18_0-0.15			✓			✓	✓
EP2309599-088	13-Jul-2023 00:00	TP18_0.5	✓						
EP2309599-089	13-Jul-2023 00:00	TP18_1.0	✓						
EP2309599-090	13-Jul-2023 00:00	TP19_0-0.15			✓			✓	✓
EP2309599-091	13-Jul-2023 00:00	TP19_0.5	✓						
EP2309599-092	13-Jul-2023 00:00	TP19_1.0	✓						
EP2309599-093	13-Jul-2023 00:00	TP21_0-0.15			✓			✓	✓
EP2309599-094	13-Jul-2023 00:00	TP21_0.5	✓						
EP2309599-095	13-Jul-2023 00:00	TP21_1.0	✓						
EP2309599-096	13-Jul-2023 00:00	TP22_0-0.15			✓			✓	✓
EP2309599-097	13-Jul-2023 00:00	TP22_0.5	✓						
EP2309599-098	13-Jul-2023 00:00	TP22_1.0	✓						
EP2309599-099	13-Jul-2023 00:00	TP28_0-0.15					✓	✓	
EP2309599-100	13-Jul-2023 00:00	TP28_0.5	✓						
EP2309599-101	13-Jul-2023 00:00	TP28_1.0	✓						
EP2309599-102	13-Jul-2023 00:00	TP29_0-0.15					✓	✓	
EP2309599-103	13-Jul-2023 00:00	TP29_0.5	✓						
EP2309599-104	13-Jul-2023 00:00	TP29_1.0	✓						
EP2309599-105	13-Jul-2023 00:00	TP30_0-0.15					✓	✓	
EP2309599-106	13-Jul-2023 00:00	TP30_0.5	✓						
EP2309599-107	13-Jul-2023 00:00	TP30_1.0	✓						
EP2309599-108	13-Jul-2023 00:00	TP31_0-0.15					✓	✓	
EP2309599-109	13-Jul-2023 00:00	TP31_0.5	✓						
EP2309599-110	13-Jul-2023 00:00	TP31_1.0	✓						
EP2309599-111	13-Jul-2023 00:00	TP32_0-0.15					✓	✓	
EP2309599-112	13-Jul-2023 00:00	TP32_0.5	✓						

			(On Hold) SOIL No analysis requested	SOIL - EA002 pH (1:5)	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EP004 (Carbon) Organic Matter & Total Organic Carbon (Calc.)	SOIL - S-02 8 Metals (incl. Digestion)	SOIL - S-12 OC/OP Pesticides	SOIL - S-24 TRH/BTEXN/PAH + Phenols
EP2309599-113	13-Jul-2023 00:00	TP32_1.0	✓						
EP2309599-114	14-Jul-2023 00:00	TB02	✓						

Matrix: **SOIL**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	SOIL - EA150H-C Clay Content by Hydrometer	SOIL - ED008 Def Exchangeable Cations with pre-treatment -
EP2309599-046	13-Jul-2023 00:00	BG01	✓	✓

Matrix: **WATER**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	WATER - EG020F Dissolved Metals by ICP/MS	WATER - EP080 BTEXN	WATER - W-23 SVOC/VOC
EP2309599-001	13-Jul-2023 00:00	RN/FB01	✓	✓	✓
EP2309599-071	14-Jul-2023 00:00	RN/FB02	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ACCOUNTS ADDRESS		
- A4 - AU Tax Invoice (INV)	Email	accounts@westenv.com.au
ESDAT reports		
- *AU Certificate of Analysis - NATA (COA)	Email	westenv@esdat.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	westenv@esdat.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	westenv@esdat.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	westenv@esdat.com.au
- Attachment - Report (SUBCO)	Email	westenv@esdat.com.au
- Chain of Custody (CoC) (COC)	Email	westenv@esdat.com.au
- EDI Format - ESDAT (ESDAT)	Email	westenv@esdat.com.au
- EDI Format - XTab (XTAB)	Email	westenv@esdat.com.au
JADE DENNIS		
- *AU Certificate of Analysis - NATA (COA)	Email	jade.d@westenv.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jade.d@westenv.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jade.d@westenv.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jade.d@westenv.com.au
- Attachment - Report (SUBCO)	Email	jade.d@westenv.com.au
- Chain of Custody (CoC) (COC)	Email	jade.d@westenv.com.au
- EDI Format - ESDAT (ESDAT)	Email	jade.d@westenv.com.au
- EDI Format - XTab (XTAB)	Email	jade.d@westenv.com.au
Louis Grogan		
- *AU Certificate of Analysis - NATA (COA)	Email	louis.g@westenv.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	louis.g@westenv.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	louis.g@westenv.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	louis.g@westenv.com.au
- Attachment - Report (SUBCO)	Email	louis.g@westenv.com.au
- Chain of Custody (CoC) (COC)	Email	louis.g@westenv.com.au
- EDI Format - ESDAT (ESDAT)	Email	louis.g@westenv.com.au
- EDI Format - XTab (XTAB)	Email	louis.g@westenv.com.au
ROBIN A		
- *AU Certificate of Analysis - NATA (COA)	Email	robin.a@westenv.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	robin.a@westenv.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	robin.a@westenv.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	robin.a@westenv.com.au
- Attachment - Report (SUBCO)	Email	robin.a@westenv.com.au
- Chain of Custody (CoC) (COC)	Email	robin.a@westenv.com.au
- EDI Format - ESDAT (ESDAT)	Email	robin.a@westenv.com.au
- EDI Format - XTab (XTAB)	Email	robin.a@westenv.com.au

Inter-Laboratory Testing

Analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no. 1656 (Chemistry) 9854 (Biology).

(SOIL) EA150: Soil Classification based on Particle Size

(SOIL) EA152: Soil Particle Density

CERTIFICATE OF ANALYSIS

Work Order	: **EP2309599**	Page	: 1 of 76
Client	: **WESTERN ENVIRONMENTAL P/L**	Laboratory	: Environmental Division Perth
Contact	: Louis Grogan	Contact	: Customer Services EP
Address	: Unit 5, 162 Colin Street West Perth 6005	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: ----	Telephone	: +61-8-9406 1301
Project	: P22.142	Date Samples Received	: 14-Jul-2023 16:20
Order number	: P22.114	Date Analysis Commenced	: 20-Jul-2023
C-O-C number	: ----	Issue Date	: 31-Jul-2023 18:16
Sampler	: JADE DENNIS, Louis Grogan		
Site	: ----		
Quote number	: EN/110		
No. of samples received	: 113		
No. of samples analysed	: 41		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Aleksandar Vujkovic	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
David Viner	SENIOR LAB TECH	Perth Organics, Wangara, WA
Niamh Carthew	Lab Technichian	Perth Inorganics, Wangara, WA
Thomas Donovan	Senior Organic Chemist	Perth Organics, Wangara, WA

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EA150H: Soil particle density results fell outside the scope of AS1289.3.6.3. Results should be scrutinised accordingly.
- EP075: Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP068: Where reported, Total Chlordane (sum) is the sum of the reported concentrations of cis-Chlordane and trans-Chlordane at or above the LOR.
- EP068: Where reported, Total OCP is the sum of the reported concentrations of all Organochlorine Pesticides at or above LOR.
- EP074: Where reported, Total Trihalomethanes is the sum of the reported concentrations of all Trihalomethanes at or above the LOR.
- EP074: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP074: Where reported, Sum of chlorinated hydrocarbons includes carbon tetrachloride, chlorobenzene, chloroform, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichloroethane, 1,1-dichloroethene, cis-1,2-dichlorothene, trans-1,2-dichlorothene, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,2,4-trichlorobenzene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichloroethene, vinyl chloride, hexachlorobutadiene and methylene chloride.
- EP074: Where reported, Total Trimethylbenzenes is the sum of the reported concentrations of 1.2.3-Trimethylbenzene, 1.2.4-Trimethylbenzene and 1.3.5-Trimethylbenzene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EP074 / EP075 / EP075: High LCS recovery deemed acceptable as all associated analyte results are less than LOR.
- EP075: Some of the analytes in the LCS fall outside of the ALS dynamic control limits. The noted analytes have been detected at <LOR for all samples and therefore no further action was required.
- EG005: High Zn result for sample EP2309599-002 has been confirmed by re-preparation and re-analysis.
- EP075: Where reported, 'Sum of PAH' is the sum of the USEPA 16 priority PAHs
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.

- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	SED01	TB01	Dup01	TP33_0-0.15	TP20_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-002	EP2309599-003	EP2309599-004	EP2309599-006	EP2309599-009
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**15.9**	<1.0	**4.7**	**14.0**	**12.7**
EG005(ED093)T: Total Metals by ICP-AES								
Antimony	7440-36-0	5	mg/kg	----	----	<5	----	----
Barium	7440-39-3	10	mg/kg	----	----	<10	----	----
Beryllium	7440-41-7	1	mg/kg	----	----	<1	----	----
Boron	7440-42-8	50	mg/kg	----	----	<50	----	----
Cobalt	7440-48-4	2	mg/kg	----	----	<2	----	----
Manganese	7439-96-5	5	mg/kg	----	----	**8**	----	----
Molybdenum	7439-98-7	2	mg/kg	----	----	<2	----	----
Selenium	7782-49-2	5	mg/kg	----	----	<5	----	----
Tin	7440-31-5	5	mg/kg	----	----	<5	----	----
Arsenic	7440-38-2	5	mg/kg	<5	----	<5	<5	**5**
Cadmium	7440-43-9	1	mg/kg	<1	----	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	**3**	----	<2	<2	**7**
Copper	7440-50-8	5	mg/kg	**24**	----	<5	<5	**5**
Lead	7439-92-1	5	mg/kg	**5**	----	<5	<5	<5
Nickel	7440-02-0	2	mg/kg	<2	----	<2	<2	<2
Zinc	7440-66-6	5	mg/kg	**466**	----	**9**	**6**	**42**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	----	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	----	----	----	<0.05	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	----	----	----	<0.05	----
beta-BHC	319-85-7	0.05	mg/kg	----	----	----	<0.05	----
gamma-BHC	58-89-9	0.05	mg/kg	----	----	----	<0.05	----
delta-BHC	319-86-8	0.05	mg/kg	----	----	----	<0.05	----
Heptachlor	76-44-8	0.05	mg/kg	----	----	----	<0.05	----
Aldrin	309-00-2	0.05	mg/kg	----	----	----	<0.05	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	----	----	----	<0.05	----
^ Total Chlordane (sum)	----	0.05	mg/kg	----	----	----	<0.05	----
trans-Chlordane	5103-74-2	0.05	mg/kg	----	----	----	<0.05	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	----	----	----	<0.05	----
cis-Chlordane	5103-71-9	0.05	mg/kg	----	----	----	<0.05	----
Dieldrin	60-57-1	0.05	mg/kg	----	----	----	<0.05	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	SED01	TB01	Dup01	TP33_0-0.15	TP20_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-002	EP2309599-003	EP2309599-004	EP2309599-006	EP2309599-009
				Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued								
4.4`-DDE	72-55-9	0.05	mg/kg	----	----	----	<0.05	----
Endrin	72-20-8	0.05	mg/kg	----	----	----	<0.05	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	----	----	----	<0.05	----
^ **Endosulfan (sum)**	115-29-7	0.05	mg/kg	----	----	----	<0.05	----
4.4`-DDD	72-54-8	0.05	mg/kg	----	----	----	<0.05	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	----	----	----	<0.05	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	----	----	----	<0.05	----
4.4`-DDT	50-29-3	0.2	mg/kg	----	----	----	<0.2	----
Endrin ketone	53494-70-5	0.05	mg/kg	----	----	----	<0.05	----
Methoxychlor	72-43-5	0.2	mg/kg	----	----	----	<0.2	----
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	0.05	mg/kg	----	----	----	<0.05	----
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/50-2	0.05	mg/kg	----	----	----	<0.05	----
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	----	----	----	<0.05	----
Demeton-S-methyl	919-86-8	0.05	mg/kg	----	----	----	<0.05	----
Monocrotophos	6923-22-4	0.2	mg/kg	----	----	----	<0.2	----
Dimethoate	60-51-5	0.05	mg/kg	----	----	----	<0.05	----
Diazinon	333-41-5	0.05	mg/kg	----	----	----	<0.05	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	----	----	----	<0.05	----
Parathion-methyl	298-00-0	0.2	mg/kg	----	----	----	<0.2	----
Malathion	121-75-5	0.05	mg/kg	----	----	----	<0.05	----
Fenthion	55-38-9	0.05	mg/kg	----	----	----	<0.05	----
Chlorpyrifos	2921-88-2	0.05	mg/kg	----	----	----	<0.05	----
Parathion	56-38-2	0.2	mg/kg	----	----	----	<0.2	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	----	----	----	<0.05	----
Chlorfenvinphos	470-90-6	0.05	mg/kg	----	----	----	<0.05	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg	----	----	----	<0.05	----
Fenamiphos	22224-92-6	0.05	mg/kg	----	----	----	<0.05	----
Prothiofos	34643-46-4	0.05	mg/kg	----	----	----	<0.05	----
Ethion	563-12-2	0.05	mg/kg	----	----	----	<0.05	----
Carbophenothion	786-19-6	0.05	mg/kg	----	----	----	<0.05	----
Azinphos Methyl	86-50-0	0.05	mg/kg	----	----	----	<0.05	----
EP074A: Monocyclic Aromatic Hydrocarbons								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	SED01	TB01	Dup01	TP33_0-0.15	TP20_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-002	EP2309599-003	EP2309599-004	EP2309599-006	EP2309599-009
				Result	Result	Result	Result	Result
EP074A: Monocyclic Aromatic Hydrocarbons - Continued								
Benzene	71-43-2	0.2	mg/kg	----	----	<0.2	----	<0.2
Toluene	108-88-3	0.5	mg/kg	----	----	<0.5	----	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	----	----	<0.5	----	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	----	----	<0.5	----	<0.5
Styrene	100-42-5	0.5	mg/kg	----	----	<0.5	----	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	----	----	<0.5	----	<0.5
Isopropylbenzene	98-82-8	0.5	mg/kg	----	----	<0.5	----	<0.5
n-Propylbenzene	103-65-1	0.5	mg/kg	----	----	<0.5	----	<0.5
1.3.5-Trimethylbenzene	108-67-8	0.5	mg/kg	----	----	<0.5	----	<0.5
sec-Butylbenzene	135-98-8	0.5	mg/kg	----	----	<0.5	----	<0.5
1.2.4-Trimethylbenzene	95-63-6	0.5	mg/kg	----	----	<0.5	----	<0.5
tert-Butylbenzene	98-06-6	0.5	mg/kg	----	----	<0.5	----	<0.5
p-Isopropyltoluene	99-87-6	0.5	mg/kg	----	----	<0.5	----	<0.5
n-Butylbenzene	104-51-8	0.5	mg/kg	----	----	<0.5	----	<0.5
EP074B: Oxygenated Compounds								
Vinyl Acetate	108-05-4	5	mg/kg	----	----	<5	----	<5
2-Butanone (MEK)	78-93-3	5	mg/kg	----	----	<5	----	<5
4-Methyl-2-pentanone (MIBK)	108-10-1	5	mg/kg	----	----	<5	----	<5
2-Hexanone (MBK)	591-78-6	5	mg/kg	----	----	<5	----	<5
EP074C: Sulfonated Compounds								
Carbon disulfide	75-15-0	0.5	mg/kg	----	----	<0.5	----	<0.5
EP074D: Fumigants								
2.2-Dichloropropane	594-20-7	0.5	mg/kg	----	----	<0.5	----	<0.5
1.2-Dichloropropane	78-87-5	0.5	mg/kg	----	----	<0.5	----	<0.5
cis-1.3-Dichloropropylene	10061-01-5	0.5	mg/kg	----	----	<0.5	----	<0.5
trans-1.3-Dichloropropylene	10061-02-6	0.5	mg/kg	----	----	<0.5	----	<0.5
1.2-Dibromoethane (EDB)	106-93-4	0.5	mg/kg	----	----	<0.5	----	<0.5
EP074E: Halogenated Aliphatic Compounds								
Dichlorodifluoromethane	75-71-8	5	mg/kg	----	----	<5	----	<5
Chloromethane	74-87-3	5	mg/kg	----	----	<5	----	<5
Vinyl chloride	75-01-4	5	mg/kg	----	----	<5	----	<5
Bromomethane	74-83-9	5	mg/kg	----	----	<5	----	<5
Chloroethane	75-00-3	5	mg/kg	----	----	<5	----	<5
Trichlorofluoromethane	75-69-4	5	mg/kg	----	----	<5	----	<5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	SED01	TB01	Dup01	TP33_0-0.15	TP20_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-002	EP2309599-003	EP2309599-004	EP2309599-006	EP2309599-009
				Result	Result	Result	Result	Result
EP074E: Halogenated Aliphatic Compounds - Continued								
1.1-Dichloroethene	75-35-4	0.5	mg/kg	----	----	<0.5	----	<0.5
Iodomethane	74-88-4	0.5	mg/kg	----	----	<0.5	----	<0.5
trans-1.2-Dichloroethene	156-60-5	0.5	mg/kg	----	----	<0.5	----	<0.5
1.1-Dichloroethane	75-34-3	0.5	mg/kg	----	----	<0.5	----	<0.5
cis-1.2-Dichloroethene	156-59-2	0.5	mg/kg	----	----	<0.5	----	<0.5
1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	----	----	<0.5	----	<0.5
1.1-Dichloropropylene	563-58-6	0.5	mg/kg	----	----	<0.5	----	<0.5
Carbon Tetrachloride	56-23-5	0.5	mg/kg	----	----	<0.5	----	<0.5
1.2-Dichloroethane	107-06-2	0.5	mg/kg	----	----	<0.5	----	<0.5
Trichloroethene	79-01-6	0.5	mg/kg	----	----	<0.5	----	<0.5
Dibromomethane	74-95-3	0.5	mg/kg	----	----	<0.5	----	<0.5
1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	----	----	<0.5	----	<0.5
1.3-Dichloropropane	142-28-9	0.5	mg/kg	----	----	<0.5	----	<0.5
Tetrachloroethene	127-18-4	0.5	mg/kg	----	----	<0.5	----	<0.5
1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	----	----	<0.5	----	<0.5
trans-1.4-Dichloro-2-butene	110-57-6	0.5	mg/kg	----	----	<0.5	----	<0.5
cis-1.4-Dichloro-2-butene	1476-11-5	0.5	mg/kg	----	----	<0.5	----	<0.5
1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	----	----	<0.5	----	<0.5
1.2.3-Trichloropropane	96-18-4	0.5	mg/kg	----	----	<0.5	----	<0.5
Pentachloroethane	76-01-7	0.5	mg/kg	----	----	<0.5	----	<0.5
1.2-Dibromo-3-chloropropane	96-12-8	0.5	mg/kg	----	----	<0.5	----	<0.5
EP074F: Halogenated Aromatic Compounds								
Chlorobenzene	108-90-7	0.5	mg/kg	----	----	<0.5	----	<0.5
Bromobenzene	108-86-1	0.5	mg/kg	----	----	<0.5	----	<0.5
2-Chlorotoluene	95-49-8	0.5	mg/kg	----	----	<0.5	----	<0.5
4-Chlorotoluene	106-43-4	0.5	mg/kg	----	----	<0.5	----	<0.5
1.2.3-Trichlorobenzene	87-61-6	0.5	mg/kg	----	----	<0.5	----	<0.5
EP074G: Trihalomethanes								
Chloroform	67-66-3	0.5	mg/kg	----	----	<0.5	----	<0.5
Bromodichloromethane	75-27-4	0.5	mg/kg	----	----	<0.5	----	<0.5
Dibromochloromethane	124-48-1	0.5	mg/kg	----	----	<0.5	----	<0.5
Bromoform	75-25-2	0.5	mg/kg	----	----	<0.5	----	<0.5
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	<0.5	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	SED01	TB01	Dup01	TP33_0-0.15	TP20_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-002	EP2309599-003	EP2309599-004	EP2309599-006	EP2309599-009
				Result	Result	Result	Result	Result
EP075(SIM)A: Phenolic Compounds - Continued								
2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	----	----	----	----
2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	----	----	----	----
3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	----	----	----	----
2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	----	----	----	----
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	----	----	----	----
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	----	----	----	----
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	----	----	----	----
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	----	----	----	----
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	----	----	----	----
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	----	----	----	----
Pentachlorophenol	87-86-5	2	mg/kg	<2	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	----	----	----	----
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	----	----	----	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	----	----	----	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	----	----	----	----
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	----	----	----	----
Anthracene	120-12-7	0.5	mg/kg	<0.5	----	----	----	----
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	----	----	----	----
Pyrene	129-00-0	0.5	mg/kg	<0.5	----	----	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	----	----	----	----
Chrysene	218-01-9	0.5	mg/kg	<0.5	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	----	----	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	----	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	----	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	----	----	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	**0.6**	----	----	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	**1.2**	----	----	----	----
EP075A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	----	----	<0.5	----	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	SED01	TB01	Dup01	TP33_0-0.15	TP20_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-002	EP2309599-003	EP2309599-004	EP2309599-006	EP2309599-009
				Result	Result	Result	Result	Result
EP075A: Phenolic Compounds - Continued								
2-Chlorophenol	95-57-8	0.5	mg/kg	----	----	<0.5	----	<0.5
2-Methylphenol	95-48-7	0.5	mg/kg	----	----	<0.5	----	<0.5
3- & 4-Methylphenol	1319-77-3	0.5	mg/kg	----	----	<0.5	----	<0.5
2-Nitrophenol	88-75-5	0.5	mg/kg	----	----	<0.5	----	<0.5
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	----	----	<0.5	----	<0.5
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	----	----	<0.5	----	<0.5
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	----	----	<0.5	----	<0.5
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	----	----	<0.5	----	<0.5
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	----	----	<0.5	----	<0.5
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	----	----	<0.5	----	<0.5
Pentachlorophenol	87-86-5	1	mg/kg	----	----	<1	----	<1
EP075B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	----	----	<0.5	----	<0.5
2-Methylnaphthalene	91-57-6	0.5	mg/kg	----	----	<0.5	----	<0.5
2-Chloronaphthalene	91-58-7	0.5	mg/kg	----	----	<0.5	----	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	----	----	<0.5	----	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	----	----	<0.5	----	<0.5
Fluorene	86-73-7	0.5	mg/kg	----	----	<0.5	----	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	----	----	<0.5	----	<0.5
Anthracene	120-12-7	0.5	mg/kg	----	----	<0.5	----	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	----	----	<0.5	----	**1.2**
Pyrene	129-00-0	0.5	mg/kg	----	----	<0.5	----	**1.2**
N-2-Fluorenyl Acetamide	53-96-3	0.5	mg/kg	----	----	<0.5	----	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	----	----	<0.5	----	<0.5
Chrysene	218-01-9	0.5	mg/kg	----	----	<0.5	----	**0.6**
Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	----	----	<1	----	<1
7.12-Dimethylbenz(a)anthracene	57-97-6	0.5	mg/kg	----	----	<0.5	----	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	----	----	<0.5	----	**0.7**
3-Methylcholanthrene	56-49-5	0.5	mg/kg	----	----	<0.5	----	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	----	----	<0.5	----	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	----	----	<0.5	----	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	----	----	<0.5	----	<0.5
^ Sum of PAHs	----	0.5	mg/kg	----	----	<0.5	----	**3.7**
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	----	----	<0.5	----	**0.7**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	SED01	TB01	Dup01	TP33_0-0.15	TP20_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-002	EP2309599-003	EP2309599-004	EP2309599-006	EP2309599-009
				Result	Result	Result	Result	Result
EP075B: Polynuclear Aromatic Hydrocarbons - Continued								
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	----	----	**0.6**	----	**1.0**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	----	----	**1.2**	----	**1.4**
EP075C: Phthalate Esters								
Dimethyl phthalate	131-11-3	0.5	mg/kg	----	----	<0.5	----	<0.5
Diethyl phthalate	84-66-2	0.5	mg/kg	----	----	<0.5	----	<0.5
Di-n-butyl phthalate	84-74-2	0.5	mg/kg	----	----	<0.5	----	<0.5
Butyl benzyl phthalate	85-68-7	0.5	mg/kg	----	----	<0.5	----	<0.5
bis(2-ethylhexyl) phthalate	117-81-7	5.0	mg/kg	----	----	<5.0	----	<5.0
Di-n-octylphthalate	117-84-0	0.5	mg/kg	----	----	<0.5	----	<0.5
EP075D: Nitrosamines								
N-Nitrosomethylethylamine	10595-95-6	0.5	mg/kg	----	----	<0.5	----	<0.5
N-Nitrosodiethylamine	55-18-5	0.5	mg/kg	----	----	<0.5	----	<0.5
N-Nitrosopyrrolidine	930-55-2	1.0	mg/kg	----	----	<1.0	----	<1.0
N-Nitrosomorpholine	59-89-2	0.5	mg/kg	----	----	<0.5	----	<0.5
N-Nitrosodi-n-propylamine	621-64-7	0.5	mg/kg	----	----	<0.5	----	<0.5
N-Nitrosopiperidine	100-75-4	0.5	mg/kg	----	----	<0.5	----	<0.5
N-Nitrosodibutylamine	924-16-3	0.5	mg/kg	----	----	<0.5	----	<0.5
N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	1.0	mg/kg	----	----	<1.0	----	<1.0
Methapyrilene	91-80-5	0.5	mg/kg	----	----	<0.5	----	<0.5
EP075E: Nitroaromatics and Ketones								
2-Picoline	109-06-8	0.5	mg/kg	----	----	<0.5	----	<0.5
Acetophenone	98-86-2	0.5	mg/kg	----	----	<0.5	----	<0.5
Nitrobenzene	98-95-3	0.5	mg/kg	----	----	<0.5	----	<0.5
Isophorone	78-59-1	0.5	mg/kg	----	----	<0.5	----	<0.5
2.6-Dinitrotoluene	606-20-2	1.0	mg/kg	----	----	<1.0	----	<1.0
2.4-Dinitrotoluene	121-14-2	1.0	mg/kg	----	----	<1.0	----	<1.0
1-Naphthylamine	134-32-7	0.5	mg/kg	----	----	<0.5	----	<0.5
4-Nitroquinoline-N-oxide	56-57-5	0.5	mg/kg	----	----	<0.5	----	<0.5
5-Nitro-o-toluidine	99-55-8	0.5	mg/kg	----	----	<0.5	----	<0.5
Azobenzene	103-33-3	1	mg/kg	----	----	<1	----	<1
1.3.5-Trinitrobenzene	99-35-4	0.5	mg/kg	----	----	<0.5	----	<0.5
Phenacetin	62-44-2	0.5	mg/kg	----	----	<0.5	----	<0.5
4-Aminobiphenyl	92-67-1	0.5	mg/kg	----	----	<0.5	----	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	SED01	TB01	Dup01	TP33_0-0.15	TP20_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-002	EP2309599-003	EP2309599-004	EP2309599-006	EP2309599-009
				Result	Result	Result	Result	Result
EP075E: Nitroaromatics and Ketones - Continued								
Pentachloronitrobenzene	82-68-8	0.5	mg/kg	----	----	<0.5	----	<0.5
Pronamide	23950-58-5	0.5	mg/kg	----	----	<0.5	----	<0.5
Dimethylaminoazobenzene	60-11-7	0.5	mg/kg	----	----	<0.5	----	<0.5
Chlorobenzilate	510-15-6	0.5	mg/kg	----	----	<0.5	----	<0.5
EP075F: Haloethers								
Bis(2-chloroethyl) ether	111-44-4	0.5	mg/kg	----	----	<0.5	----	<0.5
Bis(2-chloroethoxy) methane	111-91-1	0.5	mg/kg	----	----	<0.5	----	<0.5
4-Chlorophenyl phenyl ether	7005-72-3	0.5	mg/kg	----	----	<0.5	----	<0.5
4-Bromophenyl phenyl ether	101-55-3	0.5	mg/kg	----	----	<0.5	----	<0.5
EP075G: Chlorinated Hydrocarbons								
1.3-Dichlorobenzene	541-73-1	0.5	mg/kg	----	----	<0.5	----	<0.5
1.4-Dichlorobenzene	106-46-7	0.5	mg/kg	----	----	<0.5	----	<0.5
1.2-Dichlorobenzene	95-50-1	0.5	mg/kg	----	----	<0.5	----	<0.5
Hexachloroethane	67-72-1	0.5	mg/kg	----	----	<0.5	----	<0.5
1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg	----	----	<0.5	----	<0.5
Hexachloropropylene	1888-71-7	0.5	mg/kg	----	----	<0.5	----	<0.5
Hexachlorobutadiene	87-68-3	0.5	mg/kg	----	----	<0.5	----	<0.5
Hexachlorocyclopentadiene	77-47-4	2.5	mg/kg	----	----	<2.5	----	<2.5
Pentachlorobenzene	608-93-5	0.5	mg/kg	----	----	<0.5	----	<0.5
Hexachlorobenzene (HCB)	118-74-1	1.0	mg/kg	----	----	<1.0	----	<1.0
EP075H: Anilines and Benzidines								
Aniline	62-53-3	0.5	mg/kg	----	----	<0.5	----	<0.5
4-Chloroaniline	106-47-8	0.5	mg/kg	----	----	<0.5	----	<0.5
2-Nitroaniline	88-74-4	1.0	mg/kg	----	----	<1.0	----	<1.0
3-Nitroaniline	99-09-2	1.0	mg/kg	----	----	<1.0	----	<1.0
Dibenzofuran	132-64-9	0.5	mg/kg	----	----	<0.5	----	<0.5
4-Nitroaniline	100-01-6	0.5	mg/kg	----	----	<0.5	----	<0.5
Carbazole	86-74-8	0.5	mg/kg	----	----	<0.5	----	<0.5
3.3`-Dichlorobenzidine	91-94-1	0.5	mg/kg	----	----	<0.5	----	<0.5
EP075I: Organochlorine Pesticides								
alpha-BHC	319-84-6	0.5	mg/kg	----	----	<0.5	----	<0.5
beta-BHC	319-85-7	0.5	mg/kg	----	----	<0.5	----	<0.5
gamma-BHC	58-89-9	0.5	mg/kg	----	----	<0.5	----	<0.5
delta-BHC	319-86-8	0.5	mg/kg	----	----	<0.5	----	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	SED01	TB01	Dup01	TP33_0-0.15	TP20_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-002	EP2309599-003	EP2309599-004	EP2309599-006	EP2309599-009
				Result	Result	Result	Result	Result
EP075I: Organochlorine Pesticides - Continued								
Heptachlor	76-44-8	0.5	mg/kg	----	----	<0.5	----	<0.5
Aldrin	309-00-2	0.5	mg/kg	----	----	<0.5	----	<0.5
Heptachlor epoxide	1024-57-3	0.5	mg/kg	----	----	<0.5	----	<0.5
alpha-Endosulfan	959-98-8	0.5	mg/kg	----	----	<0.5	----	<0.5
4.4`-DDE	72-55-9	0.5	mg/kg	----	----	<0.5	----	<0.5
Dieldrin	60-57-1	0.5	mg/kg	----	----	<0.5	----	<0.5
Endrin	72-20-8	0.5	mg/kg	----	----	<0.5	----	<0.5
beta-Endosulfan	33213-65-9	0.5	mg/kg	----	----	<0.5	----	<0.5
4.4`-DDD	72-54-8	0.5	mg/kg	----	----	<0.5	----	<0.5
Endosulfan sulfate	1031-07-8	0.5	mg/kg	----	----	<0.5	----	<0.5
4.4`-DDT	50-29-3	1.0	mg/kg	----	----	<1.0	----	<1.0
EP075J: Organophosphorus Pesticides								
Dichlorvos	62-73-7	0.5	mg/kg	----	----	<0.5	----	<0.5
Dimethoate	60-51-5	0.5	mg/kg	----	----	<0.5	----	<0.5
Diazinon	333-41-5	0.5	mg/kg	----	----	<0.5	----	<0.5
Chlorpyrifos-methyl	5598-13-0	0.5	mg/kg	----	----	<0.5	----	<0.5
Malathion	121-75-5	0.5	mg/kg	----	----	<0.5	----	<0.5
Fenthion	55-38-9	0.5	mg/kg	----	----	<0.5	----	<0.5
Chlorpyrifos	2921-88-2	0.5	mg/kg	----	----	<0.5	----	<0.5
Pirimphos-ethyl	23505-41-1	0.5	mg/kg	----	----	<0.5	----	<0.5
Chlorfenvinphos	470-90-6	0.5	mg/kg	----	----	<0.5	----	<0.5
Prothiofos	34643-46-4	0.5	mg/kg	----	----	<0.5	----	<0.5
Ethion	563-12-2	0.5	mg/kg	----	----	<0.5	----	<0.5
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	----	<10
C10 - C14 Fraction	----	50	mg/kg	<50	----	<50	----	<50
C15 - C28 Fraction	----	100	mg/kg	**170**	----	<100	----	<100
C29 - C36 Fraction	----	100	mg/kg	<100	----	<100	----	<100
^ **C10 - C36 Fraction (sum)**	----	50	mg/kg	**170**	----	<50	----	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	----	<10
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	10	mg/kg	<10	<10	<10	----	<10
>C10 - C16 Fraction	----	50	mg/kg	**60**	----	<50	----	<50

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	SED01	TB01	Dup01	TP33_0-0.15	TP20_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-002	EP2309599-003	EP2309599-004	EP2309599-006	EP2309599-009
				Result	Result	Result	Result	Result
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued								
>C16 - C34 Fraction	----	100	mg/kg	**200**	----	<100	----	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	----	<100	----	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	**260**	----	<50	----	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	**60**	----	<50	----	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	----	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	----	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	----	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	----	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	----	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	----	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	----	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	----	<1
EP074S: VOC Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.5	%	----	----	**67.7**	----	----
Toluene-D8	2037-26-5	0.5	%	----	----	**80.1**	----	----
4-Bromofluorobenzene	460-00-4	0.5	%	----	----	**85.8**	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**114**	----	----	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%	**116**	----	----	----	----
2.4.6-Tribromophenol	118-79-6	0.5	%	**129**	----	----	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**116**	----	----	----	----
Anthracene-d10	1719-06-8	0.5	%	**116**	----	----	----	----
4-Terphenyl-d14	1718-51-0	0.5	%	**120**	----	----	----	----
EP075S: Acid Extractable Surrogates								
2-Fluorophenol	367-12-4	0.5	%	----	----	**95.1**	----	**94.0**
Phenol-d6	13127-88-3	0.5	%	----	----	**107**	----	**106**
2-Chlorophenol-D4	93951-73-6	0.5	%	----	----	**101**	----	**102**
2.4.6-Tribromophenol	118-79-6	0.5	%	----	----	**93.4**	----	**92.5**
EP075T: Base/Neutral Extractable Surrogates								
Nitrobenzene-D5	4165-60-0	0.5	%	----	----	**93.2**	----	**97.7**
1.2-Dichlorobenzene-D4	2199-69-1	0.5	%	----	----	**85.4**	----	**88.0**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	SED01	TB01	Dup01	TP33_0-0.15	TP20_0-0.15
				Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit		EP2309599-002	EP2309599-003	EP2309599-004	EP2309599-006	EP2309599-009
					Result	Result	Result	Result	Result
EP075T: Base/Neutral Extractable Surrogates - Continued									
2-Fluorobiphenyl	321-60-8	0.5	%		----	----	**110**	----	**110**
Anthracene-d10	1719-06-8	0.5	%		----	----	**116**	----	**109**
4-Terphenyl-d14	1718-51-0	0.5	%		----	----	**127**	----	**130**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		**110**	----	----	----	----
Toluene-D8	2037-26-5	0.2	%		**82.6**	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		**78.8**	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP34_0-0.15	TP26_0-0.15	TP27_0-0.15	TP12_0-0.15	TP11_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-012	EP2309599-015	EP2309599-018	EP2309599-021	EP2309599-024
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**3.6**	**3.6**	**10.8**	**3.0**	**11.4**
EG005(ED093)T: Total Metals by ICP-AES								
Antimony	7440-36-0	5	mg/kg	----	----	----	<5	<5
Barium	7440-39-3	10	mg/kg	----	----	----	<10	**10**
Beryllium	7440-41-7	1	mg/kg	----	----	----	<1	<1
Boron	7440-42-8	50	mg/kg	----	----	----	<50	<50
Cobalt	7440-48-4	2	mg/kg	----	----	----	<2	<2
Manganese	7439-96-5	5	mg/kg	----	----	----	<5	**88**
Molybdenum	7439-98-7	2	mg/kg	----	----	----	<2	<2
Selenium	7782-49-2	5	mg/kg	----	----	----	<5	<5
Tin	7440-31-5	5	mg/kg	----	----	----	<5	<5
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	<2	<2	**3**	<2	<2
Copper	7440-50-8	5	mg/kg	<5	<5	**8**	<5	<5
Lead	7439-92-1	5	mg/kg	<5	<5	<5	<5	<5
Nickel	7440-02-0	2	mg/kg	<2	<2	<2	<2	<2
Zinc	7440-66-6	5	mg/kg	**24**	<5	**90**	<5	**28**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	----	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP34_0-0.15	TP26_0-0.15	TP27_0-0.15	TP12_0-0.15	TP11_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-012	EP2309599-015	EP2309599-018	EP2309599-021	EP2309599-024
				Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued								
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ **Endosulfan (sum)**	115-29-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
EP075(SIM)A: Phenolic Compounds								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP34_0-0.15	TP26_0-0.15	TP27_0-0.15	TP12_0-0.15	TP11_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-012	EP2309599-015	EP2309599-018	EP2309599-021	EP2309599-024
				Result	Result	Result	Result	Result
EP075(SIM)A: Phenolic Compounds - Continued								
Phenol	108-95-2	0.5	mg/kg	----	----	----	<0.5	<0.5
2-Chlorophenol	95-57-8	0.5	mg/kg	----	----	----	<0.5	<0.5
2-Methylphenol	95-48-7	0.5	mg/kg	----	----	----	<0.5	<0.5
3- & 4-Methylphenol	1319-77-3	1	mg/kg	----	----	----	<1	<1
2-Nitrophenol	88-75-5	0.5	mg/kg	----	----	----	<0.5	<0.5
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	----	----	----	<0.5	<0.5
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	----	----	----	<0.5	<0.5
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	----	----	----	<0.5	<0.5
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	----	----	----	<0.5	<0.5
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	----	----	----	<0.5	<0.5
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	----	----	----	<0.5	<0.5
Pentachlorophenol	87-86-5	2	mg/kg	----	----	----	<2	<2
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	----	----	----	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	----	----	----	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	----	----	----	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	----	----	----	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	----	----	----	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	----	----	----	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	----	----	----	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	----	----	----	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	----	----	----	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	----	----	----	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	----	----	----	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	----	----	----	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	----	----	----	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	----	----	----	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	----	----	----	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	----	----	----	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	----	----	----	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	----	----	----	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	----	----	----	**0.6**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	----	----	----	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	TP34_0-0.15	TP26_0-0.15	TP27_0-0.15	TP12_0-0.15	TP11_0-0.15
				Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit		EP2309599-012	EP2309599-015	EP2309599-018	EP2309599-021	EP2309599-024
					Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons - Continued									
C6 - C9 Fraction	----	10	mg/kg		----	----	----	<10	<10
C10 - C14 Fraction	----	50	mg/kg		----	----	----	<50	<50
C15 - C28 Fraction	----	100	mg/kg		----	----	----	<100	<100
C29 - C36 Fraction	----	100	mg/kg		----	----	----	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		----	----	----	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		----	----	----	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		----	----	----	<10	<10
>C10 - C16 Fraction	----	50	mg/kg		----	----	----	<50	<50
>C16 - C34 Fraction	----	100	mg/kg		----	----	----	<100	<100
>C34 - C40 Fraction	----	100	mg/kg		----	----	----	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		----	----	----	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		----	----	----	<50	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		----	----	----	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		----	----	----	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		----	----	----	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		----	----	----	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		----	----	----	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		----	----	----	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		----	----	----	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg		----	----	----	<1	<1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP13_0-0.15	TP07_0-0.15	TP10_0-0.15	TP08_0-0.15	TP09_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-027	EP2309599-030	EP2309599-033	EP2309599-036	EP2309599-039
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**8.5**	**9.4**	**8.3**	**10.4**	**7.7**
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	<2	**8**	**7**	**7**	<2
Copper	7440-50-8	5	mg/kg	<5	<5	<5	**15**	<5
Lead	7439-92-1	5	mg/kg	<5	<5	<5	<5	<5
Nickel	7440-02-0	2	mg/kg	<2	<2	<2	**4**	<2
Zinc	7440-66-6	5	mg/kg	**45**	**26**	**48**	**63**	**40**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	----	<0.05	----	----	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	----	<0.05	----	----	<0.05
beta-BHC	319-85-7	0.05	mg/kg	----	<0.05	----	----	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	----	<0.05	----	----	<0.05
delta-BHC	319-86-8	0.05	mg/kg	----	<0.05	----	----	<0.05
Heptachlor	76-44-8	0.05	mg/kg	----	<0.05	----	----	<0.05
Aldrin	309-00-2	0.05	mg/kg	----	<0.05	----	----	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	----	<0.05	----	----	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg	----	<0.05	----	----	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	----	<0.05	----	----	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	----	<0.05	----	----	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	----	<0.05	----	----	<0.05
Dieldrin	60-57-1	0.05	mg/kg	----	<0.05	----	----	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg	----	<0.05	----	----	<0.05
Endrin	72-20-8	0.05	mg/kg	----	<0.05	----	----	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	----	<0.05	----	----	<0.05
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	----	<0.05	----	----	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	----	<0.05	----	----	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	----	<0.05	----	----	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	----	<0.05	----	----	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg	----	<0.2	----	----	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	----	<0.05	----	----	<0.05

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP13_0-0.15	TP07_0-0.15	TP10_0-0.15	TP08_0-0.15	TP09_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-027	EP2309599-030	EP2309599-033	EP2309599-036	EP2309599-039
				Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued								
Methoxychlor	72-43-5	0.2	mg/kg	----	<0.2	----	----	<0.2
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	----	<0.05	----	----	<0.05
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	----	<0.05	----	----	<0.05
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	----	<0.05	----	----	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg	----	<0.05	----	----	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg	----	<0.2	----	----	<0.2
Dimethoate	60-51-5	0.05	mg/kg	----	<0.05	----	----	<0.05
Diazinon	333-41-5	0.05	mg/kg	----	<0.05	----	----	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	----	<0.05	----	----	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg	----	<0.2	----	----	<0.2
Malathion	121-75-5	0.05	mg/kg	----	<0.05	----	----	<0.05
Fenthion	55-38-9	0.05	mg/kg	----	<0.05	----	----	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg	----	<0.05	----	----	<0.05
Parathion	56-38-2	0.2	mg/kg	----	<0.2	----	----	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	----	<0.05	----	----	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg	----	<0.05	----	----	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg	----	<0.05	----	----	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg	----	<0.05	----	----	<0.05
Prothiofos	34643-46-4	0.05	mg/kg	----	<0.05	----	----	<0.05
Ethion	563-12-2	0.05	mg/kg	----	<0.05	----	----	<0.05
Carbophenothion	786-19-6	0.05	mg/kg	----	<0.05	----	----	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg	----	<0.05	----	----	<0.05
EP074A: Monocyclic Aromatic Hydrocarbons								
Benzene	71-43-2	0.2	mg/kg	<0.2	----	<0.2	<0.2	----
Toluene	108-88-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Styrene	100-42-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Isopropylbenzene	98-82-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
n-Propylbenzene	103-65-1	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
1.3.5-Trimethylbenzene	108-67-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP13_0-0.15	TP07_0-0.15	TP10_0-0.15	TP08_0-0.15	TP09_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-027	EP2309599-030	EP2309599-033	EP2309599-036	EP2309599-039
				Result	Result	Result	Result	Result
EP074A: Monocyclic Aromatic Hydrocarbons - Continued								
sec-Butylbenzene	135-98-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
1.2.4-Trimethylbenzene	95-63-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
tert-Butylbenzene	98-06-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
p-Isopropyltoluene	99-87-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
n-Butylbenzene	104-51-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
EP074B: Oxygenated Compounds								
Vinyl Acetate	108-05-4	5	mg/kg	<5	----	<5	<5	----
2-Butanone (MEK)	78-93-3	5	mg/kg	<5	----	<5	<5	----
4-Methyl-2-pentanone (MIBK)	108-10-1	5	mg/kg	<5	----	<5	<5	----
2-Hexanone (MBK)	591-78-6	5	mg/kg	<5	----	<5	<5	----
EP074C: Sulfonated Compounds								
Carbon disulfide	75-15-0	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
EP074D: Fumigants								
2.2-Dichloropropane	594-20-7	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
1.2-Dichloropropane	78-87-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
cis-1.3-Dichloropropylene	10061-01-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
trans-1.3-Dichloropropylene	10061-02-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
1.2-Dibromoethane (EDB)	106-93-4	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
EP074E: Halogenated Aliphatic Compounds								
Dichlorodifluoromethane	75-71-8	5	mg/kg	<5	----	<5	<5	----
Chloromethane	74-87-3	5	mg/kg	<5	----	<5	<5	----
Vinyl chloride	75-01-4	5	mg/kg	<5	----	<5	<5	----
Bromomethane	74-83-9	5	mg/kg	<5	----	<5	<5	----
Chloroethane	75-00-3	5	mg/kg	<5	----	<5	<5	----
Trichlorofluoromethane	75-69-4	5	mg/kg	<5	----	<5	<5	----
1.1-Dichloroethene	75-35-4	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Iodomethane	74-88-4	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
trans-1.2-Dichloroethene	156-60-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
1.1-Dichloroethane	75-34-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
cis-1.2-Dichloroethene	156-59-2	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
1.1-Dichloropropylene	563-58-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Carbon Tetrachloride	56-23-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
1.2-Dichloroethane	107-06-2	0.5	mg/kg	<0.5	----	<0.5	<0.5	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP13_0-0.15	TP07_0-0.15	TP10_0-0.15	TP08_0-0.15	TP09_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-027	EP2309599-030	EP2309599-033	EP2309599-036	EP2309599-039
				Result	Result	Result	Result	Result
EP074E: Halogenated Aliphatic Compounds - Continued								
Trichloroethene	79-01-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Dibromomethane	74-95-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
1.3-Dichloropropane	142-28-9	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Tetrachloroethene	127-18-4	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
trans-1.4-Dichloro-2-butene	110-57-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
cis-1.4-Dichloro-2-butene	1476-11-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
1.2.3-Trichloropropane	96-18-4	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Pentachloroethane	76-01-7	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
1.2-Dibromo-3-chloropropane	96-12-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
EP074F: Halogenated Aromatic Compounds								
Chlorobenzene	108-90-7	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Bromobenzene	108-86-1	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
2-Chlorotoluene	95-49-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
4-Chlorotoluene	106-43-4	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
1.2.3-Trichlorobenzene	87-61-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
EP074G: Trihalomethanes								
Chloroform	67-66-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Bromodichloromethane	75-27-4	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Dibromochloromethane	124-48-1	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Bromoform	75-25-2	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
EP075A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
3- & 4-Methylphenol	1319-77-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	----	<0.5	<0.5	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP13_0-0.15	TP07_0-0.15	TP10_0-0.15	TP08_0-0.15	TP09_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-027	EP2309599-030	EP2309599-033	EP2309599-036	EP2309599-039
				Result	Result	Result	Result	Result
EP075A: Phenolic Compounds - Continued								
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Pentachlorophenol	87-86-5	1	mg/kg	<1	----	<1	<1	----
EP075B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
2-Methylnaphthalene	91-57-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
2-Chloronaphthalene	91-58-7	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Anthracene	120-12-7	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Pyrene	129-00-0	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
N-2-Fluorenyl Acetamide	53-96-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Chrysene	218-01-9	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	<1	----	<1	<1	----
7.12-Dimethylbenz(a)anthracene	57-97-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
3-Methylcholanthrene	56-49-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
^ Sum of PAHs	----	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	**0.6**	----	**0.6**	**0.6**	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	**1.2**	----	**1.2**	**1.2**	----
EP075C: Phthalate Esters								
Dimethyl phthalate	131-11-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Diethyl phthalate	84-66-2	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Di-n-butyl phthalate	84-74-2	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Butyl benzyl phthalate	85-68-7	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
bis(2-ethylhexyl) phthalate	117-81-7	5.0	mg/kg	<5.0	----	<5.0	<5.0	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP13_0-0.15	TP07_0-0.15	TP10_0-0.15	TP08_0-0.15	TP09_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-027	EP2309599-030	EP2309599-033	EP2309599-036	EP2309599-039
				Result	Result	Result	Result	Result
EP075C: Phthalate Esters - Continued								
Di-n-octylphthalate	117-84-0	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
EP075D: Nitrosamines								
N-Nitrosomethylethylamine	10595-95-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
N-Nitrosodiethylamine	55-18-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
N-Nitrosopyrrolidine	930-55-2	1.0	mg/kg	<1.0	----	<1.0	<1.0	----
N-Nitrosomorpholine	59-89-2	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
N-Nitrosodi-n-propylamine	621-64-7	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
N-Nitrosopiperidine	100-75-4	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
N-Nitrosodibutylamine	924-16-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	1.0	mg/kg	<1.0	----	<1.0	<1.0	----
Methapyrilene	91-80-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
EP075E: Nitroaromatics and Ketones								
2-Picoline	109-06-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Acetophenone	98-86-2	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Nitrobenzene	98-95-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Isophorone	78-59-1	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
2.6-Dinitrotoluene	606-20-2	1.0	mg/kg	<1.0	----	<1.0	<1.0	----
2.4-Dinitrotoluene	121-14-2	1.0	mg/kg	<1.0	----	<1.0	<1.0	----
1-Naphthylamine	134-32-7	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
4-Nitroquinoline-N-oxide	56-57-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
5-Nitro-o-toluidine	99-55-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Azobenzene	103-33-3	1	mg/kg	<1	----	<1	<1	----
1.3.5-Trinitrobenzene	99-35-4	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Phenacetin	62-44-2	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
4-Aminobiphenyl	92-67-1	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Pentachloronitrobenzene	82-68-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Pronamide	23950-58-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Dimethylaminoazobenzene	60-11-7	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Chlorobenzilate	510-15-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
EP075F: Haloethers								
Bis(2-chloroethyl) ether	111-44-4	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Bis(2-chloroethoxy) methane	111-91-1	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
4-Chlorophenyl phenyl ether	7005-72-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP13_0-0.15	TP07_0-0.15	TP10_0-0.15	TP08_0-0.15	TP09_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-027	EP2309599-030	EP2309599-033	EP2309599-036	EP2309599-039
				Result	Result	Result	Result	Result
EP075F: Haloethers - Continued								
4-Bromophenyl phenyl ether	101-55-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
EP075G: Chlorinated Hydrocarbons								
1.3-Dichlorobenzene	541-73-1	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
1.4-Dichlorobenzene	106-46-7	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
1.2-Dichlorobenzene	95-50-1	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Hexachloroethane	67-72-1	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Hexachloropropylene	1888-71-7	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Hexachlorobutadiene	87-68-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Hexachlorocyclopentadiene	77-47-4	2.5	mg/kg	<2.5	----	<2.5	<2.5	----
Pentachlorobenzene	608-93-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Hexachlorobenzene (HCB)	118-74-1	1.0	mg/kg	<1.0	----	<1.0	<1.0	----
EP075H: Anilines and Benzidines								
Aniline	62-53-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
4-Chloroaniline	106-47-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
2-Nitroaniline	88-74-4	1.0	mg/kg	<1.0	----	<1.0	<1.0	----
3-Nitroaniline	99-09-2	1.0	mg/kg	<1.0	----	<1.0	<1.0	----
Dibenzofuran	132-64-9	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
4-Nitroaniline	100-01-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Carbazole	86-74-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
3.3`-Dichlorobenzidine	91-94-1	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
EP075I: Organochlorine Pesticides								
alpha-BHC	319-84-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
beta-BHC	319-85-7	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
gamma-BHC	58-89-9	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
delta-BHC	319-86-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Heptachlor	76-44-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Aldrin	309-00-2	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Heptachlor epoxide	1024-57-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
alpha-Endosulfan	959-98-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
4.4`-DDE	72-55-9	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Dieldrin	60-57-1	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Endrin	72-20-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
beta-Endosulfan	33213-65-9	0.5	mg/kg	<0.5	----	<0.5	<0.5	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP13_0-0.15	TP07_0-0.15	TP10_0-0.15	TP08_0-0.15	TP09_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-027	EP2309599-030	EP2309599-033	EP2309599-036	EP2309599-039
				Result	Result	Result	Result	Result
EP075I: Organochlorine Pesticides - Continued								
4.4`-DDD	72-54-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Endosulfan sulfate	1031-07-8	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
4.4`-DDT	50-29-3	1.0	mg/kg	<1.0	----	<1.0	<1.0	----
EP075J: Organophosphorus Pesticides								
Dichlorvos	62-73-7	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Dimethoate	60-51-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Diazinon	333-41-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Chlorpyrifos-methyl	5598-13-0	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Malathion	121-75-5	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Fenthion	55-38-9	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Chlorpyrifos	2921-88-2	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Pirimphos-ethyl	23505-41-1	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Chlorfenvinphos	470-90-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Prothiofos	34643-46-4	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Ethion	563-12-2	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	----	<10	<10	----
C10 - C14 Fraction	----	50	mg/kg	<50	----	<50	<50	----
C15 - C28 Fraction	----	100	mg/kg	<100	----	<100	<100	----
C29 - C36 Fraction	----	100	mg/kg	<100	----	<100	<100	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	----	<50	<50	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	----	<10	<10	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	----	<10	<10	----
>C10 - C16 Fraction	----	50	mg/kg	<50	----	<50	<50	----
>C16 - C34 Fraction	----	100	mg/kg	<100	----	<100	<100	----
>C34 - C40 Fraction	----	100	mg/kg	<100	----	<100	<100	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	----	<50	<50	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	----	<50	<50	----
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	----	<0.2	<0.2	----
Toluene	108-88-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP13_0-0.15	TP07_0-0.15	TP10_0-0.15	TP08_0-0.15	TP09_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-027	EP2309599-030	EP2309599-033	EP2309599-036	EP2309599-039
				Result	Result	Result	Result	Result
EP080: BTEXN - Continued								
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
^ **Sum of BTEX**	----	0.2	mg/kg	<0.2	----	<0.2	<0.2	----
^ **Total Xylenes**	----	0.5	mg/kg	<0.5	----	<0.5	<0.5	----
Naphthalene	91-20-3	1	mg/kg	<1	----	<1	<1	----
EP075S: Acid Extractable Surrogates								
2-Fluorophenol	367-12-4	0.5	%	**91.5**	----	**94.6**	**93.9**	----
Phenol-d6	13127-88-3	0.5	%	**98.0**	----	**96.9**	**95.1**	----
2-Chlorophenol-D4	93951-73-6	0.5	%	**93.9**	----	**96.1**	**95.7**	----
2.4.6-Tribromophenol	118-79-6	0.5	%	**86.5**	----	**83.8**	**83.0**	----
EP075T: Base/Neutral Extractable Surrogates								
Nitrobenzene-D5	4165-60-0	0.5	%	**85.2**	----	**87.6**	**87.9**	----
1.2-Dichlorobenzene-D4	2199-69-1	0.5	%	**81.0**	----	**86.5**	**85.2**	----
2-Fluorobiphenyl	321-60-8	0.5	%	**97.1**	----	**97.9**	**99.0**	----
Anthracene-d10	1719-06-8	0.5	%	**113**	----	**113**	**104**	----
4-Terphenyl-d14	1718-51-0	0.5	%	**117**	----	**117**	**122**	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP25_0-0.15	BG01	TP01_0-0.15	TP02_0-0.15	TP03_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-042	EP2309599-046	EP2309599-047	EP2309599-050	EP2309599-053
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	----	6.4	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	----	6.8	----	----	----
Moisture Content	----	1.0	%	11.9	----	3.2	27.4	9.2
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	----	36	----	----	----
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	----	2.22	----	----	----
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	2.6	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g	----	0.5	----	----	----
Exchangeable Potassium	----	0.1	meq/100g	----	<0.1	----	----	----
Exchangeable Sodium	----	0.1	meq/100g	----	<0.1	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g	----	3.2	----	----	----
Exchangeable Sodium Percent	----	0.1	%	----	1.8	----	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Antimony	7440-36-0	5	mg/kg	----	----	<5	----	----
Barium	7440-39-3	10	mg/kg	----	----	10	----	----
Beryllium	7440-41-7	1	mg/kg	----	----	<1	----	----
Boron	7440-42-8	50	mg/kg	----	----	<50	----	----
Cobalt	7440-48-4	2	mg/kg	----	----	<2	----	----
Iron	7439-89-6	50	mg/kg	----	690	----	----	----
Manganese	7439-96-5	5	mg/kg	----	----	35	----	----
Molybdenum	7439-98-7	2	mg/kg	----	----	<2	----	----
Selenium	7782-49-2	5	mg/kg	----	----	<5	----	----
Tin	7440-31-5	5	mg/kg	----	----	<5	----	----
Arsenic	7440-38-2	5	mg/kg	<5	----	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	----	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	2	----	3	2	3
Copper	7440-50-8	5	mg/kg	7	----	<5	<5	<5
Lead	7439-92-1	5	mg/kg	<5	----	<5	<5	<5
Nickel	7440-02-0	2	mg/kg	<2	----	<2	<2	<2
Zinc	7440-66-6	5	mg/kg	128	----	26	93	24
EG035T: Total Recoverable Mercury by FIMS								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP25_0-0.15	BG01	TP01_0-0.15	TP02_0-0.15	TP03_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-042	EP2309599-046	EP2309599-047	EP2309599-050	EP2309599-053
				Result	Result	Result	Result	Result
EG035T: Total Recoverable Mercury by FIMS - Continued								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	----	<0.1	<0.1
EP004: Organic Matter								
Organic Matter	----	0.5	%	----	**2.3**	----	----	----
Total Organic Carbon	----	0.5	%	----	**1.3**	----	----	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	----	<0.05	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	----	<0.05	----	----
beta-BHC	319-85-7	0.05	mg/kg	<0.05	----	<0.05	----	----
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	----	<0.05	----	----
delta-BHC	319-86-8	0.05	mg/kg	<0.05	----	<0.05	----	----
Heptachlor	76-44-8	0.05	mg/kg	<0.05	----	<0.05	----	----
Aldrin	309-00-2	0.05	mg/kg	<0.05	----	<0.05	----	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	----	<0.05	----	----
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	----	<0.05	----	----
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	----	<0.05	----	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	----	<0.05	----	----
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	----	<0.05	----	----
Dieldrin	60-57-1	0.05	mg/kg	<0.05	----	<0.05	----	----
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	----	<0.05	----	----
Endrin	72-20-8	0.05	mg/kg	<0.05	----	<0.05	----	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	----	<0.05	----	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	----	<0.05	----	----
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	----	<0.05	----	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	----	<0.05	----	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	----	<0.05	----	----
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	----	<0.2	----	----
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	----	<0.05	----	----
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	----	<0.2	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	----	<0.05	----	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05	----	<0.05	----	----
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	----	<0.05	----	----
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	----	<0.05	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP25_0-0.15	BG01	TP01_0-0.15	TP02_0-0.15	TP03_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-042	EP2309599-046	EP2309599-047	EP2309599-050	EP2309599-053
				Result	Result	Result	Result	Result
EP068B: Organophosphorus Pesticides (OP) - Continued								
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	----	<0.2	----	----
Dimethoate	60-51-5	0.05	mg/kg	<0.05	----	<0.05	----	----
Diazinon	333-41-5	0.05	mg/kg	<0.05	----	<0.05	----	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	----	<0.05	----	----
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	----	<0.2	----	----
Malathion	121-75-5	0.05	mg/kg	<0.05	----	<0.05	----	----
Fenthion	55-38-9	0.05	mg/kg	<0.05	----	<0.05	----	----
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	----	<0.05	----	----
Parathion	56-38-2	0.2	mg/kg	<0.2	----	<0.2	----	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	----	<0.05	----	----
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	----	<0.05	----	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	----	<0.05	----	----
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	----	<0.05	----	----
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	----	<0.05	----	----
Ethion	563-12-2	0.05	mg/kg	<0.05	----	<0.05	----	----
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	----	<0.05	----	----
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	----	<0.05	----	----
EP074A: Monocyclic Aromatic Hydrocarbons								
Benzene	71-43-2	0.2	mg/kg	----	----	----	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	----	----	----	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	----	----	----	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	----	----	----	<0.5	<0.5
Styrene	100-42-5	0.5	mg/kg	----	----	----	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	----	----	----	<0.5	<0.5
Isopropylbenzene	98-82-8	0.5	mg/kg	----	----	----	<0.5	<0.5
n-Propylbenzene	103-65-1	0.5	mg/kg	----	----	----	<0.5	<0.5
1.3.5-Trimethylbenzene	108-67-8	0.5	mg/kg	----	----	----	<0.5	<0.5
sec-Butylbenzene	135-98-8	0.5	mg/kg	----	----	----	<0.5	<0.5
1.2.4-Trimethylbenzene	95-63-6	0.5	mg/kg	----	----	----	<0.5	<0.5
tert-Butylbenzene	98-06-6	0.5	mg/kg	----	----	----	<0.5	<0.5
p-Isopropyltoluene	99-87-6	0.5	mg/kg	----	----	----	<0.5	<0.5
n-Butylbenzene	104-51-8	0.5	mg/kg	----	----	----	<0.5	<0.5
EP074B: Oxygenated Compounds								
Vinyl Acetate	108-05-4	5	mg/kg	----	----	----	<5	<5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP25_0-0.15	BG01	TP01_0-0.15	TP02_0-0.15	TP03_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-042	EP2309599-046	EP2309599-047	EP2309599-050	EP2309599-053
				Result	Result	Result	Result	Result
EP074B: Oxygenated Compounds - Continued								
2-Butanone (MEK)	78-93-3	5	mg/kg	----	----	----	<5	<5
4-Methyl-2-pentanone (MIBK)	108-10-1	5	mg/kg	----	----	----	<5	<5
2-Hexanone (MBK)	591-78-6	5	mg/kg	----	----	----	<5	<5
EP074C: Sulfonated Compounds								
Carbon disulfide	75-15-0	0.5	mg/kg	----	----	----	<0.5	<0.5
EP074D: Fumigants								
2.2-Dichloropropane	594-20-7	0.5	mg/kg	----	----	----	<0.5	<0.5
1.2-Dichloropropane	78-87-5	0.5	mg/kg	----	----	----	<0.5	<0.5
cis-1.3-Dichloropropylene	10061-01-5	0.5	mg/kg	----	----	----	<0.5	<0.5
trans-1.3-Dichloropropylene	10061-02-6	0.5	mg/kg	----	----	----	<0.5	<0.5
1.2-Dibromoethane (EDB)	106-93-4	0.5	mg/kg	----	----	----	<0.5	<0.5
EP074E: Halogenated Aliphatic Compounds								
Dichlorodifluoromethane	75-71-8	5	mg/kg	----	----	----	<5	<5
Chloromethane	74-87-3	5	mg/kg	----	----	----	<5	<5
Vinyl chloride	75-01-4	5	mg/kg	----	----	----	<5	<5
Bromomethane	74-83-9	5	mg/kg	----	----	----	<5	<5
Chloroethane	75-00-3	5	mg/kg	----	----	----	<5	<5
Trichlorofluoromethane	75-69-4	5	mg/kg	----	----	----	<5	<5
1.1-Dichloroethene	75-35-4	0.5	mg/kg	----	----	----	<0.5	<0.5
Iodomethane	74-88-4	0.5	mg/kg	----	----	----	<0.5	<0.5
trans-1.2-Dichloroethene	156-60-5	0.5	mg/kg	----	----	----	<0.5	<0.5
1.1-Dichloroethane	75-34-3	0.5	mg/kg	----	----	----	<0.5	<0.5
cis-1.2-Dichloroethene	156-59-2	0.5	mg/kg	----	----	----	<0.5	<0.5
1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	----	----	----	<0.5	<0.5
1.1-Dichloropropylene	563-58-6	0.5	mg/kg	----	----	----	<0.5	<0.5
Carbon Tetrachloride	56-23-5	0.5	mg/kg	----	----	----	<0.5	<0.5
1.2-Dichloroethane	107-06-2	0.5	mg/kg	----	----	----	<0.5	<0.5
Trichloroethene	79-01-6	0.5	mg/kg	----	----	----	<0.5	<0.5
Dibromomethane	74-95-3	0.5	mg/kg	----	----	----	<0.5	<0.5
1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	----	----	----	<0.5	<0.5
1.3-Dichloropropane	142-28-9	0.5	mg/kg	----	----	----	<0.5	<0.5
Tetrachloroethene	127-18-4	0.5	mg/kg	----	----	----	<0.5	<0.5
1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	----	----	----	<0.5	<0.5
trans-1.4-Dichloro-2-butene	110-57-6	0.5	mg/kg	----	----	----	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP25_0-0.15	BG01	TP01_0-0.15	TP02_0-0.15	TP03_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-042	EP2309599-046	EP2309599-047	EP2309599-050	EP2309599-053
				Result	Result	Result	Result	Result
EP074E: Halogenated Aliphatic Compounds - Continued								
cis-1.4-Dichloro-2-butene	1476-11-5	0.5	mg/kg	----	----	----	<0.5	<0.5
1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	----	----	----	<0.5	<0.5
1.2.3-Trichloropropane	96-18-4	0.5	mg/kg	----	----	----	<0.5	<0.5
Pentachloroethane	76-01-7	0.5	mg/kg	----	----	----	<0.5	<0.5
1.2-Dibromo-3-chloropropane	96-12-8	0.5	mg/kg	----	----	----	<0.5	<0.5
EP074F: Halogenated Aromatic Compounds								
Chlorobenzene	108-90-7	0.5	mg/kg	----	----	----	<0.5	<0.5
Bromobenzene	108-86-1	0.5	mg/kg	----	----	----	<0.5	<0.5
2-Chlorotoluene	95-49-8	0.5	mg/kg	----	----	----	<0.5	<0.5
4-Chlorotoluene	106-43-4	0.5	mg/kg	----	----	----	<0.5	<0.5
1.2.3-Trichlorobenzene	87-61-6	0.5	mg/kg	----	----	----	<0.5	<0.5
EP074G: Trihalomethanes								
Chloroform	67-66-3	0.5	mg/kg	----	----	----	<0.5	<0.5
Bromodichloromethane	75-27-4	0.5	mg/kg	----	----	----	<0.5	<0.5
Dibromochloromethane	124-48-1	0.5	mg/kg	----	----	----	<0.5	<0.5
Bromoform	75-25-2	0.5	mg/kg	----	----	----	<0.5	<0.5
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	----	----	<0.5	----	----
2-Chlorophenol	95-57-8	0.5	mg/kg	----	----	<0.5	----	----
2-Methylphenol	95-48-7	0.5	mg/kg	----	----	<0.5	----	----
3- & 4-Methylphenol	1319-77-3	1	mg/kg	----	----	<1	----	----
2-Nitrophenol	88-75-5	0.5	mg/kg	----	----	<0.5	----	----
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	----	----	<0.5	----	----
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	----	----	<0.5	----	----
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	----	----	<0.5	----	----
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	----	----	<0.5	----	----
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	----	----	<0.5	----	----
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	----	----	<0.5	----	----
Pentachlorophenol	87-86-5	2	mg/kg	----	----	<2	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	----	----	<0.5	----	----
Acenaphthylene	208-96-8	0.5	mg/kg	----	----	<0.5	----	----
Acenaphthene	83-32-9	0.5	mg/kg	----	----	<0.5	----	----
Fluorene	86-73-7	0.5	mg/kg	----	----	<0.5	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	TP25_0-0.15	BG01	TP01_0-0.15	TP02_0-0.15	TP03_0-0.15
				Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit		EP2309599-042	EP2309599-046	EP2309599-047	EP2309599-050	EP2309599-053
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Phenanthrene	85-01-8	0.5	mg/kg		----	----	<0.5	----	----
Anthracene	120-12-7	0.5	mg/kg		----	----	<0.5	----	----
Fluoranthene	206-44-0	0.5	mg/kg		----	----	<0.5	----	----
Pyrene	129-00-0	0.5	mg/kg		----	----	<0.5	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg		----	----	<0.5	----	----
Chrysene	218-01-9	0.5	mg/kg		----	----	<0.5	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		----	----	<0.5	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		----	----	<0.5	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg		----	----	<0.5	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		----	----	<0.5	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		----	----	<0.5	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		----	----	<0.5	----	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	mg/kg		----	----	<0.5	----	----
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	mg/kg		----	----	<0.5	----	----
^ **Benzo(a)pyrene TEQ (half LOR)**	----	0.5	mg/kg		----	----	**0.6**	----	----
^ **Benzo(a)pyrene TEQ (LOR)**	----	0.5	mg/kg		----	----	**1.2**	----	----
EP075A: Phenolic Compounds									
Phenol	108-95-2	0.5	mg/kg		----	----	----	<0.5	<0.5
2-Chlorophenol	95-57-8	0.5	mg/kg		----	----	----	<0.5	<0.5
2-Methylphenol	95-48-7	0.5	mg/kg		----	----	----	<0.5	<0.5
3- & 4-Methylphenol	1319-77-3	0.5	mg/kg		----	----	----	<0.5	<0.5
2-Nitrophenol	88-75-5	0.5	mg/kg		----	----	----	<0.5	<0.5
2.4-Dimethylphenol	105-67-9	0.5	mg/kg		----	----	----	<0.5	<0.5
2.4-Dichlorophenol	120-83-2	0.5	mg/kg		----	----	----	<0.5	<0.5
2.6-Dichlorophenol	87-65-0	0.5	mg/kg		----	----	----	<0.5	<0.5
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg		----	----	----	<0.5	<0.5
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg		----	----	----	<0.5	<0.5
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg		----	----	----	<0.5	<0.5
Pentachlorophenol	87-86-5	1	mg/kg		----	----	----	<1	<1
EP075B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		----	----	----	<0.5	<0.5
2-Methylnaphthalene	91-57-6	0.5	mg/kg		----	----	----	<0.5	<0.5
2-Chloronaphthalene	91-58-7	0.5	mg/kg		----	----	----	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		----	----	----	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP25_0-0.15	BG01	TP01_0-0.15	TP02_0-0.15	TP03_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-042	EP2309599-046	EP2309599-047	EP2309599-050	EP2309599-053
				Result	Result	Result	Result	Result
EP075B: Polynuclear Aromatic Hydrocarbons - Continued								
Acenaphthene	83-32-9	0.5	mg/kg	----	----	----	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	----	----	----	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	----	----	----	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	----	----	----	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	----	----	----	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	----	----	----	<0.5	<0.5
N-2-Fluorenyl Acetamide	53-96-3	0.5	mg/kg	----	----	----	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	----	----	----	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	----	----	----	<0.5	<0.5
Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	----	----	----	<1	<1
7.12-Dimethylbenz(a)anthracene	57-97-6	0.5	mg/kg	----	----	----	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	----	----	----	<0.5	<0.5
3-Methylcholanthrene	56-49-5	0.5	mg/kg	----	----	----	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	----	----	----	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	----	----	----	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	----	----	----	<0.5	<0.5
^ Sum of PAHs	----	0.5	mg/kg	----	----	----	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	----	----	----	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	----	----	----	**0.6**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	----	----	----	**1.2**	**1.2**
EP075C: Phthalate Esters								
Dimethyl phthalate	131-11-3	0.5	mg/kg	----	----	----	<0.5	<0.5
Diethyl phthalate	84-66-2	0.5	mg/kg	----	----	----	<0.5	<0.5
Di-n-butyl phthalate	84-74-2	0.5	mg/kg	----	----	----	<0.5	<0.5
Butyl benzyl phthalate	85-68-7	0.5	mg/kg	----	----	----	<0.5	<0.5
bis(2-ethylhexyl) phthalate	117-81-7	5.0	mg/kg	----	----	----	<5.0	<5.0
Di-n-octylphthalate	117-84-0	0.5	mg/kg	----	----	----	<0.5	<0.5
EP075D: Nitrosamines								
N-Nitrosomethylethylamine	10595-95-6	0.5	mg/kg	----	----	----	<0.5	<0.5
N-Nitrosodiethylamine	55-18-5	0.5	mg/kg	----	----	----	<0.5	<0.5
N-Nitrosopyrrolidine	930-55-2	1.0	mg/kg	----	----	----	<1.0	<1.0
N-Nitrosomorpholine	59-89-2	0.5	mg/kg	----	----	----	<0.5	<0.5
N-Nitrosodi-n-propylamine	621-64-7	0.5	mg/kg	----	----	----	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP25_0-0.15	BG01	TP01_0-0.15	TP02_0-0.15	TP03_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-042	EP2309599-046	EP2309599-047	EP2309599-050	EP2309599-053
				Result	Result	Result	Result	Result
EP075D: Nitrosamines - Continued								
N-Nitrosopiperidine	100-75-4	0.5	mg/kg	----	----	----	<0.5	<0.5
N-Nitrosodibutylamine	924-16-3	0.5	mg/kg	----	----	----	<0.5	<0.5
N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	1.0	mg/kg	----	----	----	<1.0	<1.0
Methapyrilene	91-80-5	0.5	mg/kg	----	----	----	<0.5	<0.5
EP075E: Nitroaromatics and Ketones								
2-Picoline	109-06-8	0.5	mg/kg	----	----	----	<0.5	<0.5
Acetophenone	98-86-2	0.5	mg/kg	----	----	----	<0.5	<0.5
Nitrobenzene	98-95-3	0.5	mg/kg	----	----	----	<0.5	<0.5
Isophorone	78-59-1	0.5	mg/kg	----	----	----	<0.5	<0.5
2.6-Dinitrotoluene	606-20-2	1.0	mg/kg	----	----	----	<1.0	<1.0
2.4-Dinitrotoluene	121-14-2	1.0	mg/kg	----	----	----	<1.0	<1.0
1-Naphthylamine	134-32-7	0.5	mg/kg	----	----	----	<0.5	<0.5
4-Nitroquinoline-N-oxide	56-57-5	0.5	mg/kg	----	----	----	<0.5	<0.5
5-Nitro-o-toluidine	99-55-8	0.5	mg/kg	----	----	----	<0.5	<0.5
Azobenzene	103-33-3	1	mg/kg	----	----	----	<1	<1
1.3.5-Trinitrobenzene	99-35-4	0.5	mg/kg	----	----	----	<0.5	<0.5
Phenacetin	62-44-2	0.5	mg/kg	----	----	----	<0.5	<0.5
4-Aminobiphenyl	92-67-1	0.5	mg/kg	----	----	----	<0.5	<0.5
Pentachloronitrobenzene	82-68-8	0.5	mg/kg	----	----	----	<0.5	<0.5
Pronamide	23950-58-5	0.5	mg/kg	----	----	----	<0.5	<0.5
Dimethylaminoazobenzene	60-11-7	0.5	mg/kg	----	----	----	<0.5	<0.5
Chlorobenzilate	510-15-6	0.5	mg/kg	----	----	----	<0.5	<0.5
EP075F: Haloethers								
Bis(2-chloroethyl) ether	111-44-4	0.5	mg/kg	----	----	----	<0.5	<0.5
Bis(2-chloroethoxy) methane	111-91-1	0.5	mg/kg	----	----	----	<0.5	<0.5
4-Chlorophenyl phenyl ether	7005-72-3	0.5	mg/kg	----	----	----	<0.5	<0.5
4-Bromophenyl phenyl ether	101-55-3	0.5	mg/kg	----	----	----	<0.5	<0.5
EP075G: Chlorinated Hydrocarbons								
1.3-Dichlorobenzene	541-73-1	0.5	mg/kg	----	----	----	<0.5	<0.5
1.4-Dichlorobenzene	106-46-7	0.5	mg/kg	----	----	----	<0.5	<0.5
1.2-Dichlorobenzene	95-50-1	0.5	mg/kg	----	----	----	<0.5	<0.5
Hexachloroethane	67-72-1	0.5	mg/kg	----	----	----	<0.5	<0.5
1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg	----	----	----	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP25_0-0.15	BG01	TP01_0-0.15	TP02_0-0.15	TP03_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-042	EP2309599-046	EP2309599-047	EP2309599-050	EP2309599-053
				Result	Result	Result	Result	Result
EP075G: Chlorinated Hydrocarbons - Continued								
Hexachloropropylene	1888-71-7	0.5	mg/kg	----	----	----	<0.5	<0.5
Hexachlorobutadiene	87-68-3	0.5	mg/kg	----	----	----	<0.5	<0.5
Hexachlorocyclopentadiene	77-47-4	2.5	mg/kg	----	----	----	<2.5	<2.5
Pentachlorobenzene	608-93-5	0.5	mg/kg	----	----	----	<0.5	<0.5
Hexachlorobenzene (HCB)	118-74-1	1.0	mg/kg	----	----	----	<1.0	<1.0
EP075H: Anilines and Benzidines								
Aniline	62-53-3	0.5	mg/kg	----	----	----	<0.5	<0.5
4-Chloroaniline	106-47-8	0.5	mg/kg	----	----	----	<0.5	<0.5
2-Nitroaniline	88-74-4	1.0	mg/kg	----	----	----	<1.0	<1.0
3-Nitroaniline	99-09-2	1.0	mg/kg	----	----	----	<1.0	<1.0
Dibenzofuran	132-64-9	0.5	mg/kg	----	----	----	<0.5	<0.5
4-Nitroaniline	100-01-6	0.5	mg/kg	----	----	----	<0.5	<0.5
Carbazole	86-74-8	0.5	mg/kg	----	----	----	<0.5	<0.5
3.3`-Dichlorobenzidine	91-94-1	0.5	mg/kg	----	----	----	<0.5	<0.5
EP075I: Organochlorine Pesticides								
alpha-BHC	319-84-6	0.5	mg/kg	----	----	----	<0.5	<0.5
beta-BHC	319-85-7	0.5	mg/kg	----	----	----	<0.5	<0.5
gamma-BHC	58-89-9	0.5	mg/kg	----	----	----	<0.5	<0.5
delta-BHC	319-86-8	0.5	mg/kg	----	----	----	<0.5	<0.5
Heptachlor	76-44-8	0.5	mg/kg	----	----	----	<0.5	<0.5
Aldrin	309-00-2	0.5	mg/kg	----	----	----	<0.5	<0.5
Heptachlor epoxide	1024-57-3	0.5	mg/kg	----	----	----	<0.5	<0.5
alpha-Endosulfan	959-98-8	0.5	mg/kg	----	----	----	<0.5	<0.5
4.4`-DDE	72-55-9	0.5	mg/kg	----	----	----	<0.5	<0.5
Dieldrin	60-57-1	0.5	mg/kg	----	----	----	<0.5	<0.5
Endrin	72-20-8	0.5	mg/kg	----	----	----	<0.5	<0.5
beta-Endosulfan	33213-65-9	0.5	mg/kg	----	----	----	<0.5	<0.5
4.4`-DDD	72-54-8	0.5	mg/kg	----	----	----	<0.5	<0.5
Endosulfan sulfate	1031-07-8	0.5	mg/kg	----	----	----	<0.5	<0.5
4.4`-DDT	50-29-3	1.0	mg/kg	----	----	----	<1.0	<1.0
EP075J: Organophosphorus Pesticides								
Dichlorvos	62-73-7	0.5	mg/kg	----	----	----	<0.5	<0.5
Dimethoate	60-51-5	0.5	mg/kg	----	----	----	<0.5	<0.5
Diazinon	333-41-5	0.5	mg/kg	----	----	----	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP25_0-0.15	BG01	TP01_0-0.15	TP02_0-0.15	TP03_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-042	EP2309599-046	EP2309599-047	EP2309599-050	EP2309599-053
				Result	Result	Result	Result	Result
EP075J: Organophosphorus Pesticides - Continued								
Chlorpyrifos-methyl	5598-13-0	0.5	mg/kg	----	----	----	<0.5	<0.5
Malathion	121-75-5	0.5	mg/kg	----	----	----	<0.5	<0.5
Fenthion	55-38-9	0.5	mg/kg	----	----	----	<0.5	<0.5
Chlorpyrifos	2921-88-2	0.5	mg/kg	----	----	----	<0.5	<0.5
Pirimphos-ethyl	23505-41-1	0.5	mg/kg	----	----	----	<0.5	<0.5
Chlorfenvinphos	470-90-6	0.5	mg/kg	----	----	----	<0.5	<0.5
Prothiofos	34643-46-4	0.5	mg/kg	----	----	----	<0.5	<0.5
Ethion	563-12-2	0.5	mg/kg	----	----	----	<0.5	<0.5
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	----	----	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	----	----	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	----	----	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	----	----	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	----	----	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	----	----	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	----	----	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	----	----	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	----	----	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	----	----	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	----	----	<50	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	----	----	<50	<50	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	----	----	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	----	----	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	----	----	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	----	----	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	----	----	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	----	----	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	----	----	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	----	----	<1	<1	<1
EP075S: Acid Extractable Surrogates								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	TP25_0-0.15	BG01	TP01_0-0.15	TP02_0-0.15	TP03_0-0.15
				Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit		EP2309599-042	EP2309599-046	EP2309599-047	EP2309599-050	EP2309599-053
					Result	Result	Result	Result	Result
EP075S: Acid Extractable Surrogates - Continued									
2-Fluorophenol	367-12-4	0.5	%		----	----	----	**106**	**107**
Phenol-d6	13127-88-3	0.5	%		----	----	----	**104**	**108**
2-Chlorophenol-D4	93951-73-6	0.5	%		----	----	----	**107**	**108**
2.4.6-Tribromophenol	118-79-6	0.5	%		----	----	----	**90.4**	**91.0**
EP075T: Base/Neutral Extractable Surrogates									
Nitrobenzene-D5	4165-60-0	0.5	%		----	----	----	**88.9**	**90.6**
1.2-Dichlorobenzene-D4	2199-69-1	0.5	%		----	----	----	**92.7**	**97.9**
2-Fluorobiphenyl	321-60-8	0.5	%		----	----	----	**112**	**114**
Anthracene-d10	1719-06-8	0.5	%		----	----	----	**108**	**108**
4-Terphenyl-d14	1718-51-0	0.5	%		----	----	----	**115**	**123**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP04_0-0.15	TP05_0-0.15	TP06_0-0.15	TP23_0-0.15	TP24_0-0.15
			Sampling date / time	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-056	EP2309599-059	EP2309599-062	EP2309599-065	EP2309599-068
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**7.3**	**14.6**	**3.2**	**4.9**	**4.9**
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	**12**	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	<2	**15**	<2	<2	<2
Copper	7440-50-8	5	mg/kg	<5	**10**	<5	<5	<5
Lead	7439-92-1	5	mg/kg	<5	<5	<5	<5	<5
Nickel	7440-02-0	2	mg/kg	<2	<2	<2	<2	<2
Zinc	7440-66-6	5	mg/kg	**11**	**33**	**13**	<5	**7**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	**0.08**	----	----	<0.05	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg	**0.18**	----	----	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	**0.18**	----	----	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	----	----	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	----	----	<0.05	<0.05

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP04_0-0.15	TP05_0-0.15	TP06_0-0.15	TP23_0-0.15	TP24_0-0.15
			Sampling date / time	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-056	EP2309599-059	EP2309599-062	EP2309599-065	EP2309599-068
				Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued								
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	----	----	<0.2	<0.2
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	----	----	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	----	----	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg	<0.2	----	----	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
EP074A: Monocyclic Aromatic Hydrocarbons								
Benzene	71-43-2	0.2	mg/kg	----	<0.2	<0.2	----	----
Toluene	108-88-3	0.5	mg/kg	----	<0.5	<0.5	----	----
Ethylbenzene	100-41-4	0.5	mg/kg	----	<0.5	<0.5	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	----	<0.5	<0.5	----	----
Styrene	100-42-5	0.5	mg/kg	----	<0.5	<0.5	----	----
ortho-Xylene	95-47-6	0.5	mg/kg	----	<0.5	<0.5	----	----
Isopropylbenzene	98-82-8	0.5	mg/kg	----	<0.5	<0.5	----	----
n-Propylbenzene	103-65-1	0.5	mg/kg	----	<0.5	<0.5	----	----
1.3.5-Trimethylbenzene	108-67-8	0.5	mg/kg	----	<0.5	<0.5	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP04_0-0.15	TP05_0-0.15	TP06_0-0.15	TP23_0-0.15	TP24_0-0.15
			Sampling date / time	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-056	EP2309599-059	EP2309599-062	EP2309599-065	EP2309599-068
				Result	Result	Result	Result	Result
EP074A: Monocyclic Aromatic Hydrocarbons - Continued								
sec-Butylbenzene	135-98-8	0.5	mg/kg	----	<0.5	<0.5	----	----
1.2.4-Trimethylbenzene	95-63-6	0.5	mg/kg	----	<0.5	<0.5	----	----
tert-Butylbenzene	98-06-6	0.5	mg/kg	----	<0.5	<0.5	----	----
p-Isopropyltoluene	99-87-6	0.5	mg/kg	----	<0.5	<0.5	----	----
n-Butylbenzene	104-51-8	0.5	mg/kg	----	<0.5	<0.5	----	----
EP074B: Oxygenated Compounds								
Vinyl Acetate	108-05-4	5	mg/kg	----	<5	<5	----	----
2-Butanone (MEK)	78-93-3	5	mg/kg	----	<5	<5	----	----
4-Methyl-2-pentanone (MIBK)	108-10-1	5	mg/kg	----	<5	<5	----	----
2-Hexanone (MBK)	591-78-6	5	mg/kg	----	<5	<5	----	----
EP074C: Sulfonated Compounds								
Carbon disulfide	75-15-0	0.5	mg/kg	----	<0.5	<0.5	----	----
EP074D: Fumigants								
2.2-Dichloropropane	594-20-7	0.5	mg/kg	----	<0.5	<0.5	----	----
1.2-Dichloropropane	78-87-5	0.5	mg/kg	----	<0.5	<0.5	----	----
cis-1.3-Dichloropropylene	10061-01-5	0.5	mg/kg	----	<0.5	<0.5	----	----
trans-1.3-Dichloropropylene	10061-02-6	0.5	mg/kg	----	<0.5	<0.5	----	----
1.2-Dibromoethane (EDB)	106-93-4	0.5	mg/kg	----	<0.5	<0.5	----	----
EP074E: Halogenated Aliphatic Compounds								
Dichlorodifluoromethane	75-71-8	5	mg/kg	----	<5	<5	----	----
Chloromethane	74-87-3	5	mg/kg	----	<5	<5	----	----
Vinyl chloride	75-01-4	5	mg/kg	----	<5	<5	----	----
Bromomethane	74-83-9	5	mg/kg	----	<5	<5	----	----
Chloroethane	75-00-3	5	mg/kg	----	<5	<5	----	----
Trichlorofluoromethane	75-69-4	5	mg/kg	----	<5	<5	----	----
1.1-Dichloroethene	75-35-4	0.5	mg/kg	----	<0.5	<0.5	----	----
Iodomethane	74-88-4	0.5	mg/kg	----	<0.5	<0.5	----	----
trans-1.2-Dichloroethene	156-60-5	0.5	mg/kg	----	<0.5	<0.5	----	----
1.1-Dichloroethane	75-34-3	0.5	mg/kg	----	<0.5	<0.5	----	----
cis-1.2-Dichloroethene	156-59-2	0.5	mg/kg	----	<0.5	<0.5	----	----
1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	----	<0.5	<0.5	----	----
1.1-Dichloropropylene	563-58-6	0.5	mg/kg	----	<0.5	<0.5	----	----
Carbon Tetrachloride	56-23-5	0.5	mg/kg	----	<0.5	<0.5	----	----
1.2-Dichloroethane	107-06-2	0.5	mg/kg	----	<0.5	<0.5	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP04_0-0.15	TP05_0-0.15	TP06_0-0.15	TP23_0-0.15	TP24_0-0.15
			Sampling date / time	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-056	EP2309599-059	EP2309599-062	EP2309599-065	EP2309599-068
				Result	Result	Result	Result	Result
EP074E: Halogenated Aliphatic Compounds - Continued								
Trichloroethene	79-01-6	0.5	mg/kg	----	<0.5	<0.5	----	----
Dibromomethane	74-95-3	0.5	mg/kg	----	<0.5	<0.5	----	----
1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	----	<0.5	<0.5	----	----
1.3-Dichloropropane	142-28-9	0.5	mg/kg	----	<0.5	<0.5	----	----
Tetrachloroethene	127-18-4	0.5	mg/kg	----	<0.5	<0.5	----	----
1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	----	<0.5	<0.5	----	----
trans-1.4-Dichloro-2-butene	110-57-6	0.5	mg/kg	----	<0.5	<0.5	----	----
cis-1.4-Dichloro-2-butene	1476-11-5	0.5	mg/kg	----	<0.5	<0.5	----	----
1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	----	<0.5	<0.5	----	----
1.2.3-Trichloropropane	96-18-4	0.5	mg/kg	----	<0.5	<0.5	----	----
Pentachloroethane	76-01-7	0.5	mg/kg	----	<0.5	<0.5	----	----
1.2-Dibromo-3-chloropropane	96-12-8	0.5	mg/kg	----	<0.5	<0.5	----	----
EP074F: Halogenated Aromatic Compounds								
Chlorobenzene	108-90-7	0.5	mg/kg	----	<0.5	<0.5	----	----
Bromobenzene	108-86-1	0.5	mg/kg	----	<0.5	<0.5	----	----
2-Chlorotoluene	95-49-8	0.5	mg/kg	----	<0.5	<0.5	----	----
4-Chlorotoluene	106-43-4	0.5	mg/kg	----	<0.5	<0.5	----	----
1.2.3-Trichlorobenzene	87-61-6	0.5	mg/kg	----	<0.5	<0.5	----	----
EP074G: Trihalomethanes								
Chloroform	67-66-3	0.5	mg/kg	----	<0.5	<0.5	----	----
Bromodichloromethane	75-27-4	0.5	mg/kg	----	<0.5	<0.5	----	----
Dibromochloromethane	124-48-1	0.5	mg/kg	----	<0.5	<0.5	----	----
Bromoform	75-25-2	0.5	mg/kg	----	<0.5	<0.5	----	----
EP075A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	----	<0.5	<0.5	----	----
2-Chlorophenol	95-57-8	0.5	mg/kg	----	<0.5	<0.5	----	----
2-Methylphenol	95-48-7	0.5	mg/kg	----	<0.5	<0.5	----	----
3- & 4-Methylphenol	1319-77-3	0.5	mg/kg	----	<0.5	<0.5	----	----
2-Nitrophenol	88-75-5	0.5	mg/kg	----	<0.5	<0.5	----	----
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	----	<0.5	<0.5	----	----
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	----	<0.5	<0.5	----	----
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	----	<0.5	<0.5	----	----
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	----	<0.5	<0.5	----	----
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	----	<0.5	<0.5	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP04_0-0.15	TP05_0-0.15	TP06_0-0.15	TP23_0-0.15	TP24_0-0.15
			Sampling date / time	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-056	EP2309599-059	EP2309599-062	EP2309599-065	EP2309599-068
				Result	Result	Result	Result	Result
EP075A: Phenolic Compounds - Continued								
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	----	<0.5	<0.5	----	----
Pentachlorophenol	87-86-5	1	mg/kg	----	<1	<1	----	----
EP075B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	----	<0.5	<0.5	----	----
2-Methylnaphthalene	91-57-6	0.5	mg/kg	----	<0.5	<0.5	----	----
2-Chloronaphthalene	91-58-7	0.5	mg/kg	----	<0.5	<0.5	----	----
Acenaphthylene	208-96-8	0.5	mg/kg	----	<0.5	<0.5	----	----
Acenaphthene	83-32-9	0.5	mg/kg	----	<0.5	<0.5	----	----
Fluorene	86-73-7	0.5	mg/kg	----	<0.5	<0.5	----	----
Phenanthrene	85-01-8	0.5	mg/kg	----	<0.5	<0.5	----	----
Anthracene	120-12-7	0.5	mg/kg	----	<0.5	<0.5	----	----
Fluoranthene	206-44-0	0.5	mg/kg	----	<0.5	<0.5	----	----
Pyrene	129-00-0	0.5	mg/kg	----	<0.5	<0.5	----	----
N-2-Fluorenyl Acetamide	53-96-3	0.5	mg/kg	----	<0.5	<0.5	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	----	<0.5	<0.5	----	----
Chrysene	218-01-9	0.5	mg/kg	----	<0.5	<0.5	----	----
Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	----	<1	<1	----	----
7.12-Dimethylbenz(a)anthracene	57-97-6	0.5	mg/kg	----	<0.5	<0.5	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	----	<0.5	<0.5	----	----
3-Methylcholanthrene	56-49-5	0.5	mg/kg	----	<0.5	<0.5	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	----	<0.5	<0.5	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	----	<0.5	<0.5	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	----	<0.5	<0.5	----	----
^ Sum of PAHs	----	0.5	mg/kg	----	<0.5	<0.5	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	----	<0.5	<0.5	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	----	**0.6**	**0.6**	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	----	**1.2**	**1.2**	----	----
EP075C: Phthalate Esters								
Dimethyl phthalate	131-11-3	0.5	mg/kg	----	<0.5	<0.5	----	----
Diethyl phthalate	84-66-2	0.5	mg/kg	----	<0.5	<0.5	----	----
Di-n-butyl phthalate	84-74-2	0.5	mg/kg	----	<0.5	<0.5	----	----
Butyl benzyl phthalate	85-68-7	0.5	mg/kg	----	<0.5	<0.5	----	----
bis(2-ethylhexyl) phthalate	117-81-7	5.0	mg/kg	----	<5.0	<5.0	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP04_0-0.15	TP05_0-0.15	TP06_0-0.15	TP23_0-0.15	TP24_0-0.15
			Sampling date / time	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-056	EP2309599-059	EP2309599-062	EP2309599-065	EP2309599-068
				Result	Result	Result	Result	Result
EP075C: Phthalate Esters - Continued								
Di-n-octylphthalate	117-84-0	0.5	mg/kg	----	<0.5	<0.5	----	----
EP075D: Nitrosamines								
N-Nitrosomethylethylamine	10595-95-6	0.5	mg/kg	----	<0.5	<0.5	----	----
N-Nitrosodiethylamine	55-18-5	0.5	mg/kg	----	<0.5	<0.5	----	----
N-Nitrosopyrrolidine	930-55-2	1.0	mg/kg	----	<1.0	<1.0	----	----
N-Nitrosomorpholine	59-89-2	0.5	mg/kg	----	<0.5	<0.5	----	----
N-Nitrosodi-n-propylamine	621-64-7	0.5	mg/kg	----	<0.5	<0.5	----	----
N-Nitrosopiperidine	100-75-4	0.5	mg/kg	----	<0.5	<0.5	----	----
N-Nitrosodibutylamine	924-16-3	0.5	mg/kg	----	<0.5	<0.5	----	----
N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	1.0	mg/kg	----	<1.0	<1.0	----	----
Methapyrilene	91-80-5	0.5	mg/kg	----	<0.5	<0.5	----	----
EP075E: Nitroaromatics and Ketones								
2-Picoline	109-06-8	0.5	mg/kg	----	<0.5	<0.5	----	----
Acetophenone	98-86-2	0.5	mg/kg	----	<0.5	<0.5	----	----
Nitrobenzene	98-95-3	0.5	mg/kg	----	<0.5	<0.5	----	----
Isophorone	78-59-1	0.5	mg/kg	----	<0.5	<0.5	----	----
2.6-Dinitrotoluene	606-20-2	1.0	mg/kg	----	<1.0	<1.0	----	----
2.4-Dinitrotoluene	121-14-2	1.0	mg/kg	----	<1.0	<1.0	----	----
1-Naphthylamine	134-32-7	0.5	mg/kg	----	<0.5	<0.5	----	----
4-Nitroquinoline-N-oxide	56-57-5	0.5	mg/kg	----	<0.5	<0.5	----	----
5-Nitro-o-toluidine	99-55-8	0.5	mg/kg	----	<0.5	<0.5	----	----
Azobenzene	103-33-3	1	mg/kg	----	<1	<1	----	----
1.3.5-Trinitrobenzene	99-35-4	0.5	mg/kg	----	<0.5	<0.5	----	----
Phenacetin	62-44-2	0.5	mg/kg	----	<0.5	<0.5	----	----
4-Aminobiphenyl	92-67-1	0.5	mg/kg	----	<0.5	<0.5	----	----
Pentachloronitrobenzene	82-68-8	0.5	mg/kg	----	<0.5	<0.5	----	----
Pronamide	23950-58-5	0.5	mg/kg	----	<0.5	<0.5	----	----
Dimethylaminoazobenzene	60-11-7	0.5	mg/kg	----	<0.5	<0.5	----	----
Chlorobenzilate	510-15-6	0.5	mg/kg	----	<0.5	<0.5	----	----
EP075F: Haloethers								
Bis(2-chloroethyl) ether	111-44-4	0.5	mg/kg	----	<0.5	<0.5	----	----
Bis(2-chloroethoxy) methane	111-91-1	0.5	mg/kg	----	<0.5	<0.5	----	----
4-Chlorophenyl phenyl ether	7005-72-3	0.5	mg/kg	----	<0.5	<0.5	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP04_0-0.15	TP05_0-0.15	TP06_0-0.15	TP23_0-0.15	TP24_0-0.15
			Sampling date / time	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-056	EP2309599-059	EP2309599-062	EP2309599-065	EP2309599-068
				Result	Result	Result	Result	Result
EP075F: Haloethers - Continued								
4-Bromophenyl phenyl ether	101-55-3	0.5	mg/kg	----	<0.5	<0.5	----	----
EP075G: Chlorinated Hydrocarbons								
1.3-Dichlorobenzene	541-73-1	0.5	mg/kg	----	<0.5	<0.5	----	----
1.4-Dichlorobenzene	106-46-7	0.5	mg/kg	----	<0.5	<0.5	----	----
1.2-Dichlorobenzene	95-50-1	0.5	mg/kg	----	<0.5	<0.5	----	----
Hexachloroethane	67-72-1	0.5	mg/kg	----	<0.5	<0.5	----	----
1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg	----	<0.5	<0.5	----	----
Hexachloropropylene	1888-71-7	0.5	mg/kg	----	<0.5	<0.5	----	----
Hexachlorobutadiene	87-68-3	0.5	mg/kg	----	<0.5	<0.5	----	----
Hexachlorocyclopentadiene	77-47-4	2.5	mg/kg	----	<2.5	<2.5	----	----
Pentachlorobenzene	608-93-5	0.5	mg/kg	----	<0.5	<0.5	----	----
Hexachlorobenzene (HCB)	118-74-1	1.0	mg/kg	----	<1.0	<1.0	----	----
EP075H: Anilines and Benzidines								
Aniline	62-53-3	0.5	mg/kg	----	<0.5	<0.5	----	----
4-Chloroaniline	106-47-8	0.5	mg/kg	----	<0.5	<0.5	----	----
2-Nitroaniline	88-74-4	1.0	mg/kg	----	<1.0	<1.0	----	----
3-Nitroaniline	99-09-2	1.0	mg/kg	----	<1.0	<1.0	----	----
Dibenzofuran	132-64-9	0.5	mg/kg	----	<0.5	<0.5	----	----
4-Nitroaniline	100-01-6	0.5	mg/kg	----	<0.5	<0.5	----	----
Carbazole	86-74-8	0.5	mg/kg	----	<0.5	<0.5	----	----
3.3`-Dichlorobenzidine	91-94-1	0.5	mg/kg	----	<0.5	<0.5	----	----
EP075I: Organochlorine Pesticides								
alpha-BHC	319-84-6	0.5	mg/kg	----	<0.5	<0.5	----	----
beta-BHC	319-85-7	0.5	mg/kg	----	<0.5	<0.5	----	----
gamma-BHC	58-89-9	0.5	mg/kg	----	<0.5	<0.5	----	----
delta-BHC	319-86-8	0.5	mg/kg	----	<0.5	<0.5	----	----
Heptachlor	76-44-8	0.5	mg/kg	----	<0.5	<0.5	----	----
Aldrin	309-00-2	0.5	mg/kg	----	<0.5	<0.5	----	----
Heptachlor epoxide	1024-57-3	0.5	mg/kg	----	<0.5	<0.5	----	----
alpha-Endosulfan	959-98-8	0.5	mg/kg	----	<0.5	<0.5	----	----
4.4`-DDE	72-55-9	0.5	mg/kg	----	<0.5	<0.5	----	----
Dieldrin	60-57-1	0.5	mg/kg	----	<0.5	<0.5	----	----
Endrin	72-20-8	0.5	mg/kg	----	<0.5	<0.5	----	----
beta-Endosulfan	33213-65-9	0.5	mg/kg	----	<0.5	<0.5	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP04_0-0.15	TP05_0-0.15	TP06_0-0.15	TP23_0-0.15	TP24_0-0.15
			Sampling date / time	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-056	EP2309599-059	EP2309599-062	EP2309599-065	EP2309599-068
				Result	Result	Result	Result	Result
EP075I: Organochlorine Pesticides - Continued								
4.4`-DDD	72-54-8	0.5	mg/kg	----	<0.5	<0.5	----	----
Endosulfan sulfate	1031-07-8	0.5	mg/kg	----	<0.5	<0.5	----	----
4.4`-DDT	50-29-3	1.0	mg/kg	----	<1.0	<1.0	----	----
EP075J: Organophosphorus Pesticides								
Dichlorvos	62-73-7	0.5	mg/kg	----	<0.5	<0.5	----	----
Dimethoate	60-51-5	0.5	mg/kg	----	<0.5	<0.5	----	----
Diazinon	333-41-5	0.5	mg/kg	----	<0.5	<0.5	----	----
Chlorpyrifos-methyl	5598-13-0	0.5	mg/kg	----	<0.5	<0.5	----	----
Malathion	121-75-5	0.5	mg/kg	----	<0.5	<0.5	----	----
Fenthion	55-38-9	0.5	mg/kg	----	<0.5	<0.5	----	----
Chlorpyrifos	2921-88-2	0.5	mg/kg	----	<0.5	<0.5	----	----
Pirimphos-ethyl	23505-41-1	0.5	mg/kg	----	<0.5	<0.5	----	----
Chlorfenvinphos	470-90-6	0.5	mg/kg	----	<0.5	<0.5	----	----
Prothiofos	34643-46-4	0.5	mg/kg	----	<0.5	<0.5	----	----
Ethion	563-12-2	0.5	mg/kg	----	<0.5	<0.5	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	----	<10	<10	----	----
C10 - C14 Fraction	----	50	mg/kg	----	<50	<50	----	----
C15 - C28 Fraction	----	100	mg/kg	----	<100	<100	----	----
C29 - C36 Fraction	----	100	mg/kg	----	<100	<100	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg	----	<50	<50	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	----	<10	<10	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	----	<10	<10	----	----
>C10 - C16 Fraction	----	50	mg/kg	----	<50	<50	----	----
>C16 - C34 Fraction	----	100	mg/kg	----	<100	<100	----	----
>C34 - C40 Fraction	----	100	mg/kg	----	<100	<100	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	----	<50	<50	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	----	<50	<50	----	----
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	----	<0.2	<0.2	----	----
Toluene	108-88-3	0.5	mg/kg	----	<0.5	<0.5	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP04_0-0.15	TP05_0-0.15	TP06_0-0.15	TP23_0-0.15	TP24_0-0.15
			Sampling date / time	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-056	EP2309599-059	EP2309599-062	EP2309599-065	EP2309599-068
				Result	Result	Result	Result	Result
EP080: BTEXN - Continued								
Ethylbenzene	100-41-4	0.5	mg/kg	----	<0.5	<0.5	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	----	<0.5	<0.5	----	----
ortho-Xylene	95-47-6	0.5	mg/kg	----	<0.5	<0.5	----	----
^ Sum of BTEX	----	0.2	mg/kg	----	<0.2	<0.2	----	----
^ Total Xylenes	----	0.5	mg/kg	----	<0.5	<0.5	----	----
Naphthalene	91-20-3	1	mg/kg	----	<1	<1	----	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	----	----	----	118	126
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	----	----	----	94.9	92.5
EP074S: VOC Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.5	%	----	----	114	84.2	108
Toluene-D8	2037-26-5	0.5	%	----	----	92.4	93.5	85.0
4-Bromofluorobenzene	460-00-4	0.5	%	----	----	96.9	92.4	81.8
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	----	----	----	88.4	114
2-Chlorophenol-D4	93951-73-6	0.5	%	----	----	----	87.4	113
2.4.6-Tribromophenol	118-79-6	0.5	%	----	----	----	110	103
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	----	----	----	105	112
Anthracene-d10	1719-06-8	0.5	%	----	----	----	118	107
4-Terphenyl-d14	1718-51-0	0.5	%	----	----	----	98.2	89.5
EP075S: Acid Extractable Surrogates								
2-Fluorophenol	367-12-4	0.5	%	----	105	108	----	----
Phenol-d6	13127-88-3	0.5	%	----	101	108	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%	----	103	108	----	----
2.4.6-Tribromophenol	118-79-6	0.5	%	----	94.8	89.4	----	----
EP075T: Base/Neutral Extractable Surrogates								
Nitrobenzene-D5	4165-60-0	0.5	%	----	89.2	94.0	----	----
1.2-Dichlorobenzene-D4	2199-69-1	0.5	%	----	93.7	95.7	----	----
2-Fluorobiphenyl	321-60-8	0.5	%	----	110	116	----	----
Anthracene-d10	1719-06-8	0.5	%	----	105	109	----	----
4-Terphenyl-d14	1718-51-0	0.5	%	----	116	120	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	TP04_0-0.15	TP05_0-0.15	TP06_0-0.15	TP23_0-0.15	TP24_0-0.15
				Sampling date / time	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00
Compound	CAS Number	LOR	Unit		EP2309599-056	EP2309599-059	EP2309599-062	EP2309599-065	EP2309599-068
					Result	Result	Result	Result	Result
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		----	----	**95.2**	**89.5**	**115**
Toluene-D8	2037-26-5	0.2	%		----	----	**93.8**	**88.2**	**80.0**
4-Bromofluorobenzene	460-00-4	0.2	%		----	----	**93.8**	**89.2**	**75.4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	Dup03	TP14_0-0.15	TP15_0-0.15	TP16_0-0.15	TP17_0-0.15
			Sampling date / time	14-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-072	EP2309599-075	EP2309599-078	EP2309599-081	EP2309599-084
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**10.4**	**5.4**	**5.5**	**6.0**	**7.6**
EG005(ED093)T: Total Metals by ICP-AES								
Antimony	7440-36-0	5	mg/kg	<5	<5	<5	----	----
Barium	7440-39-3	10	mg/kg	**100**	<10	<10	----	----
Beryllium	7440-41-7	1	mg/kg	<1	<1	<1	----	----
Boron	7440-42-8	50	mg/kg	<50	<50	<50	----	----
Cobalt	7440-48-4	2	mg/kg	<2	<2	<2	----	----
Manganese	7439-96-5	5	mg/kg	**527**	<5	**10**	----	----
Molybdenum	7439-98-7	2	mg/kg	<2	<2	<2	----	----
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	----	----
Tin	7440-31-5	5	mg/kg	<5	<5	<5	----	----
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	**2**	<2	<2	<2	<2
Copper	7440-50-8	5	mg/kg	**6**	<5	<5	<5	<5
Lead	7439-92-1	5	mg/kg	<5	<5	<5	<5	**14**
Nickel	7440-02-0	2	mg/kg	<2	<2	<2	<2	<2
Zinc	7440-66-6	5	mg/kg	**126**	<5	**12**	**14**	**51**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	----	----	----	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
beta-BHC	319-85-7	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
delta-BHC	319-86-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Heptachlor	76-44-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Aldrin	309-00-2	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Dieldrin	60-57-1	0.05	mg/kg	----	<0.05	<0.05	----	<0.05

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	Dup03	TP14_0-0.15	TP15_0-0.15	TP16_0-0.15	TP17_0-0.15
			Sampling date / time	14-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-072	EP2309599-075	EP2309599-078	EP2309599-081	EP2309599-084
				Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued								
4.4`-DDE	72-55-9	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Endrin	72-20-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg	----	<0.2	<0.2	----	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Methoxychlor	72-43-5	0.2	mg/kg	----	<0.2	<0.2	----	<0.2
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg	----	<0.2	<0.2	----	<0.2
Dimethoate	60-51-5	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Diazinon	333-41-5	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg	----	<0.2	<0.2	----	<0.2
Malathion	121-75-5	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Fenthion	55-38-9	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Parathion	56-38-2	0.2	mg/kg	----	<0.2	<0.2	----	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Prothiofos	34643-46-4	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Ethion	563-12-2	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Carbophenothion	786-19-6	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
EP074A: Monocyclic Aromatic Hydrocarbons								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	Dup03	TP14_0-0.15	TP15_0-0.15	TP16_0-0.15	TP17_0-0.15
			Sampling date / time	14-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-072	EP2309599-075	EP2309599-078	EP2309599-081	EP2309599-084
				Result	Result	Result	Result	Result
EP074A: Monocyclic Aromatic Hydrocarbons - Continued								
Benzene	71-43-2	0.2	mg/kg	<0.2	----	----	<0.2	----
Toluene	108-88-3	0.5	mg/kg	<0.5	----	----	<0.5	----
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	----	----	<0.5	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	----	----	<0.5	----
Styrene	100-42-5	0.5	mg/kg	<0.5	----	----	<0.5	----
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	----	----	<0.5	----
Isopropylbenzene	98-82-8	0.5	mg/kg	<0.5	----	----	<0.5	----
n-Propylbenzene	103-65-1	0.5	mg/kg	<0.5	----	----	<0.5	----
1.3.5-Trimethylbenzene	108-67-8	0.5	mg/kg	<0.5	----	----	<0.5	----
sec-Butylbenzene	135-98-8	0.5	mg/kg	<0.5	----	----	<0.5	----
1.2.4-Trimethylbenzene	95-63-6	0.5	mg/kg	<0.5	----	----	<0.5	----
tert-Butylbenzene	98-06-6	0.5	mg/kg	<0.5	----	----	<0.5	----
p-Isopropyltoluene	99-87-6	0.5	mg/kg	<0.5	----	----	<0.5	----
n-Butylbenzene	104-51-8	0.5	mg/kg	<0.5	----	----	<0.5	----
EP074B: Oxygenated Compounds								
Vinyl Acetate	108-05-4	5	mg/kg	<5	----	----	<5	----
2-Butanone (MEK)	78-93-3	5	mg/kg	<5	----	----	<5	----
4-Methyl-2-pentanone (MIBK)	108-10-1	5	mg/kg	<5	----	----	<5	----
2-Hexanone (MBK)	591-78-6	5	mg/kg	<5	----	----	<5	----
EP074C: Sulfonated Compounds								
Carbon disulfide	75-15-0	0.5	mg/kg	<0.5	----	----	<0.5	----
EP074D: Fumigants								
2.2-Dichloropropane	594-20-7	0.5	mg/kg	<0.5	----	----	<0.5	----
1.2-Dichloropropane	78-87-5	0.5	mg/kg	<0.5	----	----	<0.5	----
cis-1.3-Dichloropropylene	10061-01-5	0.5	mg/kg	<0.5	----	----	<0.5	----
trans-1.3-Dichloropropylene	10061-02-6	0.5	mg/kg	<0.5	----	----	<0.5	----
1.2-Dibromoethane (EDB)	106-93-4	0.5	mg/kg	<0.5	----	----	<0.5	----
EP074E: Halogenated Aliphatic Compounds								
Dichlorodifluoromethane	75-71-8	5	mg/kg	<5	----	----	<5	----
Chloromethane	74-87-3	5	mg/kg	<5	----	----	<5	----
Vinyl chloride	75-01-4	5	mg/kg	<5	----	----	<5	----
Bromomethane	74-83-9	5	mg/kg	<5	----	----	<5	----
Chloroethane	75-00-3	5	mg/kg	<5	----	----	<5	----
Trichlorofluoromethane	75-69-4	5	mg/kg	<5	----	----	<5	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	Dup03	TP14_0-0.15	TP15_0-0.15	TP16_0-0.15	TP17_0-0.15
			Sampling date / time	14-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-072	EP2309599-075	EP2309599-078	EP2309599-081	EP2309599-084
				Result	Result	Result	Result	Result
EP074E: Halogenated Aliphatic Compounds - Continued								
1.1-Dichloroethene	75-35-4	0.5	mg/kg	<0.5	----	----	<0.5	----
Iodomethane	74-88-4	0.5	mg/kg	<0.5	----	----	<0.5	----
trans-1.2-Dichloroethene	156-60-5	0.5	mg/kg	<0.5	----	----	<0.5	----
1.1-Dichloroethane	75-34-3	0.5	mg/kg	<0.5	----	----	<0.5	----
cis-1.2-Dichloroethene	156-59-2	0.5	mg/kg	<0.5	----	----	<0.5	----
1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	<0.5	----	----	<0.5	----
1.1-Dichloropropylene	563-58-6	0.5	mg/kg	<0.5	----	----	<0.5	----
Carbon Tetrachloride	56-23-5	0.5	mg/kg	<0.5	----	----	<0.5	----
1.2-Dichloroethane	107-06-2	0.5	mg/kg	<0.5	----	----	<0.5	----
Trichloroethene	79-01-6	0.5	mg/kg	<0.5	----	----	<0.5	----
Dibromomethane	74-95-3	0.5	mg/kg	<0.5	----	----	<0.5	----
1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	<0.5	----	----	<0.5	----
1.3-Dichloropropane	142-28-9	0.5	mg/kg	<0.5	----	----	<0.5	----
Tetrachloroethene	127-18-4	0.5	mg/kg	<0.5	----	----	<0.5	----
1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	<0.5	----	----	<0.5	----
trans-1.4-Dichloro-2-butene	110-57-6	0.5	mg/kg	<0.5	----	----	<0.5	----
cis-1.4-Dichloro-2-butene	1476-11-5	0.5	mg/kg	<0.5	----	----	<0.5	----
1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	<0.5	----	----	<0.5	----
1.2.3-Trichloropropane	96-18-4	0.5	mg/kg	<0.5	----	----	<0.5	----
Pentachloroethane	76-01-7	0.5	mg/kg	<0.5	----	----	<0.5	----
1.2-Dibromo-3-chloropropane	96-12-8	0.5	mg/kg	<0.5	----	----	<0.5	----
EP074F: Halogenated Aromatic Compounds								
Chlorobenzene	108-90-7	0.5	mg/kg	<0.5	----	----	<0.5	----
Bromobenzene	108-86-1	0.5	mg/kg	<0.5	----	----	<0.5	----
2-Chlorotoluene	95-49-8	0.5	mg/kg	<0.5	----	----	<0.5	----
4-Chlorotoluene	106-43-4	0.5	mg/kg	<0.5	----	----	<0.5	----
1.2.3-Trichlorobenzene	87-61-6	0.5	mg/kg	<0.5	----	----	<0.5	----
EP074G: Trihalomethanes								
Chloroform	67-66-3	0.5	mg/kg	<0.5	----	----	<0.5	----
Bromodichloromethane	75-27-4	0.5	mg/kg	<0.5	----	----	<0.5	----
Dibromochloromethane	124-48-1	0.5	mg/kg	<0.5	----	----	<0.5	----
Bromoform	75-25-2	0.5	mg/kg	<0.5	----	----	<0.5	----
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	----	<0.5	<0.5	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	Dup03	TP14_0-0.15	TP15_0-0.15	TP16_0-0.15	TP17_0-0.15
			Sampling date / time	14-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-072	EP2309599-075	EP2309599-078	EP2309599-081	EP2309599-084
				Result	Result	Result	Result	Result
EP075(SIM)A: Phenolic Compounds - Continued								
2-Chlorophenol	95-57-8	0.5	mg/kg	----	<0.5	<0.5	----	----
2-Methylphenol	95-48-7	0.5	mg/kg	----	<0.5	<0.5	----	----
3- & 4-Methylphenol	1319-77-3	1	mg/kg	----	<1	<1	----	----
2-Nitrophenol	88-75-5	0.5	mg/kg	----	<0.5	<0.5	----	----
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	----	<0.5	<0.5	----	----
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	----	<0.5	<0.5	----	----
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	----	<0.5	<0.5	----	----
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	----	<0.5	<0.5	----	----
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	----	<0.5	<0.5	----	----
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	----	<0.5	<0.5	----	----
Pentachlorophenol	87-86-5	2	mg/kg	----	<2	<2	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	----	<0.5	<0.5	----	----
Acenaphthylene	208-96-8	0.5	mg/kg	----	<0.5	<0.5	----	----
Acenaphthene	83-32-9	0.5	mg/kg	----	<0.5	<0.5	----	----
Fluorene	86-73-7	0.5	mg/kg	----	<0.5	<0.5	----	----
Phenanthrene	85-01-8	0.5	mg/kg	----	<0.5	<0.5	----	----
Anthracene	120-12-7	0.5	mg/kg	----	<0.5	<0.5	----	----
Fluoranthene	206-44-0	0.5	mg/kg	----	<0.5	<0.5	----	----
Pyrene	129-00-0	0.5	mg/kg	----	<0.5	<0.5	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	----	<0.5	<0.5	----	----
Chrysene	218-01-9	0.5	mg/kg	----	<0.5	<0.5	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	----	<0.5	<0.5	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	----	<0.5	<0.5	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	----	<0.5	<0.5	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	----	<0.5	<0.5	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	----	<0.5	<0.5	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	----	<0.5	<0.5	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	----	<0.5	<0.5	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	----	<0.5	<0.5	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	----	**0.6**	**0.6**	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	----	**1.2**	**1.2**	----	----
EP075A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	<0.5	----	----	<0.5	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	Dup03	TP14_0-0.15	TP15_0-0.15	TP16_0-0.15	TP17_0-0.15
			Sampling date / time	14-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-072	EP2309599-075	EP2309599-078	EP2309599-081	EP2309599-084
				Result	Result	Result	Result	Result
EP075A: Phenolic Compounds - Continued								
2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	----	----	<0.5	----
2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	----	----	<0.5	----
3- & 4-Methylphenol	1319-77-3	0.5	mg/kg	<0.5	----	----	<0.5	----
2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	----	----	<0.5	----
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	----	----	<0.5	----
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	----	----	<0.5	----
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	----	----	<0.5	----
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	----	----	<0.5	----
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	----	----	<0.5	----
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	----	----	<0.5	----
Pentachlorophenol	87-86-5	1	mg/kg	<1	----	----	<1	----
EP075B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	----	----	<0.5	----
2-Methylnaphthalene	91-57-6	0.5	mg/kg	<0.5	----	----	<0.5	----
2-Chloronaphthalene	91-58-7	0.5	mg/kg	<0.5	----	----	<0.5	----
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	----	----	<0.5	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	----	----	<0.5	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	----	----	<0.5	----
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	----	----	<0.5	----
Anthracene	120-12-7	0.5	mg/kg	<0.5	----	----	<0.5	----
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	----	----	<0.5	----
Pyrene	129-00-0	0.5	mg/kg	<0.5	----	----	<0.5	----
N-2-Fluorenyl Acetamide	53-96-3	0.5	mg/kg	<0.5	----	----	<0.5	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	----	----	<0.5	----
Chrysene	218-01-9	0.5	mg/kg	<0.5	----	----	<0.5	----
Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	<1	----	----	<1	----
7.12-Dimethylbenz(a)anthracene	57-97-6	0.5	mg/kg	<0.5	----	----	<0.5	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	----	----	<0.5	----
3-Methylcholanthrene	56-49-5	0.5	mg/kg	<0.5	----	----	<0.5	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	----	----	<0.5	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	----	----	<0.5	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	----	----	<0.5	----
^ Sum of PAHs	----	0.5	mg/kg	<0.5	----	----	<0.5	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	----	----	<0.5	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	Dup03	TP14_0-0.15	TP15_0-0.15	TP16_0-0.15	TP17_0-0.15
				Sampling date / time	14-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit		EP2309599-072	EP2309599-075	EP2309599-078	EP2309599-081	EP2309599-084
					Result	Result	Result	Result	Result
EP075B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		**0.6**	**----**	**----**	**0.6**	**----**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		**1.2**	**----**	**----**	**1.2**	**----**
EP075C: Phthalate Esters									
Dimethyl phthalate	131-11-3	0.5	mg/kg		<0.5	----	----	<0.5	----
Diethyl phthalate	84-66-2	0.5	mg/kg		<0.5	----	----	<0.5	----
Di-n-butyl phthalate	84-74-2	0.5	mg/kg		<0.5	----	----	<0.5	----
Butyl benzyl phthalate	85-68-7	0.5	mg/kg		<0.5	----	----	<0.5	----
bis(2-ethylhexyl) phthalate	117-81-7	5.0	mg/kg		<5.0	----	----	<5.0	----
Di-n-octylphthalate	117-84-0	0.5	mg/kg		<0.5	----	----	<0.5	----
EP075D: Nitrosamines									
N-Nitrosomethylethylamine	10595-95-6	0.5	mg/kg		<0.5	----	----	<0.5	----
N-Nitrosodiethylamine	55-18-5	0.5	mg/kg		<0.5	----	----	<0.5	----
N-Nitrosopyrrolidine	930-55-2	1.0	mg/kg		<1.0	----	----	<1.0	----
N-Nitrosomorpholine	59-89-2	0.5	mg/kg		<0.5	----	----	<0.5	----
N-Nitrosodi-n-propylamine	621-64-7	0.5	mg/kg		<0.5	----	----	<0.5	----
N-Nitrosopiperidine	100-75-4	0.5	mg/kg		<0.5	----	----	<0.5	----
N-Nitrosodibutylamine	924-16-3	0.5	mg/kg		<0.5	----	----	<0.5	----
N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	1.0	mg/kg		<1.0	----	----	<1.0	----
Methapyrilene	91-80-5	0.5	mg/kg		<0.5	----	----	<0.5	----
EP075E: Nitroaromatics and Ketones									
2-Picoline	109-06-8	0.5	mg/kg		<0.5	----	----	<0.5	----
Acetophenone	98-86-2	0.5	mg/kg		<0.5	----	----	<0.5	----
Nitrobenzene	98-95-3	0.5	mg/kg		<0.5	----	----	<0.5	----
Isophorone	78-59-1	0.5	mg/kg		<0.5	----	----	<0.5	----
2.6-Dinitrotoluene	606-20-2	1.0	mg/kg		<1.0	----	----	<1.0	----
2.4-Dinitrotoluene	121-14-2	1.0	mg/kg		<1.0	----	----	<1.0	----
1-Naphthylamine	134-32-7	0.5	mg/kg		<0.5	----	----	<0.5	----
4-Nitroquinoline-N-oxide	56-57-5	0.5	mg/kg		<0.5	----	----	<0.5	----
5-Nitro-o-toluidine	99-55-8	0.5	mg/kg		<0.5	----	----	<0.5	----
Azobenzene	103-33-3	1	mg/kg		<1	----	----	<1	----
1.3.5-Trinitrobenzene	99-35-4	0.5	mg/kg		<0.5	----	----	<0.5	----
Phenacetin	62-44-2	0.5	mg/kg		<0.5	----	----	<0.5	----
4-Aminobiphenyl	92-67-1	0.5	mg/kg		<0.5	----	----	<0.5	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	Dup03	TP14_0-0.15	TP15_0-0.15	TP16_0-0.15	TP17_0-0.15
			Sampling date / time	14-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-072	EP2309599-075	EP2309599-078	EP2309599-081	EP2309599-084
				Result	Result	Result	Result	Result
EP075E: Nitroaromatics and Ketones - Continued								
Pentachloronitrobenzene	82-68-8	0.5	mg/kg	<0.5	----	----	<0.5	----
Pronamide	23950-58-5	0.5	mg/kg	<0.5	----	----	<0.5	----
Dimethylaminoazobenzene	60-11-7	0.5	mg/kg	<0.5	----	----	<0.5	----
Chlorobenzilate	510-15-6	0.5	mg/kg	<0.5	----	----	<0.5	----
EP075F: Haloethers								
Bis(2-chloroethyl) ether	111-44-4	0.5	mg/kg	<0.5	----	----	<0.5	----
Bis(2-chloroethoxy) methane	111-91-1	0.5	mg/kg	<0.5	----	----	<0.5	----
4-Chlorophenyl phenyl ether	7005-72-3	0.5	mg/kg	<0.5	----	----	<0.5	----
4-Bromophenyl phenyl ether	101-55-3	0.5	mg/kg	<0.5	----	----	<0.5	----
EP075G: Chlorinated Hydrocarbons								
1.3-Dichlorobenzene	541-73-1	0.5	mg/kg	<0.5	----	----	<0.5	----
1.4-Dichlorobenzene	106-46-7	0.5	mg/kg	<0.5	----	----	<0.5	----
1.2-Dichlorobenzene	95-50-1	0.5	mg/kg	<0.5	----	----	<0.5	----
Hexachloroethane	67-72-1	0.5	mg/kg	<0.5	----	----	<0.5	----
1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg	<0.5	----	----	<0.5	----
Hexachloropropylene	1888-71-7	0.5	mg/kg	<0.5	----	----	<0.5	----
Hexachlorobutadiene	87-68-3	0.5	mg/kg	<0.5	----	----	<0.5	----
Hexachlorocyclopentadiene	77-47-4	2.5	mg/kg	<2.5	----	----	<2.5	----
Pentachlorobenzene	608-93-5	0.5	mg/kg	<0.5	----	----	<0.5	----
Hexachlorobenzene (HCB)	118-74-1	1.0	mg/kg	<1.0	----	----	<1.0	----
EP075H: Anilines and Benzidines								
Aniline	62-53-3	0.5	mg/kg	<0.5	----	----	<0.5	----
4-Chloroaniline	106-47-8	0.5	mg/kg	<0.5	----	----	<0.5	----
2-Nitroaniline	88-74-4	1.0	mg/kg	<1.0	----	----	<1.0	----
3-Nitroaniline	99-09-2	1.0	mg/kg	<1.0	----	----	<1.0	----
Dibenzofuran	132-64-9	0.5	mg/kg	<0.5	----	----	<0.5	----
4-Nitroaniline	100-01-6	0.5	mg/kg	<0.5	----	----	<0.5	----
Carbazole	86-74-8	0.5	mg/kg	<0.5	----	----	<0.5	----
3.3`-Dichlorobenzidine	91-94-1	0.5	mg/kg	<0.5	----	----	<0.5	----
EP075I: Organochlorine Pesticides								
alpha-BHC	319-84-6	0.5	mg/kg	<0.5	----	----	<0.5	----
beta-BHC	319-85-7	0.5	mg/kg	<0.5	----	----	<0.5	----
gamma-BHC	58-89-9	0.5	mg/kg	<0.5	----	----	<0.5	----
delta-BHC	319-86-8	0.5	mg/kg	<0.5	----	----	<0.5	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	Dup03	TP14_0-0.15	TP15_0-0.15	TP16_0-0.15	TP17_0-0.15
			Sampling date / time	14-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-072	EP2309599-075	EP2309599-078	EP2309599-081	EP2309599-084
				Result	Result	Result	Result	Result
EP075I: Organochlorine Pesticides - Continued								
Heptachlor	76-44-8	0.5	mg/kg	<0.5	----	----	<0.5	----
Aldrin	309-00-2	0.5	mg/kg	<0.5	----	----	<0.5	----
Heptachlor epoxide	1024-57-3	0.5	mg/kg	<0.5	----	----	<0.5	----
alpha-Endosulfan	959-98-8	0.5	mg/kg	<0.5	----	----	<0.5	----
4.4`-DDE	72-55-9	0.5	mg/kg	<0.5	----	----	<0.5	----
Dieldrin	60-57-1	0.5	mg/kg	<0.5	----	----	<0.5	----
Endrin	72-20-8	0.5	mg/kg	<0.5	----	----	<0.5	----
beta-Endosulfan	33213-65-9	0.5	mg/kg	<0.5	----	----	<0.5	----
4.4`-DDD	72-54-8	0.5	mg/kg	<0.5	----	----	<0.5	----
Endosulfan sulfate	1031-07-8	0.5	mg/kg	<0.5	----	----	<0.5	----
4.4`-DDT	50-29-3	1.0	mg/kg	<1.0	----	----	<1.0	----
EP075J: Organophosphorus Pesticides								
Dichlorvos	62-73-7	0.5	mg/kg	<0.5	----	----	<0.5	----
Dimethoate	60-51-5	0.5	mg/kg	<0.5	----	----	<0.5	----
Diazinon	333-41-5	0.5	mg/kg	<0.5	----	----	<0.5	----
Chlorpyrifos-methyl	5598-13-0	0.5	mg/kg	<0.5	----	----	<0.5	----
Malathion	121-75-5	0.5	mg/kg	<0.5	----	----	<0.5	----
Fenthion	55-38-9	0.5	mg/kg	<0.5	----	----	<0.5	----
Chlorpyrifos	2921-88-2	0.5	mg/kg	<0.5	----	----	<0.5	----
Pirimphos-ethyl	23505-41-1	0.5	mg/kg	<0.5	----	----	<0.5	----
Chlorfenvinphos	470-90-6	0.5	mg/kg	<0.5	----	----	<0.5	----
Prothiofos	34643-46-4	0.5	mg/kg	<0.5	----	----	<0.5	----
Ethion	563-12-2	0.5	mg/kg	<0.5	----	----	<0.5	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	----
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	----
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	<100	----
C29 - C36 Fraction	----	100	mg/kg	<100	<100	<100	<100	----
^ **C10 - C36 Fraction (sum)**	----	50	mg/kg	<50	<50	<50	<50	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	<10	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	10	mg/kg	<10	<10	<10	<10	----
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	Dup03	TP14_0-0.15	TP15_0-0.15	TP16_0-0.15	TP17_0-0.15
				Sampling date / time	14-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit		EP2309599-072	EP2309599-075	EP2309599-078	EP2309599-081	EP2309599-084
					Result	Result	Result	Result	Result
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued									
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	<100	<100	----
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	<100	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	----
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	----
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	----
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		----	112	117	----	118
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		----	78.1	87.1	----	85.0
EP074S: VOC Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.5	%		84.2	73.7	68.3	78.9	74.7
Toluene-D8	2037-26-5	0.5	%		92.6	83.2	78.1	88.2	83.7
4-Bromofluorobenzene	460-00-4	0.5	%		89.6	85.7	81.0	89.2	85.2
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		----	110	109	----	102
2-Chlorophenol-D4	93951-73-6	0.5	%		----	129	100	----	102
2.4.6-Tribromophenol	118-79-6	0.5	%		----	72.4	81.2	----	88.8
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		----	98.6	107	----	114
Anthracene-d10	1719-06-8	0.5	%		----	111	124	----	108
4-Terphenyl-d14	1718-51-0	0.5	%		----	101	112	----	124
EP075S: Acid Extractable Surrogates									
2-Fluorophenol	367-12-4	0.5	%		103	----	----	85.6	----
Phenol-d6	13127-88-3	0.5	%		100	----	----	91.3	----
2-Chlorophenol-D4	93951-73-6	0.5	%		104	----	----	90.7	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	Dup03	TP14_0-0.15	TP15_0-0.15	TP16_0-0.15	TP17_0-0.15
				Sampling date / time	14-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit		EP2309599-072	EP2309599-075	EP2309599-078	EP2309599-081	EP2309599-084
					Result	Result	Result	Result	Result
EP075S: Acid Extractable Surrogates - Continued									
2.4.6-Tribromophenol	118-79-6	0.5	%		90.0	----	----	75.6	----
EP075T: Base/Neutral Extractable Surrogates									
Nitrobenzene-D5	4165-60-0	0.5	%		87.2	----	----	83.4	----
1.2-Dichlorobenzene-D4	2199-69-1	0.5	%		92.1	----	----	83.6	----
2-Fluorobiphenyl	321-60-8	0.5	%		106	----	----	97.6	----
Anthracene-d10	1719-06-8	0.5	%		99.1	----	----	101	----
4-Terphenyl-d14	1718-51-0	0.5	%		99.5	----	----	112	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		94.3	83.4	77.0	97.3	84.8
Toluene-D8	2037-26-5	0.2	%		79.6	80.2	75.3	93.5	80.9
4-Bromofluorobenzene	460-00-4	0.2	%		90.2	90.9	85.5	93.5	90.2

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP18_0-0.15	TP19_0-0.15	TP21_0-0.15	TP22_0-0.15	TP28_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-087	EP2309599-090	EP2309599-093	EP2309599-096	EP2309599-099
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**17.3**	**11.0**	**4.8**	**3.8**	**6.9**
EG005(ED093)T: Total Metals by ICP-AES								
Antimony	7440-36-0	5	mg/kg	<5	<5	<5	<5	----
Barium	7440-39-3	10	mg/kg	**20**	**20**	<10	<10	----
Beryllium	7440-41-7	1	mg/kg	<1	<1	<1	<1	----
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	----
Cobalt	7440-48-4	2	mg/kg	<2	<2	<2	<2	----
Manganese	7439-96-5	5	mg/kg	**155**	**89**	<5	**14**	----
Molybdenum	7439-98-7	2	mg/kg	<2	<2	<2	<2	----
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	----
Tin	7440-31-5	5	mg/kg	<5	<5	<5	<5	----
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	**2**	**3**	<2	<2	<2
Copper	7440-50-8	5	mg/kg	**10**	**7**	<5	<5	<5
Lead	7439-92-1	5	mg/kg	<5	<5	<5	<5	<5
Nickel	7440-02-0	2	mg/kg	<2	<2	<2	<2	<2
Zinc	7440-66-6	5	mg/kg	**140**	**138**	<5	**17**	**53**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	----	----	----	----	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP18_0-0.15	TP19_0-0.15	TP21_0-0.15	TP22_0-0.15	TP28_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-087	EP2309599-090	EP2309599-093	EP2309599-096	EP2309599-099
				Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued								
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	**0.11**
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ **Endosulfan (sum)**	115-29-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	**0.11**
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
EP075(SIM)A: Phenolic Compounds								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP18_0-0.15	TP19_0-0.15	TP21_0-0.15	TP22_0-0.15	TP28_0-0.15
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309599-087	EP2309599-090	EP2309599-093	EP2309599-096	EP2309599-099
				Result	Result	Result	Result	Result
EP075(SIM)A: Phenolic Compounds - Continued								
Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	<1	<1	<1	----
2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Pentachlorophenol	87-86-5	2	mg/kg	<2	<2	<2	<2	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	**0.6**	**0.6**	**0.6**	**0.6**	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	**1.2**	**1.2**	**1.2**	**1.2**	----
EP080/071: Total Petroleum Hydrocarbons								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	TP18_0-0.15	TP19_0-0.15	TP21_0-0.15	TP22_0-0.15	TP28_0-0.15
				Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit		EP2309599-087	EP2309599-090	EP2309599-093	EP2309599-096	EP2309599-099
					Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons - Continued									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	----
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	----
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	<100	----
C29 - C36 Fraction	----	100	mg/kg		**120**	<100	<100	<100	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg		**120**	<50	<50	<50	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	----
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	<50	<50	----
>C16 - C34 Fraction	----	100	mg/kg		**160**	<100	<100	<100	----
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	<100	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		**160**	<50	<50	<50	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	----
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	----
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	----
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		**134**	**129**	**112**	**124**	**122**
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		**136**	**128**	**103**	**114**	**122**
EP074S: VOC Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.5	%		**70.1**	**72.4**	**75.0**	**73.5**	**78.4**
Toluene-D8	2037-26-5	0.5	%		**79.3**	**80.5**	**87.6**	**85.7**	**84.1**
4-Bromofluorobenzene	460-00-4	0.5	%		**81.8**	**82.3**	**89.0**	**86.8**	**87.3**
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		**92.8**	**103**	**104**	**108**	**109**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	TP18_0-0.15	TP19_0-0.15	TP21_0-0.15	TP22_0-0.15	TP28_0-0.15
				Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00
Compound	CAS Number	LOR	Unit		EP2309599-087	EP2309599-090	EP2309599-093	EP2309599-096	EP2309599-099
					Result	Result	Result	Result	Result
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
2-Chlorophenol-D4	93951-73-6	0.5	%		102	129	110	106	106
2.4.6-Tribromophenol	118-79-6	0.5	%		120	88.8	51.7	57.8	104
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		108	96.0	101	99.6	113
Anthracene-d10	1719-06-8	0.5	%		120	112	108	123	100
4-Terphenyl-d14	1718-51-0	0.5	%		120	100	112	108	114
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		78.5	83.4	85.4	83.3	89.5
Toluene-D8	2037-26-5	0.2	%		76.0	77.4	84.0	82.3	81.4
4-Bromofluorobenzene	460-00-4	0.2	%		86.2	86.8	93.3	91.4	92.3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP29_0-0.15	TP30_0-0.15	TP31_0-0.15	TP32_0-0.15	----
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	----
Compound	CAS Number	LOR	Unit	EP2309599-102	EP2309599-105	EP2309599-108	EP2309599-111	--------
				Result	Result	Result	Result	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**4.9**	**7.1**	**5.3**	**5.6**	----
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	----
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	----
Chromium	7440-47-3	2	mg/kg	<2	<2	<2	<2	----
Copper	7440-50-8	5	mg/kg	<5	<5	<5	<5	----
Lead	7439-92-1	5	mg/kg	<5	<5	<5	<5	----
Nickel	7440-02-0	2	mg/kg	<2	<2	<2	<2	----
Zinc	7440-66-6	5	mg/kg	<5	<5	<5	**6**	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	----
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP29_0-0.15	TP30_0-0.15	TP31_0-0.15	TP32_0-0.15	----
			Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	----
Compound	CAS Number	LOR	Unit	EP2309599-102	EP2309599-105	EP2309599-108	EP2309599-111	--------
				Result	Result	Result	Result	----
EP068A: Organochlorine Pesticides (OC) - Continued								
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	----
Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	----
Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	**124**	**113**	**116**	**122**	----
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	**111**	**100**	**96.6**	**111**	----
EP074S: VOC Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.5	%	**73.5**	**72.8**	**73.7**	**76.1**	----
Toluene-D8	2037-26-5	0.5	%	**86.0**	**80.6**	**82.3**	**83.6**	----
4-Bromofluorobenzene	460-00-4	0.5	%	**86.6**	**83.4**	**85.9**	**87.5**	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**106**	**103**	**107**	**104**	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	TP29_0-0.15	TP30_0-0.15	TP31_0-0.15	TP32_0-0.15	----
				Sampling date / time	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	13-Jul-2023 00:00	----
Compound	CAS Number	LOR	Unit		EP2309599-102	EP2309599-105	EP2309599-108	EP2309599-111	--------
					Result	Result	Result	Result	----
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
2-Chlorophenol-D4	93951-73-6	0.5	%		104	103	106	102	----
2.4.6-Tribromophenol	118-79-6	0.5	%		72.4	71.5	60.0	81.0	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		110	98.3	101	106	----
Anthracene-d10	1719-06-8	0.5	%		101	121	122	118	----
4-Terphenyl-d14	1718-51-0	0.5	%		113	109	109	109	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		84.5	82.7	83.1	86.2	----
Toluene-D8	2037-26-5	0.2	%		82.9	78.4	79.0	80.7	----
4-Bromofluorobenzene	460-00-4	0.2	%		91.6	88.2	90.5	92.3	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	RN/FB01	RN/FB02	----	----	----
				Sampling date / time	13-Jul-2023 00:00	14-Jul-2023 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EP2309599-001	EP2309599-071	--------	--------	--------
					Result	Result	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	----	----	----
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	----	----	----
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	----	----	----
Barium	7440-39-3	0.001	mg/L		<0.001	<0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	----	----	----
Cobalt	7440-48-4	0.001	mg/L		<0.001	<0.001	----	----	----
Nickel	7440-02-0	0.001	mg/L		<0.001	<0.001	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	----	----	----
Manganese	7439-96-5	0.001	mg/L		<0.001	<0.001	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	----	----	----
Tin	7440-31-5	0.001	mg/L		<0.001	<0.001	----	----	----
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	----	----	----
EP074A: Monocyclic Aromatic Hydrocarbons									
Benzene	71-43-2	1	µg/L		<1	<1	----	----	----
Toluene	108-88-3	2	µg/L		<2	<2	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	----	----	----
Styrene	100-42-5	5	µg/L		<5	<5	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	----	----	----
Isopropylbenzene	98-82-8	5	µg/L		<5	<5	----	----	----
n-Propylbenzene	103-65-1	5	µg/L		<5	<5	----	----	----
1.3.5-Trimethylbenzene	108-67-8	5	µg/L		<5	<5	----	----	----
sec-Butylbenzene	135-98-8	5	µg/L		<5	<5	----	----	----
1.2.4-Trimethylbenzene	95-63-6	5	µg/L		<5	<5	----	----	----
tert-Butylbenzene	98-06-6	5	µg/L		<5	<5	----	----	----
p-Isopropyltoluene	99-87-6	5	µg/L		<5	<5	----	----	----
n-Butylbenzene	104-51-8	5	µg/L		<5	<5	----	----	----
EP074B: Oxygenated Compounds									
Vinyl Acetate	108-05-4	50	µg/L		<50	<50	----	----	----
2-Butanone (MEK)	78-93-3	50	µg/L		<50	<50	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	RN/FB01	RN/FB02	----	----	----
				Sampling date / time	13-Jul-2023 00:00	14-Jul-2023 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EP2309599-001	EP2309599-071	--------	--------	--------
					Result	Result	----	----	----
EP074B: Oxygenated Compounds - Continued									
4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L		<50	<50	----	----	----
2-Hexanone (MBK)	591-78-6	50	µg/L		<50	<50	----	----	----
EP074C: Sulfonated Compounds									
Carbon disulfide	75-15-0	5	µg/L		<5	<5	----	----	----
EP074D: Fumigants									
2.2-Dichloropropane	594-20-7	5	µg/L		<5	<5	----	----	----
1.2-Dichloropropane	78-87-5	5	µg/L		<5	<5	----	----	----
cis-1.3-Dichloropropylene	10061-01-5	5	µg/L		<5	<5	----	----	----
trans-1.3-Dichloropropylene	10061-02-6	5	µg/L		<5	<5	----	----	----
1.2-Dibromoethane (EDB)	106-93-4	5	µg/L		<5	<5	----	----	----
EP074E: Halogenated Aliphatic Compounds									
Dichlorodifluoromethane	75-71-8	50	µg/L		<50	<50	----	----	----
Chloromethane	74-87-3	50	µg/L		<50	<50	----	----	----
Vinyl chloride	75-01-4	50	µg/L		<50	<50	----	----	----
Bromomethane	74-83-9	50	µg/L		<50	<50	----	----	----
Chloroethane	75-00-3	50	µg/L		<50	<50	----	----	----
Trichlorofluoromethane	75-69-4	50	µg/L		<50	<50	----	----	----
1.1-Dichloroethene	75-35-4	5	µg/L		<5	<5	----	----	----
Iodomethane	74-88-4	5	µg/L		<5	<5	----	----	----
trans-1.2-Dichloroethene	156-60-5	5	µg/L		<5	<5	----	----	----
1.1-Dichloroethane	75-34-3	5	µg/L		<5	<5	----	----	----
cis-1.2-Dichloroethene	156-59-2	5	µg/L		<5	<5	----	----	----
1.1.1-Trichloroethane	71-55-6	5	µg/L		<5	<5	----	----	----
1.1-Dichloropropylene	563-58-6	5	µg/L		<5	<5	----	----	----
Carbon Tetrachloride	56-23-5	5	µg/L		<5	<5	----	----	----
1.2-Dichloroethane	107-06-2	5	µg/L		<5	<5	----	----	----
Trichloroethene	79-01-6	5	µg/L		<5	<5	----	----	----
Dibromomethane	74-95-3	5	µg/L		<5	<5	----	----	----
1.1.2-Trichloroethane	79-00-5	5	µg/L		<5	<5	----	----	----
1.3-Dichloropropane	142-28-9	5	µg/L		<5	<5	----	----	----
Tetrachloroethene	127-18-4	5	µg/L		<5	<5	----	----	----
1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L		<5	<5	----	----	----
trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L		<5	<5	----	----	----
cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L		<5	<5	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	RN/FB01	RN/FB02	----	----	----
				Sampling date / time	13-Jul-2023 00:00	14-Jul-2023 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EP2309599-001	EP2309599-071	--------	--------	--------
					Result	Result	----	----	----
EP074E: Halogenated Aliphatic Compounds - Continued									
1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L		<5	<5	----	----	----
1.2.3-Trichloropropane	96-18-4	5	µg/L		<5	<5	----	----	----
Pentachloroethane	76-01-7	5	µg/L		<5	<5	----	----	----
1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L		<5	<5	----	----	----
EP074F: Halogenated Aromatic Compounds									
Chlorobenzene	108-90-7	5	µg/L		<5	<5	----	----	----
Bromobenzene	108-86-1	5	µg/L		<5	<5	----	----	----
2-Chlorotoluene	95-49-8	5	µg/L		<5	<5	----	----	----
4-Chlorotoluene	106-43-4	5	µg/L		<5	<5	----	----	----
1.2.3-Trichlorobenzene	87-61-6	5	µg/L		<5	<5	----	----	----
EP074G: Trihalomethanes									
Chloroform	67-66-3	5	µg/L		<5	<5	----	----	----
Bromodichloromethane	75-27-4	5	µg/L		<5	<5	----	----	----
Dibromochloromethane	124-48-1	5	µg/L		<5	<5	----	----	----
Bromoform	75-25-2	5	µg/L		<5	<5	----	----	----
EP075A: Phenolic Compounds									
Phenol	108-95-2	2	µg/L		<2	<2	----	----	----
2-Chlorophenol	95-57-8	2	µg/L		<2	<2	----	----	----
2-Methylphenol	95-48-7	2	µg/L		<2	<2	----	----	----
3- & 4-Methylphenol	1319-77-3	4	µg/L		<4	<4	----	----	----
2-Nitrophenol	88-75-5	2	µg/L		<2	<2	----	----	----
2.4-Dimethylphenol	105-67-9	2	µg/L		<2	<2	----	----	----
2.4-Dichlorophenol	120-83-2	2	µg/L		<2	<2	----	----	----
2.6-Dichlorophenol	87-65-0	2	µg/L		<2	<2	----	----	----
4-Chloro-3-methylphenol	59-50-7	2	µg/L		<2	<2	----	----	----
2.4.6-Trichlorophenol	88-06-2	2	µg/L		<2	<2	----	----	----
2.4.5-Trichlorophenol	95-95-4	2	µg/L		<2	<2	----	----	----
Pentachlorophenol	87-86-5	4	µg/L		<4	<4	----	----	----
EP075B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	2	µg/L		<2	<2	----	----	----
2-Methylnaphthalene	91-57-6	2	µg/L		<2	<2	----	----	----
2-Chloronaphthalene	91-58-7	2	µg/L		<2	<2	----	----	----
Acenaphthylene	208-96-8	2	µg/L		<2	<2	----	----	----
Acenaphthene	83-32-9	2	µg/L		<2	<2	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	RN/FB01	RN/FB02	----	----	----
				Sampling date / time	13-Jul-2023 00:00	14-Jul-2023 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EP2309599-001	EP2309599-071	--------	--------	--------
					Result	Result	----	----	----
EP075B: Polynuclear Aromatic Hydrocarbons - Continued									
Fluorene	86-73-7	2	µg/L		<2	<2	----	----	----
Phenanthrene	85-01-8	2	µg/L		<2	<2	----	----	----
Anthracene	120-12-7	2	µg/L		<2	<2	----	----	----
Fluoranthene	206-44-0	2	µg/L		<2	<2	----	----	----
Pyrene	129-00-0	2	µg/L		<2	<2	----	----	----
N-2-Fluorenyl Acetamide	53-96-3	2	µg/L		<2	<2	----	----	----
Benz(a)anthracene	56-55-3	2	µg/L		<2	<2	----	----	----
Chrysene	218-01-9	2	µg/L		<2	<2	----	----	----
Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L		<4	<4	----	----	----
7.12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L		<2	<2	----	----	----
Benzo(a)pyrene	50-32-8	2	µg/L		<2	<2	----	----	----
3-Methylcholanthrene	56-49-5	2	µg/L		<2	<2	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	2	µg/L		<2	<2	----	----	----
Dibenz(a.h)anthracene	53-70-3	2	µg/L		<2	<2	----	----	----
Benzo(g.h.i)perylene	191-24-2	2	µg/L		<2	<2	----	----	----
^ Sum of PAHs	----	2	µg/L		<2	<2	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	2	µg/L		<2	<2	----	----	----
EP075C: Phthalate Esters									
Dimethyl phthalate	131-11-3	2	µg/L		<2	<2	----	----	----
Diethyl phthalate	84-66-2	2	µg/L		<2	<2	----	----	----
Di-n-butyl phthalate	84-74-2	2	µg/L		<2	<2	----	----	----
Butyl benzyl phthalate	85-68-7	2	µg/L		<2	<2	----	----	----
bis(2-ethylhexyl) phthalate	117-81-7	10	µg/L		<10	<10	----	----	----
Di-n-octylphthalate	117-84-0	2	µg/L		<2	<2	----	----	----
EP075D: Nitrosamines									
N-Nitrosomethylethylamine	10595-95-6	2	µg/L		<2	<2	----	----	----
N-Nitrosodiethylamine	55-18-5	2	µg/L		<2	<2	----	----	----
N-Nitrosopyrrolidine	930-55-2	4	µg/L		<4	<4	----	----	----
N-Nitrosomorpholine	59-89-2	2	µg/L		<2	<2	----	----	----
N-Nitrosodi-n-propylamine	621-64-7	2	µg/L		<2	<2	----	----	----
N-Nitrosopiperidine	100-75-4	2	µg/L		<2	<2	----	----	----
N-Nitrosodibutylamine	924-16-3	2	µg/L		<2	<2	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	RN/FB01	RN/FB02	----	----	----
			Sampling date / time	13-Jul-2023 00:00	14-Jul-2023 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EP2309599-001	EP2309599-071	--------	--------	--------
				Result	Result	----	----	----
EP075D: Nitrosamines - Continued								
N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	4	µg/L	<4	<4	----	----	----
Methapyrilene	91-80-5	2	µg/L	<2	<2	----	----	----
EP075E: Nitroaromatics and Ketones								
2-Picoline	109-06-8	2	µg/L	<2	<2	----	----	----
Acetophenone	98-86-2	2	µg/L	<2	<2	----	----	----
Nitrobenzene	98-95-3	2	µg/L	<2	<2	----	----	----
Isophorone	78-59-1	2	µg/L	<2	<2	----	----	----
2.6-Dinitrotoluene	606-20-2	4	µg/L	<4	<4	----	----	----
2.4-Dinitrotoluene	121-14-2	4	µg/L	<4	<4	----	----	----
1-Naphthylamine	134-32-7	2	µg/L	<2	<2	----	----	----
4-Nitroquinoline-N-oxide	56-57-5	2	µg/L	<2	<2	----	----	----
5-Nitro-o-toluidine	99-55-8	2	µg/L	<2	<2	----	----	----
Azobenzene	103-33-3	2	µg/L	<2	<2	----	----	----
1.3.5-Trinitrobenzene	99-35-4	2	µg/L	<2	<2	----	----	----
Phenacetin	62-44-2	2	µg/L	<2	<2	----	----	----
4-Aminobiphenyl	92-67-1	2	µg/L	<2	<2	----	----	----
Pentachloronitrobenzene	82-68-8	2	µg/L	<2	<2	----	----	----
Pronamide	23950-58-5	2	µg/L	<2	<2	----	----	----
Dimethylaminoazobenzene	60-11-7	2	µg/L	<2	<2	----	----	----
Chlorobenzilate	510-15-6	2	µg/L	<2	<2	----	----	----
EP075F: Haloethers								
Bis(2-chloroethyl) ether	111-44-4	2	µg/L	<2	<2	----	----	----
Bis(2-chloroethoxy) methane	111-91-1	2	µg/L	<2	<2	----	----	----
4-Chlorophenyl phenyl ether	7005-72-3	2	µg/L	<2	<2	----	----	----
4-Bromophenyl phenyl ether	101-55-3	2	µg/L	<2	<2	----	----	----
EP075G: Chlorinated Hydrocarbons								
1.3-Dichlorobenzene	541-73-1	2	µg/L	<2	<2	----	----	----
1.4-Dichlorobenzene	106-46-7	2	µg/L	<2	<2	----	----	----
1.2-Dichlorobenzene	95-50-1	2	µg/L	<2	<2	----	----	----
Hexachloroethane	67-72-1	2	µg/L	<2	<2	----	----	----
1.2.4-Trichlorobenzene	120-82-1	2	µg/L	<2	<2	----	----	----
Hexachloropropylene	1888-71-7	2	µg/L	<2	<2	----	----	----
Hexachlorobutadiene	87-68-3	2	µg/L	<2	<2	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	RN/FB01	RN/FB02	----	----	----
				Sampling date / time	13-Jul-2023 00:00	14-Jul-2023 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EP2309599-001	EP2309599-071	--------	--------	--------
					Result	Result	----	----	----
EP075G: Chlorinated Hydrocarbons - Continued									
Hexachlorocyclopentadiene	77-47-4	10	µg/L		<10	<10	----	----	----
Pentachlorobenzene	608-93-5	2	µg/L		<2	<2	----	----	----
Hexachlorobenzene (HCB)	118-74-1	4	µg/L		<4	<4	----	----	----
EP075H: Anilines and Benzidines									
Aniline	62-53-3	2	µg/L		<2	<2	----	----	----
4-Chloroaniline	106-47-8	2	µg/L		<2	<2	----	----	----
2-Nitroaniline	88-74-4	4	µg/L		<4	<4	----	----	----
3-Nitroaniline	99-09-2	4	µg/L		<4	<4	----	----	----
Dibenzofuran	132-64-9	2	µg/L		<2	<2	----	----	----
4-Nitroaniline	100-01-6	2	µg/L		<2	<2	----	----	----
Carbazole	86-74-8	2	µg/L		<2	<2	----	----	----
3.3`-Dichlorobenzidine	91-94-1	2	µg/L		<2	<2	----	----	----
EP075I: Organochlorine Pesticides									
alpha-BHC	319-84-6	2	µg/L		<2	<2	----	----	----
beta-BHC	319-85-7	2	µg/L		<2	<2	----	----	----
gamma-BHC	58-89-9	2	µg/L		<2	<2	----	----	----
delta-BHC	319-86-8	2	µg/L		<2	<2	----	----	----
Heptachlor	76-44-8	2	µg/L		<2	<2	----	----	----
Aldrin	309-00-2	2	µg/L		<2	<2	----	----	----
Heptachlor epoxide	1024-57-3	2	µg/L		<2	<2	----	----	----
alpha-Endosulfan	959-98-8	2	µg/L		<2	<2	----	----	----
4.4`-DDE	72-55-9	2	µg/L		<2	<2	----	----	----
Dieldrin	60-57-1	2	µg/L		<2	<2	----	----	----
Endrin	72-20-8	2	µg/L		<2	<2	----	----	----
beta-Endosulfan	33213-65-9	2	µg/L		<2	<2	----	----	----
4.4`-DDD	72-54-8	2	µg/L		<2	<2	----	----	----
Endosulfan sulfate	1031-07-8	2	µg/L		<2	<2	----	----	----
4.4`-DDT	50-29-3	4	µg/L		<4	<4	----	----	----
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	4	µg/L		<4	<4	----	----	----
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/50-2	4	µg/L		<4	<4	----	----	----
EP075J: Organophosphorus Pesticides									
Dichlorvos	62-73-7	2	µg/L		<2	<2	----	----	----
Dimethoate	60-51-5	2	µg/L		<2	<2	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	RN/FB01	RN/FB02	----	----	----
				Sampling date / time	13-Jul-2023 00:00	14-Jul-2023 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EP2309599-001	EP2309599-071	--------	--------	--------
					Result	Result	----	----	----
EP075J: Organophosphorus Pesticides - Continued									
Diazinon	333-41-5	2	µg/L		<2	<2	----	----	----
Chlorpyrifos-methyl	5598-13-0	2	µg/L		<2	<2	----	----	----
Malathion	121-75-5	2	µg/L		<2	<2	----	----	----
Fenthion	55-38-9	2	µg/L		<2	<2	----	----	----
Chlorpyrifos	2921-88-2	2	µg/L		<2	<2	----	----	----
Pirimphos-ethyl	23505-41-1	2	µg/L		<2	<2	----	----	----
Chlorfenvinphos	470-90-6	2	µg/L		<2	<2	----	----	----
Prothiofos	34643-46-4	2	µg/L		<2	<2	----	----	----
Ethion	563-12-2	2	µg/L		<2	<2	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	----	----	----
Toluene	108-88-3	2	µg/L		<2	<2	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	----	----	----
^ Total Xylenes	----	2	µg/L		<2	<2	----	----	----
^ Sum of BTEX	----	1	µg/L		<1	<1	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	<5	----	----	----
EP074S: VOC Surrogates									
1.2-Dichloroethane-D4	17060-07-0	5	%		**82.0**	**82.2**	----	----	----
Toluene-D8	2037-26-5	5	%		**102**	**99.9**	----	----	----
4-Bromofluorobenzene	460-00-4	5	%		**106**	**104**	----	----	----
EP075S: Acid Extractable Surrogates									
2-Fluorophenol	367-12-4	2	%		**26.0**	**28.0**	----	----	----
Phenol-d6	13127-88-3	2	%		**15.3**	**14.8**	----	----	----
2-Chlorophenol-D4	93951-73-6	2	%		**46.9**	**47.3**	----	----	----
2.4.6-Tribromophenol	118-79-6	2	%		**22.4**	**20.2**	----	----	----
EP075T: Base/Neutral Extractable Surrogates									
Nitrobenzene-D5	4165-60-0	2	%		**53.1**	**75.3**	----	----	----
1.2-Dichlorobenzene-D4	2199-69-1	2	%		**54.3**	**68.4**	----	----	----
2-Fluorobiphenyl	321-60-8	2	%		**62.6**	**87.8**	----	----	----
Anthracene-d10	1719-06-8	2	%		**78.1**	**75.1**	----	----	----
4-Terphenyl-d14	1718-51-0	2	%		**83.8**	**81.0**	----	----	----

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	53	152
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	28	152
EP074S: VOC Surrogates			
1.2-Dichloroethane-D4	17060-07-0	66	127
Toluene-D8	2037-26-5	66	126
4-Bromofluorobenzene	460-00-4	60	115
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	57	119
2-Chlorophenol-D4	93951-73-6	52	130
2.4.6-Tribromophenol	118-79-6	40	132
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	53	139
Anthracene-d10	1719-06-8	68	124
4-Terphenyl-d14	1718-51-0	66	132
EP075S: Acid Extractable Surrogates			
2-Fluorophenol	367-12-4	34	132
Phenol-d6	13127-88-3	46	132
2-Chlorophenol-D4	93951-73-6	45	135
2.4.6-Tribromophenol	118-79-6	39	139
EP075T: Base/Neutral Extractable Surrogates			
Nitrobenzene-D5	4165-60-0	38	132
1.2-Dichlorobenzene-D4	2199-69-1	40	126
2-Fluorobiphenyl	321-60-8	43	131
Anthracene-d10	1719-06-8	49	131
4-Terphenyl-d14	1718-51-0	54	140
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	63	132
Toluene-D8	2037-26-5	66	125
4-Bromofluorobenzene	460-00-4	60	124

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP074S: VOC Surrogates			
1.2-Dichloroethane-D4	17060-07-0	62	134
Toluene-D8	2037-26-5	75	124
4-Bromofluorobenzene	460-00-4	64	118
EP075S: Acid Extractable Surrogates			

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP075S: Acid Extractable Surrogates - Continued			
2-Fluorophenol	367-12-4	23	115
Phenol-d6	13127-88-3	10	163
2-Chlorophenol-D4	93951-73-6	44	124
2.4.6-Tribromophenol	118-79-6	19	146
EP075T: Base/Neutral Extractable Surrogates			
Nitrobenzene-D5	4165-60-0	51	130
1.2-Dichlorobenzene-D4	2199-69-1	31	121
2-Fluorobiphenyl	321-60-8	42	136
Anthracene-d10	1719-06-8	53	131
4-Terphenyl-d14	1718-51-0	44	141

Inter-Laboratory Testing

Analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no. 1656 (Chemistry) 9854 (Biology).

(SOIL) EA150: Soil Classification based on Particle Size

(SOIL) EA152: Soil Particle Density

QUALITY CONTROL REPORT

Work Order	: **EP2309599**	Page	: 1 of 86
Client	: **WESTERN ENVIRONMENTAL P/L**	Laboratory	: Environmental Division Perth
Contact	: Louis Grogan	Contact	: Customer Services EP
Address	: Unit 5, 162 Colin Street West Perth 6005	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: ----	Telephone	: +61-8-9406 1301
Project	: P22.142	Date Samples Received	: 14-Jul-2023
Order number	: P22.114	Date Analysis Commenced	: 20-Jul-2023
C-O-C number	: ----	Issue Date	: 31-Jul-2023
Sampler	: JADE DENNIS, Louis Grogan		
Site	: ----		
Quote number	: EN/110		
No. of samples received	: 113		
No. of samples analysed	: 41		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
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General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 5191196)									
EP2309599-002	SED01	EG005T: Zinc	7440-66-6	5	mg/kg	466	427	8.8	0% - 20%
EP2309599-002	SED01	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	80	80	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	3	3	0.0	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Antimony	7440-36-0	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	24	26	8.5	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	5	6	19.9	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	461	445	3.4	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Tin	7440-31-5	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.0	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	3140	3140	0.0	0% - 20%
EP2309599-030	TP07_0-0.15	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	70	80	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	8	8	0.0	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 5191196) - continued									
EP2309599-030	TP07_0-0.15	EG005T: Antimony	7440-36-0	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	514	442	15.2	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Tin	7440-31-5	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	26	22	19.8	No Limit
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.0	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	3060	3070	0.0	0% - 20%
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 5198928)									
EP2309599-084	TP17_0-0.15	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	30	30	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	<2	2	0.0	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Antimony	7440-36-0	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	14	20	37.1	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	54	48	11.7	0% - 50%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Tin	7440-31-5	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	51	56	8.9	0% - 50%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.0	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	1340	1330	0.8	0% - 20%
EP2309599-053	TP03_0-0.15	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	60	50	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	3	4	33.2	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Antimony	7440-36-0	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	268	220	19.7	0% - 20%

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 5198928) - continued									
EP2309599-053	TP03_0-0.15	EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Tin	7440-31-5	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	24	24	0.0	No Limit
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.0	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	2740	2850	4.0	0% - 20%
EA002: pH 1:5 (Soils) (QC Lot: 5201105)									
EP2309599-046	BG01	EA002: pH Value	----	0.1	pH Unit	6.4	6.3	1.7	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 5183522)									
EP2309599-004	Dup01	EA055: Moisture Content	----	0.1	%	4.7	4.1	13.0	No Limit
EP2309599-030	TP07_0-0.15	EA055: Moisture Content	----	0.1	%	9.4	10.2	7.9	0% - 50%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 5183526)									
EP2309599-075	TP14_0-0.15	EA055: Moisture Content	----	0.1	%	5.4	5.4	0.0	No Limit
EP2309599-102	TP29_0-0.15	EA055: Moisture Content	----	0.1	%	4.9	4.9	0.0	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 5184938)									
EP2309599-002	SED01	EA055: Moisture Content	----	0.1	%	15.9	14.2	11.5	0% - 50%
EP2309599-068	TP24_0-0.15	EA055: Moisture Content	----	0.1	%	4.9	5.1	4.9	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 5194846)									
EP2309599-046	BG01	EA055: Moisture Content	----	0.1	%	6.8	7.8	14.6	0% - 20%
ED007: Exchangeable Cations (QC Lot: 5201986)									
EP2309599-046	BG01	ED007: Exchangeable Sodium Percent	----	0.1	%	1.8	2.0	7.9	0% - 50%
		ED007: Exchangeable Calcium	----	0.1	meq/100g	2.6	3.1	18.4	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	0.5	0.6	19.2	No Limit
		ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	<0.1	0.0	No Limit
		ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	0.0	No Limit
		ED007: Cation Exchange Capacity	----	0.1	meq/100g	3.2	3.8	18.8	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 5191197)									
EP2309599-002	SED01	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP2309599-030	TP07_0-0.15	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 5198929)									
EP2309599-087	TP18_0-0.15	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP2309599-053	TP03_0-0.15	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP004: Organic Matter (QC Lot: 5194838)									
EP2309599-046	BG01	EP004: Organic Matter	----	0.5	%	2.3	2.3	0.0	No Limit
		EP004: Total Organic Carbon	----	0.5	%	1.3	1.4	0.0	No Limit
EP068A: Organochlorine Pesticides (OC) (QC Lot: 5183509)									
EP2309599-033	TP10_0-0.15	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP068A: Organochlorine Pesticides (OC) (QC Lot: 5183509) - continued									
EP2309599-033	TP10_0-0.15	EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP2309599-004	Dup01	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP068A: Organochlorine Pesticides (OC) (QC Lot: 5183509) - continued									
EP2309599-004	Dup01	EP068: Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP068A: Organochlorine Pesticides (OC) (QC Lot: 5183514)									
EP2309599-075	TP14_0-0.15	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP2309599-108	TP31_0-0.15	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP068A: Organochlorine Pesticides (OC) (QC Lot: 5183514) - continued									
EP2309599-108	TP31_0-0.15	EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP068A: Organochlorine Pesticides (OC) (QC Lot: 5184944)									
EP2309599-050	TP02_0-0.15	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP068A: Organochlorine Pesticides (OC) (QC Lot: 5184944) - continued									
EP2309599-050	TP02_0-0.15	EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP068B: Organophosphorus Pesticides (OP) (QC Lot: 5183509)									
EP2309599-033	TP10_0-0.15	EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP2309599-004	Dup01	EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP068B: Organophosphorus Pesticides (OP) (QC Lot: 5183509) - continued									
EP2309599-004	Dup01	EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP068B: Organophosphorus Pesticides (OP) (QC Lot: 5183514)									
EP2309599-075	TP14_0-0.15	EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP2309599-108	TP31_0-0.15	EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP068B: Organophosphorus Pesticides (OP) (QC Lot: 5183514) - continued									
EP2309599-108	TP31_0-0.15	EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP068B: Organophosphorus Pesticides (OP) (QC Lot: 5184944)									
EP2309599-050	TP02_0-0.15	EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP074A: Monocyclic Aromatic Hydrocarbons (QC Lot: 5183490)									
EP2309599-004	Dup01	EP074: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP074: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Styrene	100-42-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP074A: Monocyclic Aromatic Hydrocarbons (QC Lot: 5183490) - continued									
EP2309599-004	Dup01	EP074: Isopropylbenzene	98-82-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: n-Propylbenzene	103-65-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.3.5-Trimethylbenzene	108-67-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: sec-Butylbenzene	135-98-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2.4-Trimethylbenzene	95-63-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: tert-Butylbenzene	98-06-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: p-Isopropyltoluene	99-87-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: n-Butylbenzene	104-51-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP2309599-033	TP10_0-0.15	EP074: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP074: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Styrene	100-42-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Isopropylbenzene	98-82-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: n-Propylbenzene	103-65-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.3.5-Trimethylbenzene	108-67-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: sec-Butylbenzene	135-98-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2.4-Trimethylbenzene	95-63-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: tert-Butylbenzene	98-06-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: p-Isopropyltoluene	99-87-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: n-Butylbenzene	104-51-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074A: Monocyclic Aromatic Hydrocarbons (QC Lot: 5183495)									
EP2309599-075	TP14_0-0.15	EP074: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP074: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Styrene	100-42-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Isopropylbenzene	98-82-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: n-Propylbenzene	103-65-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.3.5-Trimethylbenzene	108-67-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: sec-Butylbenzene	135-98-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2.4-Trimethylbenzene	95-63-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: tert-Butylbenzene	98-06-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: p-Isopropyltoluene	99-87-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: n-Butylbenzene	104-51-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP2309599-105	TP30_0-0.15	EP074: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP074A: Monocyclic Aromatic Hydrocarbons (QC Lot: 5183495) - continued									
EP2309599-105	TP30_0-0.15	EP074: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Styrene	100-42-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Isopropylbenzene	98-82-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: n-Propylbenzene	103-65-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.3.5-Trimethylbenzene	108-67-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: sec-Butylbenzene	135-98-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2.4-Trimethylbenzene	95-63-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: tert-Butylbenzene	98-06-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: p-Isopropyltoluene	99-87-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: n-Butylbenzene	104-51-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074A: Monocyclic Aromatic Hydrocarbons (QC Lot: 5184937)									
EP2309599-047	TP01_0-0.15	EP074: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP074: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Styrene	100-42-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Isopropylbenzene	98-82-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: n-Propylbenzene	103-65-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.3.5-Trimethylbenzene	108-67-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: sec-Butylbenzene	135-98-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2.4-Trimethylbenzene	95-63-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: tert-Butylbenzene	98-06-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: p-Isopropyltoluene	99-87-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: n-Butylbenzene	104-51-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074B: Oxygenated Compounds (QC Lot: 5183490)									
EP2309599-004	Dup01	EP074: Vinyl Acetate	108-05-4	5	mg/kg	<5	<5	0.0	No Limit
		EP074: 2-Butanone (MEK)	78-93-3	5	mg/kg	<5	<5	0.0	No Limit
		EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	5	mg/kg	<5	<5	0.0	No Limit
		EP074: 2-Hexanone (MBK)	591-78-6	5	mg/kg	<5	<5	0.0	No Limit
EP2309599-033	TP10_0-0.15	EP074: Vinyl Acetate	108-05-4	5	mg/kg	<5	<5	0.0	No Limit
		EP074: 2-Butanone (MEK)	78-93-3	5	mg/kg	<5	<5	0.0	No Limit
		EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	5	mg/kg	<5	<5	0.0	No Limit
		EP074: 2-Hexanone (MBK)	591-78-6	5	mg/kg	<5	<5	0.0	No Limit
EP074B: Oxygenated Compounds (QC Lot: 5183495)									

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP074B: Oxygenated Compounds (QC Lot: 5183495) - continued									
EP2309599-075	TP14_0-0.15	EP074: Vinyl Acetate	108-05-4	5	mg/kg	<5	<5	0.0	No Limit
		EP074: 2-Butanone (MEK)	78-93-3	5	mg/kg	<5	<5	0.0	No Limit
		EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	5	mg/kg	<5	<5	0.0	No Limit
		EP074: 2-Hexanone (MBK)	591-78-6	5	mg/kg	<5	<5	0.0	No Limit
EP2309599-105	TP30_0-0.15	EP074: Vinyl Acetate	108-05-4	5	mg/kg	<5	<5	0.0	No Limit
		EP074: 2-Butanone (MEK)	78-93-3	5	mg/kg	<5	<5	0.0	No Limit
		EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	5	mg/kg	<5	<5	0.0	No Limit
		EP074: 2-Hexanone (MBK)	591-78-6	5	mg/kg	<5	<5	0.0	No Limit
EP074B: Oxygenated Compounds (QC Lot: 5184937)									
EP2309599-047	TP01_0-0.15	EP074: Vinyl Acetate	108-05-4	5	mg/kg	<5	<5	0.0	No Limit
		EP074: 2-Butanone (MEK)	78-93-3	5	mg/kg	<5	<5	0.0	No Limit
		EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	5	mg/kg	<5	<5	0.0	No Limit
		EP074: 2-Hexanone (MBK)	591-78-6	5	mg/kg	<5	<5	0.0	No Limit
EP074C: Sulfonated Compounds (QC Lot: 5183490)									
EP2309599-004	Dup01	EP074: Carbon disulfide	75-15-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP2309599-033	TP10_0-0.15	EP074: Carbon disulfide	75-15-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074C: Sulfonated Compounds (QC Lot: 5183495)									
EP2309599-075	TP14_0-0.15	EP074: Carbon disulfide	75-15-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP2309599-105	TP30_0-0.15	EP074: Carbon disulfide	75-15-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074C: Sulfonated Compounds (QC Lot: 5184937)									
EP2309599-047	TP01_0-0.15	EP074: Carbon disulfide	75-15-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074D: Fumigants (QC Lot: 5183490)									
EP2309599-004	Dup01	EP074: 2.2-Dichloropropane	594-20-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dichloropropane	78-87-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: cis-1.3-Dichloropropylene	10061-01-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: trans-1.3-Dichloropropylene	10061-02-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dibromoethane (EDB)	106-93-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP2309599-033	TP10_0-0.15	EP074: 2.2-Dichloropropane	594-20-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dichloropropane	78-87-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: cis-1.3-Dichloropropylene	10061-01-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: trans-1.3-Dichloropropylene	10061-02-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dibromoethane (EDB)	106-93-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074D: Fumigants (QC Lot: 5183495)									
EP2309599-075	TP14_0-0.15	EP074: 2.2-Dichloropropane	594-20-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dichloropropane	78-87-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: cis-1.3-Dichloropropylene	10061-01-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: trans-1.3-Dichloropropylene	10061-02-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dibromoethane (EDB)	106-93-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP2309599-105	TP30_0-0.15	EP074: 2.2-Dichloropropane	594-20-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP074D: Fumigants (QC Lot: 5183495) - continued									
EP2309599-105	TP30_0-0.15	EP074: 1.2-Dichloropropane	78-87-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: cis-1.3-Dichloropropylene	10061-01-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: trans-1.3-Dichloropropylene	10061-02-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dibromoethane (EDB)	106-93-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074D: Fumigants (QC Lot: 5184937)									
EP2309599-047	TP01_0-0.15	EP074: 2.2-Dichloropropane	594-20-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dichloropropane	78-87-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: cis-1.3-Dichloropropylene	10061-01-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: trans-1.3-Dichloropropylene	10061-02-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dibromoethane (EDB)	106-93-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074E: Halogenated Aliphatic Compounds (QC Lot: 5183490)									
EP2309599-004	Dup01	EP074: 1.1-Dichloroethene	75-35-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Iodomethane	74-88-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: trans-1.2-Dichloroethene	156-60-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1-Dichloroethane	75-34-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: cis-1.2-Dichloroethene	156-59-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1-Dichloropropylene	563-58-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Carbon Tetrachloride	56-23-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dichloroethane	107-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Trichloroethene	79-01-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Dibromomethane	74-95-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.3-Dichloropropane	142-28-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Tetrachloroethene	127-18-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: trans-1.4-Dichloro-2-butene	110-57-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: cis-1.4-Dichloro-2-butene	1476-11-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2.3-Trichloropropane	96-18-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Pentachloroethane	76-01-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dibromo-3-chloropropane	96-12-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Dichlorodifluoromethane	75-71-8	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Chloromethane	74-87-3	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Vinyl chloride	75-01-4	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Bromomethane	74-83-9	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Chloroethane	75-00-3	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Trichlorofluoromethane	75-69-4	5	mg/kg	<5	<5	0.0	No Limit
EP2309599-033	TP10_0-0.15	EP074: 1.1-Dichloroethene	75-35-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Iodomethane	74-88-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP074E: Halogenated Aliphatic Compounds (QC Lot: 5183490) - continued									
EP2309599-033	TP10_0-0.15	EP074: trans-1.2-Dichloroethene	156-60-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1-Dichloroethane	75-34-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: cis-1.2-Dichloroethene	156-59-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1-Dichloropropylene	563-58-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Carbon Tetrachloride	56-23-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dichloroethane	107-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Trichloroethene	79-01-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Dibromomethane	74-95-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.3-Dichloropropane	142-28-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Tetrachloroethene	127-18-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: trans-1.4-Dichloro-2-butene	110-57-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: cis-1.4-Dichloro-2-butene	1476-11-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2.3-Trichloropropane	96-18-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Pentachloroethane	76-01-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dibromo-3-chloropropane	96-12-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Dichlorodifluoromethane	75-71-8	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Chloromethane	74-87-3	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Vinyl chloride	75-01-4	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Bromomethane	74-83-9	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Chloroethane	75-00-3	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Trichlorofluoromethane	75-69-4	5	mg/kg	<5	<5	0.0	No Limit
EP074E: Halogenated Aliphatic Compounds (QC Lot: 5183495)									
EP2309599-075	TP14_0-0.15	EP074: 1.1-Dichloroethene	75-35-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Iodomethane	74-88-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: trans-1.2-Dichloroethene	156-60-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1-Dichloroethane	75-34-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: cis-1.2-Dichloroethene	156-59-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1-Dichloropropylene	563-58-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Carbon Tetrachloride	56-23-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dichloroethane	107-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Trichloroethene	79-01-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Dibromomethane	74-95-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.3-Dichloropropane	142-28-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Tetrachloroethene	127-18-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP074E: Halogenated Aliphatic Compounds (QC Lot: 5183495) - continued									
EP2309599-075	TP14_0-0.15	EP074: 1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: trans-1.4-Dichloro-2-butene	110-57-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: cis-1.4-Dichloro-2-butene	1476-11-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2.3-Trichloropropane	96-18-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Pentachloroethane	76-01-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dibromo-3-chloropropane	96-12-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Dichlorodifluoromethane	75-71-8	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Chloromethane	74-87-3	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Vinyl chloride	75-01-4	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Bromomethane	74-83-9	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Chloroethane	75-00-3	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Trichlorofluoromethane	75-69-4	5	mg/kg	<5	<5	0.0	No Limit
EP2309599-105	TP30_0-0.15	EP074: 1.1-Dichloroethene	75-35-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Iodomethane	74-88-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: trans-1.2-Dichloroethene	156-60-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1-Dichloroethane	75-34-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: cis-1.2-Dichloroethene	156-59-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1-Dichloropropylene	563-58-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Carbon Tetrachloride	56-23-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dichloroethane	107-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Trichloroethene	79-01-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Dibromomethane	74-95-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.3-Dichloropropane	142-28-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Tetrachloroethene	127-18-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: trans-1.4-Dichloro-2-butene	110-57-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: cis-1.4-Dichloro-2-butene	1476-11-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2.3-Trichloropropane	96-18-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Pentachloroethane	76-01-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dibromo-3-chloropropane	96-12-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Dichlorodifluoromethane	75-71-8	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Chloromethane	74-87-3	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Vinyl chloride	75-01-4	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Bromomethane	74-83-9	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Chloroethane	75-00-3	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Trichlorofluoromethane	75-69-4	5	mg/kg	<5	<5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP074E: Halogenated Aliphatic Compounds (QC Lot: 5184937)									
EP2309599-047	TP01_0-0.15	EP074: 1.1-Dichloroethene	75-35-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Iodomethane	74-88-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: trans-1.2-Dichloroethene	156-60-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1-Dichloroethane	75-34-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: cis-1.2-Dichloroethene	156-59-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1-Dichloropropylene	563-58-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Carbon Tetrachloride	56-23-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dichloroethane	107-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Trichloroethene	79-01-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Dibromomethane	74-95-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.3-Dichloropropane	142-28-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Tetrachloroethene	127-18-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: trans-1.4-Dichloro-2-butene	110-57-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: cis-1.4-Dichloro-2-butene	1476-11-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2.3-Trichloropropane	96-18-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Pentachloroethane	76-01-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dibromo-3-chloropropane	96-12-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Dichlorodifluoromethane	75-71-8	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Chloromethane	74-87-3	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Vinyl chloride	75-01-4	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Bromomethane	74-83-9	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Chloroethane	75-00-3	5	mg/kg	<5	<5	0.0	No Limit
		EP074: Trichlorofluoromethane	75-69-4	5	mg/kg	<5	<5	0.0	No Limit
EP074F: Halogenated Aromatic Compounds (QC Lot: 5183490)									
EP2309599-004	Dup01	EP074: Chlorobenzene	108-90-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Bromobenzene	108-86-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 2-Chlorotoluene	95-49-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 4-Chlorotoluene	106-43-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2.3-Trichlorobenzene	87-61-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP2309599-033	TP10_0-0.15	EP074: Chlorobenzene	108-90-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Bromobenzene	108-86-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 2-Chlorotoluene	95-49-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 4-Chlorotoluene	106-43-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2.3-Trichlorobenzene	87-61-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074F: Halogenated Aromatic Compounds (QC Lot: 5183495)									
EP2309599-075	TP14_0-0.15	EP074: Chlorobenzene	108-90-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP074F: Halogenated Aromatic Compounds (QC Lot: 5183495) - continued									
EP2309599-075	TP14_0-0.15	EP074: Bromobenzene	108-86-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 2-Chlorotoluene	95-49-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 4-Chlorotoluene	106-43-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2.3-Trichlorobenzene	87-61-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP2309599-105	TP30_0-0.15	EP074: Chlorobenzene	108-90-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Bromobenzene	108-86-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 2-Chlorotoluene	95-49-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 4-Chlorotoluene	106-43-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2.3-Trichlorobenzene	87-61-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074F: Halogenated Aromatic Compounds (QC Lot: 5184937)									
EP2309599-047	TP01_0-0.15	EP074: Chlorobenzene	108-90-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Bromobenzene	108-86-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 2-Chlorotoluene	95-49-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 4-Chlorotoluene	106-43-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2.3-Trichlorobenzene	87-61-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074G: Trihalomethanes (QC Lot: 5183490)									
EP2309599-004	Dup01	EP074: Chloroform	67-66-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Bromodichloromethane	75-27-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Dibromochloromethane	124-48-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Bromoform	75-25-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP2309599-033	TP10_0-0.15	EP074: Chloroform	67-66-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Bromodichloromethane	75-27-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Dibromochloromethane	124-48-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Bromoform	75-25-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074G: Trihalomethanes (QC Lot: 5183495)									
EP2309599-075	TP14_0-0.15	EP074: Chloroform	67-66-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Bromodichloromethane	75-27-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Dibromochloromethane	124-48-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Bromoform	75-25-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP2309599-105	TP30_0-0.15	EP074: Chloroform	67-66-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Bromodichloromethane	75-27-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Dibromochloromethane	124-48-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Bromoform	75-25-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074G: Trihalomethanes (QC Lot: 5184937)									
EP2309599-047	TP01_0-0.15	EP074: Chloroform	67-66-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Bromodichloromethane	75-27-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Dibromochloromethane	124-48-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Bromoform	75-25-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075(SIM)A: Phenolic Compounds (QC Lot: 5183508)									

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075(SIM)A: Phenolic Compounds (QC Lot: 5183508) - continued									
EP2309599-033	TP10_0-0.15	EP075(SIM): Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	<1	0.0	No Limit
		EP075(SIM): Pentachlorophenol	87-86-5	2	mg/kg	<2	<2	0.0	No Limit
EP2309599-004	Dup01	EP075(SIM): Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	<1	0.0	No Limit
		EP075(SIM): Pentachlorophenol	87-86-5	2	mg/kg	<2	<2	0.0	No Limit
EP075(SIM)A: Phenolic Compounds (QC Lot: 5183516)									
EP2309599-075	TP14_0-0.15	EP075(SIM): Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	<1	0.0	No Limit
		EP075(SIM): Pentachlorophenol	87-86-5	2	mg/kg	<2	<2	0.0	No Limit
EP2309599-108	TP31_0-0.15	EP075(SIM): Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075(SIM)A: Phenolic Compounds (QC Lot: 5183516) - continued									
EP2309599-108	TP31_0-0.15	EP075(SIM): 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	<1	0.0	No Limit
		EP075(SIM): Pentachlorophenol	87-86-5	2	mg/kg	<2	<2	0.0	No Limit
EP075(SIM)A: Phenolic Compounds (QC Lot: 5184941)									
EP2309599-050	TP02_0-0.15	EP075(SIM): Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	<1	0.0	No Limit
		EP075(SIM): Pentachlorophenol	87-86-5	2	mg/kg	<2	<2	0.0	No Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 5183508)									
EP2309599-033	TP10_0-0.15	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 5183508) - continued									
EP2309599-004	Dup01	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 5183516)									
EP2309599-075	TP14_0-0.15	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP2309599-108	TP31_0-0.15	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 5183516) - continued									
EP2309599-108	TP31_0-0.15	EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 5184941)									
EP2309599-050	TP02_0-0.15	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075A: Phenolic Compounds (QC Lot: 5183510)									
EP2309599-004	Dup01	EP075: Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 3- & 4-Methylphenol	1319-77-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075A: Phenolic Compounds (QC Lot: 5183510) - continued									
EP2309599-004	Dup01	EP075: 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pentachlorophenol	87-86-5	1	mg/kg	<1	<1	0.0	No Limit
EP075A: Phenolic Compounds (QC Lot: 5183517)									
EP2309599-081	TP16_0-0.15	EP075: Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 3- & 4-Methylphenol	1319-77-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pentachlorophenol	87-86-5	1	mg/kg	<1	<1	0.0	No Limit
EP075A: Phenolic Compounds (QC Lot: 5184945)									
EP2309599-050	TP02_0-0.15	EP075: Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 3- & 4-Methylphenol	1319-77-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pentachlorophenol	87-86-5	1	mg/kg	<1	<1	0.0	No Limit
EP075B: Polynuclear Aromatic Hydrocarbons (QC Lot: 5183510)									
EP2309599-004	Dup01	EP075: Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Methylnaphthalene	91-57-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Chloronaphthalene	91-58-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075B: Polynuclear Aromatic Hydrocarbons (QC Lot: 5183510) - continued									
EP2309599-004	Dup01	EP075: N-2-Fluorenyl Acetamide	53-96-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 7.12-Dimethylbenz(a)anthracene	57-97-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 3-Methylcholanthrene	56-49-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	<1	<1	0.0	No Limit
EP075B: Polynuclear Aromatic Hydrocarbons (QC Lot: 5183517)									
EP2309599-081	TP16_0-0.15	EP075: Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Methylnaphthalene	91-57-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Chloronaphthalene	91-58-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-2-Fluorenyl Acetamide	53-96-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 7.12-Dimethylbenz(a)anthracene	57-97-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 3-Methylcholanthrene	56-49-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	<1	<1	0.0	No Limit
EP075B: Polynuclear Aromatic Hydrocarbons (QC Lot: 5184945)									
EP2309599-050	TP02_0-0.15	EP075: Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Methylnaphthalene	91-57-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Chloronaphthalene	91-58-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075B: Polynuclear Aromatic Hydrocarbons (QC Lot: 5184945) - continued									
EP2309599-050	TP02_0-0.15	EP075: Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-2-Fluorenyl Acetamide	53-96-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 7.12-Dimethylbenz(a)anthracene	57-97-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 3-Methylcholanthrene	56-49-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	<1	<1	0.0	No Limit
EP075C: Phthalate Esters (QC Lot: 5183510)									
EP2309599-004	Dup01	EP075: Dimethyl phthalate	131-11-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Diethyl phthalate	84-66-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Di-n-butyl phthalate	84-74-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Butyl benzyl phthalate	85-68-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Di-n-octylphthalate	117-84-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075C: Phthalate Esters (QC Lot: 5183517)									
EP2309599-081	TP16_0-0.15	EP075: Dimethyl phthalate	131-11-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Diethyl phthalate	84-66-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Di-n-butyl phthalate	84-74-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Butyl benzyl phthalate	85-68-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Di-n-octylphthalate	117-84-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075C: Phthalate Esters (QC Lot: 5184945)									
EP2309599-050	TP02_0-0.15	EP075: Dimethyl phthalate	131-11-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Diethyl phthalate	84-66-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Di-n-butyl phthalate	84-74-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Butyl benzyl phthalate	85-68-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Di-n-octylphthalate	117-84-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075D: Nitrosamines (QC Lot: 5183510)									
EP2309599-004	Dup01	EP075: N-Nitrosomethylethylamine	10595-95-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-Nitrosodiethylamine	55-18-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-Nitrosopyrrolidine	930-55-2	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: N-Nitrosomorpholine	59-89-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-Nitrosodi-n-propylamine	621-64-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075D: Nitrosamines (QC Lot: 5183510) - continued									
EP2309599-004	Dup01	EP075: N-Nitrosopiperidine	100-75-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-Nitrosodibutylamine	924-16-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: Methapyrilene	91-80-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075D: Nitrosamines (QC Lot: 5183517)									
EP2309599-081	TP16_0-0.15	EP075: N-Nitrosomethylethylamine	10595-95-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-Nitrosodiethylamine	55-18-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-Nitrosopyrrolidine	930-55-2	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: N-Nitrosomorpholine	59-89-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-Nitrosodi-n-propylamine	621-64-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-Nitrosopiperidine	100-75-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-Nitrosodibutylamine	924-16-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: Methapyrilene	91-80-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075D: Nitrosamines (QC Lot: 5184945)									
EP2309599-050	TP02_0-0.15	EP075: N-Nitrosomethylethylamine	10595-95-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-Nitrosodiethylamine	55-18-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-Nitrosopyrrolidine	930-55-2	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: N-Nitrosomorpholine	59-89-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-Nitrosodi-n-propylamine	621-64-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-Nitrosopiperidine	100-75-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-Nitrosodibutylamine	924-16-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: Methapyrilene	91-80-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075E: Nitroaromatics and Ketones (QC Lot: 5183510)									
EP2309599-004	Dup01	EP075: 2-Picoline	109-06-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Acetophenone	98-86-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Nitrobenzene	98-95-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Isophorone	78-59-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.6-Dinitrotoluene	606-20-2	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: 2.4-Dinitrotoluene	121-14-2	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: 1-Naphthylamine	134-32-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Nitroquinoline-N-oxide	56-57-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 5-Nitro-o-toluidine	99-55-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 1.3.5-Trinitrobenzene	99-35-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Phenacetin	62-44-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Aminobiphenyl	92-67-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075E: Nitroaromatics and Ketones (QC Lot: 5183510) - continued									
EP2309599-004	Dup01	EP075: Pentachloronitrobenzene	82-68-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pronamide	23950-58-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Dimethylaminoazobenzene	60-11-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Chlorobenzilate	510-15-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Azobenzene	103-33-3	1	mg/kg	<1	<1	0.0	No Limit
EP075E: Nitroaromatics and Ketones (QC Lot: 5183517)									
EP2309599-081	TP16_0-0.15	EP075: 2-Picoline	109-06-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Acetophenone	98-86-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Nitrobenzene	98-95-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Isophorone	78-59-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.6-Dinitrotoluene	606-20-2	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: 2.4-Dinitrotoluene	121-14-2	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: 1-Naphthylamine	134-32-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Nitroquinoline-N-oxide	56-57-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 5-Nitro-o-toluidine	99-55-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 1.3.5-Trinitrobenzene	99-35-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Phenacetin	62-44-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Aminobiphenyl	92-67-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pentachloronitrobenzene	82-68-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pronamide	23950-58-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Dimethylaminoazobenzene	60-11-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Chlorobenzilate	510-15-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Azobenzene	103-33-3	1	mg/kg	<1	<1	0.0	No Limit
EP075E: Nitroaromatics and Ketones (QC Lot: 5184945)									
EP2309599-050	TP02_0-0.15	EP075: 2-Picoline	109-06-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Acetophenone	98-86-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Nitrobenzene	98-95-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Isophorone	78-59-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.6-Dinitrotoluene	606-20-2	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: 2.4-Dinitrotoluene	121-14-2	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: 1-Naphthylamine	134-32-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Nitroquinoline-N-oxide	56-57-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 5-Nitro-o-toluidine	99-55-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 1.3.5-Trinitrobenzene	99-35-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Phenacetin	62-44-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Aminobiphenyl	92-67-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pentachloronitrobenzene	82-68-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pronamide	23950-58-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Dimethylaminoazobenzene	60-11-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Chlorobenzilate	510-15-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075E: Nitroaromatics and Ketones (QC Lot: 5184945) - continued									
EP2309599-050	TP02_0-0.15	EP075: Azobenzene	103-33-3	1	mg/kg	<1	<1	0.0	No Limit
EP075F: Haloethers (QC Lot: 5183510)									
EP2309599-004	Dup01	EP075: Bis(2-chloroethyl) ether	111-44-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Bis(2-chloroethoxy) methane	111-91-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Chlorophenyl phenyl ether	7005-72-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Bromophenyl phenyl ether	101-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075F: Haloethers (QC Lot: 5183517)									
EP2309599-081	TP16_0-0.15	EP075: Bis(2-chloroethyl) ether	111-44-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Bis(2-chloroethoxy) methane	111-91-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Chlorophenyl phenyl ether	7005-72-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Bromophenyl phenyl ether	101-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075F: Haloethers (QC Lot: 5184945)									
EP2309599-050	TP02_0-0.15	EP075: Bis(2-chloroethyl) ether	111-44-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Bis(2-chloroethoxy) methane	111-91-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Chlorophenyl phenyl ether	7005-72-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Bromophenyl phenyl ether	101-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075G: Chlorinated Hydrocarbons (QC Lot: 5183510)									
EP2309599-004	Dup01	EP075: 1.3-Dichlorobenzene	541-73-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 1.4-Dichlorobenzene	106-46-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 1.2-Dichlorobenzene	95-50-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Hexachloroethane	67-72-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Hexachloropropylene	1888-71-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Hexachlorobutadiene	87-68-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pentachlorobenzene	608-93-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Hexachlorobenzene (HCB)	118-74-1	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: Hexachlorocyclopentadiene	77-47-4	2.5	mg/kg	<2.5	<2.5	0.0	No Limit
EP075G: Chlorinated Hydrocarbons (QC Lot: 5183517)									
EP2309599-081	TP16_0-0.15	EP075: 1.3-Dichlorobenzene	541-73-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 1.4-Dichlorobenzene	106-46-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 1.2-Dichlorobenzene	95-50-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Hexachloroethane	67-72-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Hexachloropropylene	1888-71-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Hexachlorobutadiene	87-68-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pentachlorobenzene	608-93-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Hexachlorobenzene (HCB)	118-74-1	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: Hexachlorocyclopentadiene	77-47-4	2.5	mg/kg	<2.5	<2.5	0.0	No Limit
EP075G: Chlorinated Hydrocarbons (QC Lot: 5184945)									

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075G: Chlorinated Hydrocarbons (QC Lot: 5184945) - continued									
EP2309599-050	TP02_0-0.15	EP075: 1.3-Dichlorobenzene	541-73-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 1.4-Dichlorobenzene	106-46-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 1.2-Dichlorobenzene	95-50-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Hexachloroethane	67-72-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Hexachloropropylene	1888-71-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Hexachlorobutadiene	87-68-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pentachlorobenzene	608-93-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Hexachlorobenzene (HCB)	118-74-1	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: Hexachlorocyclopentadiene	77-47-4	2.5	mg/kg	<2.5	<2.5	0.0	No Limit
EP075H: Anilines and Benzidines (QC Lot: 5183510)									
EP2309599-004	Dup01	EP075: Aniline	62-53-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Chloroaniline	106-47-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Nitroaniline	88-74-4	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: 3-Nitroaniline	99-09-2	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: Dibenzofuran	132-64-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Nitroaniline	100-01-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Carbazole	86-74-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 3.3`-Dichlorobenzidine	91-94-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075H: Anilines and Benzidines (QC Lot: 5183517)									
EP2309599-081	TP16_0-0.15	EP075: Aniline	62-53-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Chloroaniline	106-47-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Nitroaniline	88-74-4	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: 3-Nitroaniline	99-09-2	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: Dibenzofuran	132-64-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Nitroaniline	100-01-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Carbazole	86-74-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 3.3`-Dichlorobenzidine	91-94-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075H: Anilines and Benzidines (QC Lot: 5184945)									
EP2309599-050	TP02_0-0.15	EP075: Aniline	62-53-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Chloroaniline	106-47-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Nitroaniline	88-74-4	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: 3-Nitroaniline	99-09-2	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: Dibenzofuran	132-64-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Nitroaniline	100-01-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Carbazole	86-74-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 3.3`-Dichlorobenzidine	91-94-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075I: Organochlorine Pesticides (QC Lot: 5183510)									
EP2309599-004	Dup01	EP075: alpha-BHC	319-84-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075I: Organochlorine Pesticides (QC Lot: 5183510) - continued									
EP2309599-004	Dup01	EP075: beta-BHC	319-85-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: gamma-BHC	58-89-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: delta-BHC	319-86-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Heptachlor	76-44-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Aldrin	309-00-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Heptachlor epoxide	1024-57-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: alpha-Endosulfan	959-98-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4.4`-DDE	72-55-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Dieldrin	60-57-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Endrin	72-20-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: beta-Endosulfan	33213-65-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4.4`-DDD	72-54-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Endosulfan sulfate	1031-07-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4.4`-DDT	50-29-3	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
EP075I: Organochlorine Pesticides (QC Lot: 5183517)									
EP2309599-081	TP16_0-0.15	EP075: alpha-BHC	319-84-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: beta-BHC	319-85-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: gamma-BHC	58-89-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: delta-BHC	319-86-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Heptachlor	76-44-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Aldrin	309-00-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Heptachlor epoxide	1024-57-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: alpha-Endosulfan	959-98-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4.4`-DDE	72-55-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Dieldrin	60-57-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Endrin	72-20-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: beta-Endosulfan	33213-65-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4.4`-DDD	72-54-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Endosulfan sulfate	1031-07-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4.4`-DDT	50-29-3	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
EP075I: Organochlorine Pesticides (QC Lot: 5184945)									
EP2309599-050	TP02_0-0.15	EP075: alpha-BHC	319-84-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: beta-BHC	319-85-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: gamma-BHC	58-89-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: delta-BHC	319-86-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Heptachlor	76-44-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Aldrin	309-00-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Heptachlor epoxide	1024-57-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: alpha-Endosulfan	959-98-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4.4`-DDE	72-55-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075I: Organochlorine Pesticides (QC Lot: 5184945) - continued									
EP2309599-050	TP02_0-0.15	EP075: Dieldrin	60-57-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Endrin	72-20-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: beta-Endosulfan	33213-65-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4.4`-DDD	72-54-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Endosulfan sulfate	1031-07-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4.4`-DDT	50-29-3	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
EP075J: Organophosphorus Pesticides (QC Lot: 5183510)									
EP2309599-004	Dup01	EP075: Dichlorvos	62-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Dimethoate	60-51-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Diazinon	333-41-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Chlorpyrifos-methyl	5598-13-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Malathion	121-75-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Fenthion	55-38-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Chlorpyrifos	2921-88-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pirimphos-ethyl	23505-41-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Chlorfenvinphos	470-90-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Prothiofos	34643-46-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Ethion	563-12-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075J: Organophosphorus Pesticides (QC Lot: 5183517)									
EP2309599-081	TP16_0-0.15	EP075: Dichlorvos	62-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Dimethoate	60-51-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Diazinon	333-41-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Chlorpyrifos-methyl	5598-13-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Malathion	121-75-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Fenthion	55-38-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Chlorpyrifos	2921-88-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pirimphos-ethyl	23505-41-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Chlorfenvinphos	470-90-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Prothiofos	34643-46-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Ethion	563-12-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075J: Organophosphorus Pesticides (QC Lot: 5184945)									
EP2309599-050	TP02_0-0.15	EP075: Dichlorvos	62-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Dimethoate	60-51-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Diazinon	333-41-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Chlorpyrifos-methyl	5598-13-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Malathion	121-75-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Fenthion	55-38-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Chlorpyrifos	2921-88-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pirimphos-ethyl	23505-41-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Chlorfenvinphos	470-90-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP075J: Organophosphorus Pesticides (QC Lot: 5184945) - continued									
EP2309599-050	TP02_0-0.15	EP075: Prothiofos	34643-46-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Ethion	563-12-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 5183489)									
EP2309599-004	Dup01	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP2309599-033	TP10_0-0.15	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 5183496)									
EP2309599-075	TP14_0-0.15	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP2309599-105	TP30_0-0.15	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 5183507)									
EP2309599-033	TP10_0-0.15	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP2309599-004	Dup01	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 5183515)									
EP2309599-075	TP14_0-0.15	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP2309599-108	TP31_0-0.15	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 5184936)									
EP2309599-047	TP01_0-0.15	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 5184943)									
EP2309599-050	TP02_0-0.15	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 5190120)									
EP2309710-002	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP2309710-008	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 5190125)									
EP2309710-001	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<20	<20	0.0	No Limit
EP2309838-001	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 5183489)									
EP2309599-004	Dup01	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP2309599-033	TP10_0-0.15	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 5183496)									
EP2309599-075	TP14_0-0.15	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP2309599-105	TP30_0-0.15	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 5183507)									
EP2309599-033	TP10_0-0.15	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP2309599-004	Dup01	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 5183515)									
EP2309599-075	TP14_0-0.15	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP2309599-108	TP31_0-0.15	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 5184936)									
EP2309599-047	TP01_0-0.15	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 5184943)									
EP2309599-050	TP02_0-0.15	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 5190120)									
EP2309710-002	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP2309710-008	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 5190125)									
EP2309710-001	Anonymous	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<20	<20	0.0	No Limit
EP2309838-001	Anonymous	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080: BTEXN (QC Lot: 5183489)									
EP2309599-004	Dup01	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP080: BTEXN (QC Lot: 5183489) - continued									
EP2309599-004	Dup01	EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
EP2309599-033	TP10_0-0.15	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
EP080: BTEXN (QC Lot: 5183496)									
EP2309599-075	TP14_0-0.15	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
EP2309599-105	TP30_0-0.15	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
EP080: BTEXN (QC Lot: 5184936)									
EP2309599-047	TP01_0-0.15	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
EP080: BTEXN (QC Lot: 5190120)									
EP2309710-002	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP080: BTEXN (QC Lot: 5190120) - continued									
EP2309710-002	Anonymous	EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
EP2309710-008	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 5196768)									
EP2309930-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.025	0.025	0.0	0% - 20%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.006	0.006	0.0	No Limit
		EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Tin	7440-31-5	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	0.61	0.62	0.0	0% - 50%
EP2309830-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.049	0.048	0.0	0% - 20%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.032	0.031	0.0	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 5196768) - continued									
EP2309830-001	Anonymous	EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Tin	7440-31-5	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	0.33	0.36	6.3	No Limit
EP074A: Monocyclic Aromatic Hydrocarbons (QC Lot: 5182598)									
EP2309599-001	RN/FB01	EP074: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP074: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP074: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP074: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP074: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP074: Styrene	100-42-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: Isopropylbenzene	98-82-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: n-Propylbenzene	103-65-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: sec-Butylbenzene	135-98-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: tert-Butylbenzene	98-06-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: p-Isopropyltoluene	99-87-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: n-Butylbenzene	104-51-8	5	µg/L	<5	<5	0.0	No Limit
EP074B: Oxygenated Compounds (QC Lot: 5182598)									
EP2309599-001	RN/FB01	EP074: Vinyl Acetate	108-05-4	50	µg/L	<50	<50	0.0	No Limit
		EP074: 2-Butanone (MEK)	78-93-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	<50	0.0	No Limit
		EP074: 2-Hexanone (MBK)	591-78-6	50	µg/L	<50	<50	0.0	No Limit
EP074C: Sulfonated Compounds (QC Lot: 5182598)									
EP2309599-001	RN/FB01	EP074: Carbon disulfide	75-15-0	5	µg/L	<5	<5	0.0	No Limit
EP074D: Fumigants (QC Lot: 5182598)									
EP2309599-001	RN/FB01	EP074: 2.2-Dichloropropane	594-20-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichloropropane	78-87-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.3-Dichloropropylene	10061-01-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.3-Dichloropropylene	10061-02-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	<5	0.0	No Limit
EP074E: Halogenated Aliphatic Compounds (QC Lot: 5182598)									
EP2309599-001	RN/FB01	EP074: 1.1-Dichloroethene	75-35-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Iodomethane	74-88-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	<5	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP074E: Halogenated Aliphatic Compounds (QC Lot: 5182598) - continued									
EP2309599-001	RN/FB01	EP074: 1.1-Dichloroethane	75-34-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1-Dichloropropylene	563-58-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: Carbon Tetrachloride	56-23-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichloroethane	107-06-2	5	µg/L	<5	<5	0.0	No Limit
		EP074: Trichloroethene	79-01-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dibromomethane	74-95-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3-Dichloropropane	142-28-9	5	µg/L	<5	<5	0.0	No Limit
		EP074: Tetrachloroethene	127-18-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Pentachloroethane	76-01-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dichlorodifluoromethane	75-71-8	50	µg/L	<50	<50	0.0	No Limit
		EP074: Chloromethane	74-87-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: Vinyl chloride	75-01-4	50	µg/L	<50	<50	0.0	No Limit
		EP074: Bromomethane	74-83-9	50	µg/L	<50	<50	0.0	No Limit
		EP074: Chloroethane	75-00-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: Trichlorofluoromethane	75-69-4	50	µg/L	<50	<50	0.0	No Limit
EP074F: Halogenated Aromatic Compounds (QC Lot: 5182598)									
EP2309599-001	RN/FB01	EP074: Chlorobenzene	108-90-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromobenzene	108-86-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 2-Chlorotoluene	95-49-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: 4-Chlorotoluene	106-43-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	<5	0.0	No Limit
EP074G: Trihalomethanes (QC Lot: 5182598)									
EP2309599-001	RN/FB01	EP074: Chloroform	67-66-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromodichloromethane	75-27-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dibromochloromethane	124-48-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromoform	75-25-2	5	µg/L	<5	<5	0.0	No Limit
EP075A: Phenolic Compounds (QC Lot: 5183750)									
EP2309599-001	RN/FB01	EP075: Phenol	108-95-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2-Chlorophenol	95-57-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2-Methylphenol	95-48-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: 3- & 4-Methylphenol	1319-77-3	2	µg/L	<4	<4	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075A: Phenolic Compounds (QC Lot: 5183750) - continued									
EP2309599-001	RN/FB01	EP075: 2-Nitrophenol	88-75-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2.4-Dimethylphenol	105-67-9	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2.4-Dichlorophenol	120-83-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2.6-Dichlorophenol	87-65-0	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4-Chloro-3-methylphenol	59-50-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2.4.6-Trichlorophenol	88-06-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2.4.5-Trichlorophenol	95-95-4	2	µg/L	<2	<2	0.0	No Limit
		EP075: Pentachlorophenol	87-86-5	4	µg/L	<4	<4	0.0	No Limit
EP075B: Polynuclear Aromatic Hydrocarbons (QC Lot: 5183750)									
EP2309599-001	RN/FB01	EP075: Naphthalene	91-20-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2-Methylnaphthalene	91-57-6	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2-Chloronaphthalene	91-58-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: Acenaphthylene	208-96-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: Acenaphthene	83-32-9	2	µg/L	<2	<2	0.0	No Limit
		EP075: Fluorene	86-73-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: Phenanthrene	85-01-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: Anthracene	120-12-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: Fluoranthene	206-44-0	2	µg/L	<2	<2	0.0	No Limit
		EP075: Pyrene	129-00-0	2	µg/L	<2	<2	0.0	No Limit
		EP075: N-2-Fluorenyl Acetamide	53-96-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: Benz(a)anthracene	56-55-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: Chrysene	218-01-9	2	µg/L	<2	<2	0.0	No Limit
		EP075: 7.12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L	<2	<2	0.0	No Limit
		EP075: Benzo(a)pyrene	50-32-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: 3-Methylcholanthrene	56-49-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: Indeno(1.2.3.cd)pyrene	193-39-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: Dibenz(a.h)anthracene	53-70-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: Benzo(g.h.i)perylene	191-24-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: Benzo(a)pyrene TEQ (zero)	----	2	µg/L	<2	<2	0.0	No Limit
		EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L	<4	<4	0.0	No Limit
EP075C: Phthalate Esters (QC Lot: 5183750)									
EP2309599-001	RN/FB01	EP075: Dimethyl phthalate	131-11-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: Diethyl phthalate	84-66-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: Di-n-butyl phthalate	84-74-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: Butyl benzyl phthalate	85-68-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: Di-n-octylphthalate	117-84-0	2	µg/L	<2	<2	0.0	No Limit
EP075D: Nitrosamines (QC Lot: 5183750)									
EP2309599-001	RN/FB01	EP075: N-Nitrosomethylethylamine	10595-95-6	2	µg/L	<2	<2	0.0	No Limit
		EP075: N-Nitrosodiethylamine	55-18-5	2	µg/L	<2	<2	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075D: Nitrosamines (QC Lot: 5183750) - continued									
EP2309599-001	RN/FB01	EP075: N-Nitrosomorpholine	59-89-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: N-Nitrosodi-n-propylamine	621-64-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: N-Nitrosopiperidine	100-75-4	2	µg/L	<2	<2	0.0	No Limit
		EP075: N-Nitrosodibutylamine	924-16-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: Methapyrilene	91-80-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: N-Nitrosopyrrolidine	930-55-2	4	µg/L	<4	<4	0.0	No Limit
		EP075: N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	4	µg/L	<4	<4	0.0	No Limit
EP075E: Nitroaromatics and Ketones (QC Lot: 5183750)									
EP2309599-001	RN/FB01	EP075: 2-Picoline	109-06-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: Acetophenone	98-86-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: Nitrobenzene	98-95-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: Isophorone	78-59-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: 1-Naphthylamine	134-32-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4-Nitroquinoline-N-oxide	56-57-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: 5-Nitro-o-toluidine	99-55-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: Azobenzene	103-33-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: 1.3.5-Trinitrobenzene	99-35-4	2	µg/L	<2	<2	0.0	No Limit
		EP075: Phenacetin	62-44-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4-Aminobiphenyl	92-67-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: Pentachloronitrobenzene	82-68-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: Pronamide	23950-58-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: Dimethylaminoazobenzene	60-11-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: Chlorobenzilate	510-15-6	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2.6-Dinitrotoluene	606-20-2	4	µg/L	<4	<4	0.0	No Limit
		EP075: 2.4-Dinitrotoluene	121-14-2	4	µg/L	<4	<4	0.0	No Limit
EP075F: Haloethers (QC Lot: 5183750)									
EP2309599-001	RN/FB01	EP075: Bis(2-chloroethyl) ether	111-44-4	2	µg/L	<2	<2	0.0	No Limit
		EP075: Bis(2-chloroethoxy) methane	111-91-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4-Chlorophenyl phenyl ether	7005-72-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4-Bromophenyl phenyl ether	101-55-3	2	µg/L	<2	<2	0.0	No Limit
EP075G: Chlorinated Hydrocarbons (QC Lot: 5183750)									
EP2309599-001	RN/FB01	EP075: Hexachlorocyclopentadiene	77-47-4	10	µg/L	<10	<10	0.0	No Limit
		EP075: 1.4-Dichlorobenzene	106-46-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: 1.3-Dichlorobenzene	541-73-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: 1.2-Dichlorobenzene	95-50-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: Hexachloroethane	67-72-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: 1.2.4-Trichlorobenzene	120-82-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: Hexachloropropylene	1888-71-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: Hexachlorobutadiene	87-68-3	2	µg/L	<2	<2	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075G: Chlorinated Hydrocarbons (QC Lot: 5183750) - continued									
EP2309599-001	RN/FB01	EP075: Pentachlorobenzene	608-93-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: Hexachlorobenzene (HCB)	118-74-1	4	µg/L	<4	<4	0.0	No Limit
EP075H: Anilines and Benzidines (QC Lot: 5183750)									
EP2309599-001	RN/FB01	EP075: Aniline	62-53-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4-Chloroaniline	106-47-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: Dibenzofuran	132-64-9	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4-Nitroaniline	100-01-6	2	µg/L	<2	<2	0.0	No Limit
		EP075: Carbazole	86-74-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: 3.3`-Dichlorobenzidine	91-94-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2-Nitroaniline	88-74-4	4	µg/L	<4	<4	0.0	No Limit
		EP075: 3-Nitroaniline	99-09-2	4	µg/L	<4	<4	0.0	No Limit
EP075I: Organochlorine Pesticides (QC Lot: 5183750)									
EP2309599-001	RN/FB01	EP075: alpha-BHC	319-84-6	2	µg/L	<2	<2	0.0	No Limit
		EP075: beta-BHC	319-85-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: gamma-BHC	58-89-9	2	µg/L	<2	<2	0.0	No Limit
		EP075: delta-BHC	319-86-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: Heptachlor	76-44-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: Aldrin	309-00-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: Heptachlor epoxide	1024-57-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: alpha-Endosulfan	959-98-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4.4`-DDE	72-55-9	2	µg/L	<2	<2	0.0	No Limit
		EP075: Dieldrin	60-57-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: Endrin	72-20-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: beta-Endosulfan	33213-65-9	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4.4`-DDD	72-54-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: Endosulfan sulfate	1031-07-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4.4`-DDT	50-29-3	4	µg/L	<4	<4	0.0	No Limit
		EP075: Sum of Aldrin + Dieldrin	309-00-2/60-57-1	4	µg/L	<4	<4	0.0	No Limit
		EP075: Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	4	µg/L	<4	<4	0.0	No Limit
EP075J: Organophosphorus Pesticides (QC Lot: 5183750)									
EP2309599-001	RN/FB01	EP075: Dichlorvos	62-73-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: Dimethoate	60-51-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: Diazinon	333-41-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: Chlorpyrifos-methyl	5598-13-0	2	µg/L	<2	<2	0.0	No Limit
		EP075: Malathion	121-75-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: Fenthion	55-38-9	2	µg/L	<2	<2	0.0	No Limit
		EP075: Chlorpyrifos	2921-88-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: Pirimphos-ethyl	23505-41-1	2	µg/L	<2	<2	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075J: Organophosphorus Pesticides (QC Lot: 5183750) - continued									
EP2309599-001	RN/FB01	EP075: Chlorfenvinphos	470-90-6	2	µg/L	<2	<2	0.0	No Limit
		EP075: Prothiofos	34643-46-4	2	µg/L	<2	<2	0.0	No Limit
		EP075: Ethion	563-12-2	2	µg/L	<2	<2	0.0	No Limit
EP080: BTEXN (QC Lot: 5182599)									
EP2309599-001	RN/FB01	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 5191196)								
EG005T: Antimony	7440-36-0	5	mg/kg	<5	----	----	----	----
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	100	87.2	114
EG005T: Barium	7440-39-3	10	mg/kg	<10	143 mg/kg	94.1	82.4	112
EG005T: Beryllium	7440-41-7	1	mg/kg	<1	5.63 mg/kg	106	91.3	121
EG005T: Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	89.4	80.9	105
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	76.9	70.0	100
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	16 mg/kg	90.9	79.6	112
EG005T: Copper	7440-50-8	5	mg/kg	<5	32 mg/kg	91.2	81.0	112
EG005T: Iron	7439-89-6	50	mg/kg	<50	6655 mg/kg	87.1	70.0	114
EG005T: Lead	7439-92-1	5	mg/kg	<5	40 mg/kg	94.0	77.2	104
EG005T: Manganese	7439-96-5	5	mg/kg	<5	130 mg/kg	102	70.5	128
EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	7.9 mg/kg	79.7	75.0	105
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55 mg/kg	90.0	78.7	106
EG005T: Selenium	7782-49-2	5	mg/kg	<5	5.37 mg/kg	108	75.0	115
EG005T: Tin	7440-31-5	5	mg/kg	<5	5.2 mg/kg	79.8	70.0	100
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	96.2	79.4	110
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 5198928)								
EG005T: Antimony	7440-36-0	5	mg/kg	<5	----	----	----	----
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	96.3	87.2	114
EG005T: Barium	7440-39-3	10	mg/kg	<10	143 mg/kg	88.3	82.4	112
EG005T: Beryllium	7440-41-7	1	mg/kg	<1	5.63 mg/kg	106	91.3	121
EG005T: Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	88.4	80.9	105
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	77.0	70.0	100
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	16 mg/kg	92.5	79.6	112
EG005T: Copper	7440-50-8	5	mg/kg	<5	32 mg/kg	92.2	81.0	112
EG005T: Iron	7439-89-6	50	mg/kg	<50	6655 mg/kg	86.5	70.0	114
EG005T: Lead	7439-92-1	5	mg/kg	<5	40 mg/kg	89.0	77.2	104
EG005T: Manganese	7439-96-5	5	mg/kg	<5	130 mg/kg	103	70.5	128

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 5198928) - continued								
EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	7.9 mg/kg	82.3	75.0	105
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55 mg/kg	90.1	78.7	106
EG005T: Selenium	7782-49-2	5	mg/kg	<5	5.37 mg/kg	106	75.0	115
EG005T: Tin	7440-31-5	5	mg/kg	<5	5.2 mg/kg	80.8	70.0	100
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	92.0	79.4	110
EA002: pH 1:5 (Soils) (QCLot: 5201105)								
EA002: pH Value	----	----	pH Unit	----	4 pH Unit	101	98.6	102
				----	7 pH Unit	100	98.6	102
ED007: Exchangeable Cations (QCLot: 5201986)								
ED007: Exchangeable Calcium	----	0.1	meq/100g	<0.1	21.6 meq/100g	102	83.7	116
ED007: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	1.76 meq/100g	98.3	84.7	113
ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	1 meq/100g	107	95.5	123
ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.9 meq/100g	110	91.6	123
ED007: Cation Exchange Capacity	----	0.1	meq/100g	<0.1	25.3 meq/100g	102	85.4	115
ED007: Exchangeable Sodium Percent	----	0.1	%	<0.1	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS (QCLot: 5191197)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.154 mg/kg	94.7	84.3	124
EG035T: Total Recoverable Mercury by FIMS (QCLot: 5198929)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.154 mg/kg	91.7	84.3	124
EP004: Organic Matter (QCLot: 5194838)								
EP004: Organic Matter	----	0.5	%	<0.5	2.3 %	106	70.0	120
				<0.5	85 %	81.0	70.0	120
EP004: Total Organic Carbon	----	0.5	%	<0.5	----	----	----	----
EP068A: Organochlorine Pesticides (OC) (QCLot: 5183509)								
EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	0.5 mg/kg	98.4	46.0	116
EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	0.5 mg/kg	111	53.0	133
EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	0.5 mg/kg	110	45.0	117
EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	0.5 mg/kg	85.2	46.0	122
EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	99.8	47.0	117
EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	0.5 mg/kg	77.4	40.0	118
EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	0.5 mg/kg	108	47.0	123
EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	0.5 mg/kg	102	41.0	119
EP068: Total Chlordane (sum)	----	0.05	mg/kg	<0.05	----	----	----	----
EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	0.5 mg/kg	114	43.0	119

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP068A: Organochlorine Pesticides (OC) (QCLot: 5183509) - continued								
EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	0.5 mg/kg	118	41.0	131
EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	0.5 mg/kg	116	41.0	119
EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	0.5 mg/kg	98.3	41.0	127
EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	0.5 mg/kg	63.2	44.0	122
EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	0.5 mg/kg	108	37.0	129
EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	0.5 mg/kg	117	41.0	127
EP068: Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	----	----	----	----
EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	0.5 mg/kg	81.4	42.0	122
EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	0.5 mg/kg	90.9	31.2	117
EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	0.5 mg/kg	60.6	38.0	120
EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	0.5 mg/kg	79.6	31.4	125
EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	0.5 mg/kg	116	31.2	123
EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	0.5 mg/kg	71.0	24.7	125
EP068: Sum of DDD + DDE + DDT	72-54-8/72-5 5-9/50-2	0.05	mg/kg	<0.05	----	----	----	----
EP068: Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	----	----	----	----
EP068A: Organochlorine Pesticides (OC) (QCLot: 5183514)								
EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	0.5 mg/kg	103	46.0	116
EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	0.5 mg/kg	117	53.0	133
EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	0.5 mg/kg	114	45.0	117
EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	0.5 mg/kg	105	46.0	122
EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	106	47.0	117
EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	0.5 mg/kg	79.8	40.0	118
EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	0.5 mg/kg	116	47.0	123
EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	0.5 mg/kg	109	41.0	119
EP068: Total Chlordane (sum)	----	0.05	mg/kg	<0.05	----	----	----	----
EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	0.5 mg/kg	62.8	43.0	119
EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	0.5 mg/kg	126	41.0	131
EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	0.5 mg/kg	64.2	41.0	119
EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	0.5 mg/kg	105	41.0	127
EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	0.5 mg/kg	70.4	44.0	122
EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	0.5 mg/kg	111	37.0	129
EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	0.5 mg/kg	125	41.0	127
EP068: Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	----	----	----	----

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report		
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP068A: Organochlorine Pesticides (OC) (QCLot: 5183514) - continued								
EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	0.5 mg/kg	91.8	42.0	122
EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	0.5 mg/kg	96.1	31.2	117
EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	0.5 mg/kg	67.7	38.0	120
EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	0.5 mg/kg	78.0	31.4	125
EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	0.5 mg/kg	123	31.2	123
EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	0.5 mg/kg	69.1	24.7	125
EP068: Sum of DDD + DDE + DDT	72-54-8/72-5 5-9/50-2	0.05	mg/kg	<0.05	----	----	----	----
EP068: Sum of Aldrin + Dieldrin	309-00-2/60- 57-1	0.05	mg/kg	<0.05	----	----	----	----
EP068A: Organochlorine Pesticides (OC) (QCLot: 5184944)								
EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	0.5 mg/kg	100	46.0	116
EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	0.5 mg/kg	94.7	53.0	133
EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	0.5 mg/kg	102	45.0	117
EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	0.5 mg/kg	104	46.0	122
EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	102	47.0	117
EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	0.5 mg/kg	100	40.0	118
EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	0.5 mg/kg	119	47.0	123
EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	0.5 mg/kg	114	41.0	119
EP068: Total Chlordane (sum)	----	0.05	mg/kg	<0.05	----	----	----	----
EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	0.5 mg/kg	109	43.0	119
EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	0.5 mg/kg	126	41.0	131
EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	0.5 mg/kg	111	41.0	119
EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	0.5 mg/kg	111	41.0	127
EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	0.5 mg/kg	109	44.0	122
EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	0.5 mg/kg	119	37.0	129
EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	0.5 mg/kg	106	41.0	127
EP068: Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	----	----	----	----
EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	0.5 mg/kg	103	42.0	122
EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	0.5 mg/kg	98.9	31.2	117
EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	0.5 mg/kg	101	38.0	120
EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	0.5 mg/kg	75.9	31.4	125
EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	0.5 mg/kg	100	31.2	123
EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	0.5 mg/kg	62.9	24.7	125

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report		
					Spike	Spike Recovery (%)	Acceptable Limits (%)
				Result	Concentration	LCS	Low	High
EP068A: Organochlorine Pesticides (OC) (QCLot: 5184944) - continued								
EP068: Sum of DDD + DDE + DDT	72-54-8/72-5 5-9/50-2	0.05	mg/kg	<0.05	----	----	----	----
EP068: Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	----	----	----	----
EP068B: Organophosphorus Pesticides (OP) (QCLot: 5183509)								
EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	1 mg/kg	105	61.0	141
EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	1 mg/kg	95.4	39.0	147
EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	1 mg/kg	76.9	4.10	154
EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	1 mg/kg	134	40.0	136
EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	1 mg/kg	105	59.0	133
EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	1 mg/kg	103	57.0	135
EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	1 mg/kg	66.5	39.0	133
EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	1 mg/kg	89.3	53.0	131
EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	1 mg/kg	101	53.0	133
EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	1 mg/kg	99.9	57.0	135
EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	1 mg/kg	70.0	45.0	131
EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	1 mg/kg	96.1	53.0	137
EP068: Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	1 mg/kg	85.9	53.0	133
EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	1 mg/kg	98.2	49.0	133
EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	1 mg/kg	45.8	39.0	137
EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	1 mg/kg	93.2	57.0	137
EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	1 mg/kg	83.3	53.0	135
EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	0.5 mg/kg	87.2	52.0	134
EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	1 mg/kg	65.8	20.4	154
EP068B: Organophosphorus Pesticides (OP) (QCLot: 5183514)								
EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	1 mg/kg	124	61.0	141
EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	1 mg/kg	96.0	39.0	147
EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	1 mg/kg	79.1	4.10	154
EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	1 mg/kg	109	40.0	136
EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	1 mg/kg	110	59.0	133
EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	1 mg/kg	109	57.0	135
EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	1 mg/kg	68.2	39.0	133
EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	1 mg/kg	92.7	53.0	131
EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	1 mg/kg	107	53.0	133
EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	1 mg/kg	105	57.0	135

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP068B: Organophosphorus Pesticides (OP) (QCLot: 5183514) - continued								
EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	1 mg/kg	71.7	45.0	131
EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	1 mg/kg	102	53.0	137
EP068: Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	1 mg/kg	89.2	53.0	133
EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	1 mg/kg	104	49.0	133
EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	1 mg/kg	46.7	39.0	137
EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	1 mg/kg	99.4	57.0	137
EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	1 mg/kg	87.6	53.0	135
EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	0.5 mg/kg	90.0	52.0	134
EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	1 mg/kg	65.4	20.4	154
EP068B: Organophosphorus Pesticides (OP) (QCLot: 5184944)								
EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	1 mg/kg	97.8	61.0	141
EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	1 mg/kg	69.8	39.0	147
EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	1 mg/kg	14.2	4.10	154
EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	1 mg/kg	76.2	40.0	136
EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	1 mg/kg	107	59.0	133
EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	1 mg/kg	102	57.0	135
EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	1 mg/kg	64.9	39.0	133
EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	1 mg/kg	97.9	53.0	131
EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	1 mg/kg	102	53.0	133
EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	1 mg/kg	103	57.0	135
EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	1 mg/kg	72.2	45.0	131
EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	1 mg/kg	106	53.0	137
EP068: Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	1 mg/kg	75.7	53.0	133
EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	1 mg/kg	111	49.0	133
EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	1 mg/kg	52.3	39.0	137
EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	1 mg/kg	103	57.0	137
EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	1 mg/kg	101	53.0	135
EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	0.5 mg/kg	86.2	52.0	134
EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	1 mg/kg	46.0	20.4	154
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 5183490)								
EP074: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	95.5	75.0	111
EP074: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	94.9	78.0	110
EP074: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	93.5	76.0	110

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report		
					Spike	Spike Recovery (%)	Acceptable Limits (%)
				Result	Concentration	LCS	Low	High
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 5183490) - continued								
EP074: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	94.5	77.0	111
EP074: Styrene	100-42-5	0.5	mg/kg	<0.5	1 mg/kg	92.2	69.0	117
EP074: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	94.8	76.0	112
EP074: Isopropylbenzene	98-82-8	0.5	mg/kg	<0.5	1 mg/kg	92.3	76.0	112
EP074: n-Propylbenzene	103-65-1	0.5	mg/kg	<0.5	1 mg/kg	93.5	64.0	122
EP074: 1.3.5-Trimethylbenzene	108-67-8	0.5	mg/kg	<0.5	1 mg/kg	93.0	72.0	116
EP074: sec-Butylbenzene	135-98-8	0.5	mg/kg	<0.5	1 mg/kg	96.6	71.0	117
EP074: 1.2.4-Trimethylbenzene	95-63-6	0.5	mg/kg	<0.5	1 mg/kg	92.0	74.0	114
EP074: tert-Butylbenzene	98-06-6	0.5	mg/kg	<0.5	1 mg/kg	94.9	69.0	117
EP074: p-Isopropyltoluene	99-87-6	0.5	mg/kg	<0.5	1 mg/kg	95.1	71.0	117
EP074: n-Butylbenzene	104-51-8	0.5	mg/kg	<0.5	1 mg/kg	96.9	69.0	121
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 5183495)								
EP074: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	93.1	75.0	111
EP074: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	96.9	78.0	110
EP074: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	96.0	76.0	110
EP074: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	96.8	77.0	111
EP074: Styrene	100-42-5	0.5	mg/kg	<0.5	1 mg/kg	93.4	69.0	117
EP074: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	95.5	76.0	112
EP074: Isopropylbenzene	98-82-8	0.5	mg/kg	<0.5	1 mg/kg	95.4	76.0	112
EP074: n-Propylbenzene	103-65-1	0.5	mg/kg	<0.5	1 mg/kg	89.7	64.0	122
EP074: 1.3.5-Trimethylbenzene	108-67-8	0.5	mg/kg	<0.5	1 mg/kg	90.6	72.0	116
EP074: sec-Butylbenzene	135-98-8	0.5	mg/kg	<0.5	1 mg/kg	95.6	71.0	117
EP074: 1.2.4-Trimethylbenzene	95-63-6	0.5	mg/kg	<0.5	1 mg/kg	89.2	74.0	114
EP074: tert-Butylbenzene	98-06-6	0.5	mg/kg	<0.5	1 mg/kg	93.7	69.0	117
EP074: p-Isopropyltoluene	99-87-6	0.5	mg/kg	<0.5	1 mg/kg	93.2	71.0	117
EP074: n-Butylbenzene	104-51-8	0.5	mg/kg	<0.5	1 mg/kg	95.0	69.0	121
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 5184937)								
EP074: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	99.5	75.0	111
EP074: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	104	78.0	110
EP074: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	102	76.0	110
EP074: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	103	77.0	111
EP074: Styrene	100-42-5	0.5	mg/kg	<0.5	1 mg/kg	102	69.0	117

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 5184937) - continued								
EP074: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	103	76.0	112
EP074: Isopropylbenzene	98-82-8	0.5	mg/kg	<0.5	1 mg/kg	100	76.0	112
EP074: n-Propylbenzene	103-65-1	0.5	mg/kg	<0.5	1 mg/kg	102	64.0	122
EP074: 1.3.5-Trimethylbenzene	108-67-8	0.5	mg/kg	<0.5	1 mg/kg	97.9	72.0	116
EP074: sec-Butylbenzene	135-98-8	0.5	mg/kg	<0.5	1 mg/kg	100.0	71.0	117
EP074: 1.2.4-Trimethylbenzene	95-63-6	0.5	mg/kg	<0.5	1 mg/kg	99.6	74.0	114
EP074: tert-Butylbenzene	98-06-6	0.5	mg/kg	<0.5	1 mg/kg	101	69.0	117
EP074: p-Isopropyltoluene	99-87-6	0.5	mg/kg	<0.5	1 mg/kg	104	71.0	117
EP074: n-Butylbenzene	104-51-8	0.5	mg/kg	<0.5	1 mg/kg	98.3	69.0	121
EP074B: Oxygenated Compounds (QCLot: 5183490)								
EP074: Vinyl Acetate	108-05-4	5	mg/kg	<5	10 mg/kg	90.6	44.0	140
EP074: 2-Butanone (MEK)	78-93-3	5	mg/kg	<5	10 mg/kg	86.0	49.0	143
EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	5	mg/kg	<5	10 mg/kg	88.8	59.0	131
EP074: 2-Hexanone (MBK)	591-78-6	5	mg/kg	<5	10 mg/kg	92.5	51.0	145
EP074B: Oxygenated Compounds (QCLot: 5183495)								
EP074: Vinyl Acetate	108-05-4	5	mg/kg	<5	10 mg/kg	88.6	44.0	140
EP074: 2-Butanone (MEK)	78-93-3	5	mg/kg	<5	10 mg/kg	89.9	49.0	143
EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	5	mg/kg	<5	10 mg/kg	92.6	59.0	131
EP074: 2-Hexanone (MBK)	591-78-6	5	mg/kg	<5	10 mg/kg	101	51.0	145
EP074B: Oxygenated Compounds (QCLot: 5184937)								
EP074: Vinyl Acetate	108-05-4	5	mg/kg	<5	10 mg/kg	93.5	44.0	140
EP074: 2-Butanone (MEK)	78-93-3	5	mg/kg	<5	10 mg/kg	78.8	49.0	143
EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	5	mg/kg	<5	10 mg/kg	96.5	59.0	131
EP074: 2-Hexanone (MBK)	591-78-6	5	mg/kg	<5	10 mg/kg	93.5	51.0	145
EP074C: Sulfonated Compounds (QCLot: 5183490)								
EP074: Carbon disulfide	75-15-0	0.5	mg/kg	<0.5	1 mg/kg	91.1	47.0	135
EP074C: Sulfonated Compounds (QCLot: 5183495)								
EP074: Carbon disulfide	75-15-0	0.5	mg/kg	<0.5	1 mg/kg	88.1	47.0	135
EP074C: Sulfonated Compounds (QCLot: 5184937)								
EP074: Carbon disulfide	75-15-0	0.5	mg/kg	<0.5	1 mg/kg	100	47.0	135
EP074D: Fumigants (QCLot: 5183490)								
EP074: 2.2-Dichloropropane	594-20-7	0.5	mg/kg	<0.5	1 mg/kg	83.9	63.0	121
EP074: 1.2-Dichloropropane	78-87-5	0.5	mg/kg	<0.5	1 mg/kg	96.1	74.0	112
EP074: cis-1.3-Dichloropropylene	10061-01-5	0.5	mg/kg	<0.5	1 mg/kg	93.1	66.0	118

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP074D: Fumigants (QCLot: 5183490) - continued								
EP074: trans-1.3-Dichloropropylene	10061-02-6	0.5	mg/kg	<0.5	1 mg/kg	92.9	60.0	124
EP074: 1.2-Dibromoethane (EDB)	106-93-4	0.5	mg/kg	<0.5	1 mg/kg	99.6	71.0	119
EP074D: Fumigants (QCLot: 5183495)								
EP074: 2.2-Dichloropropane	594-20-7	0.5	mg/kg	<0.5	1 mg/kg	82.7	63.0	121
EP074: 1.2-Dichloropropane	78-87-5	0.5	mg/kg	<0.5	1 mg/kg	92.0	74.0	112
EP074: cis-1.3-Dichloropropylene	10061-01-5	0.5	mg/kg	<0.5	1 mg/kg	88.0	66.0	118
EP074: trans-1.3-Dichloropropylene	10061-02-6	0.5	mg/kg	<0.5	1 mg/kg	87.0	60.0	124
EP074: 1.2-Dibromoethane (EDB)	106-93-4	0.5	mg/kg	<0.5	1 mg/kg	103	71.0	119
EP074D: Fumigants (QCLot: 5184937)								
EP074: 2.2-Dichloropropane	594-20-7	0.5	mg/kg	<0.5	1 mg/kg	103	63.0	121
EP074: 1.2-Dichloropropane	78-87-5	0.5	mg/kg	<0.5	1 mg/kg	94.1	74.0	112
EP074: cis-1.3-Dichloropropylene	10061-01-5	0.5	mg/kg	<0.5	1 mg/kg	99.9	66.0	118
EP074: trans-1.3-Dichloropropylene	10061-02-6	0.5	mg/kg	<0.5	1 mg/kg	99.8	60.0	124
EP074: 1.2-Dibromoethane (EDB)	106-93-4	0.5	mg/kg	<0.5	1 mg/kg	104	71.0	119
EP074E: Halogenated Aliphatic Compounds (QCLot: 5183490)								
EP074: Dichlorodifluoromethane	75-71-8	5	mg/kg	<5	10 mg/kg	84.3	27.3	145
EP074: Chloromethane	74-87-3	5	mg/kg	<5	10 mg/kg	99.0	50.0	130
EP074: Vinyl chloride	75-01-4	5	mg/kg	<5	10 mg/kg	95.2	49.0	133
EP074: Bromomethane	74-83-9	5	mg/kg	<5	10 mg/kg	101	54.0	138
EP074: Chloroethane	75-00-3	5	mg/kg	<5	10 mg/kg	96.4	56.0	134
EP074: Trichlorofluoromethane	75-69-4	5	mg/kg	<5	10 mg/kg	90.6	60.0	124
EP074: 1.1-Dichloroethene	75-35-4	0.5	mg/kg	<0.5	1 mg/kg	89.9	65.0	117
EP074: Iodomethane	74-88-4	0.5	mg/kg	<0.5	1 mg/kg	97.3	50.0	140
EP074: trans-1.2-Dichloroethene	156-60-5	0.5	mg/kg	<0.5	1 mg/kg	92.4	68.0	116
EP074: 1.1-Dichloroethane	75-34-3	0.5	mg/kg	<0.5	1 mg/kg	92.1	72.0	112
EP074: cis-1.2-Dichloroethene	156-59-2	0.5	mg/kg	<0.5	1 mg/kg	91.5	72.0	112
EP074: 1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	<0.5	1 mg/kg	88.2	68.0	118
EP074: 1.1-Dichloropropylene	563-58-6	0.5	mg/kg	<0.5	1 mg/kg	93.0	69.0	117
EP074: Carbon Tetrachloride	56-23-5	0.5	mg/kg	<0.5	1 mg/kg	86.0	64.0	120
EP074: 1.2-Dichloroethane	107-06-2	0.5	mg/kg	<0.5	1 mg/kg	80.9	70.0	120
EP074: Trichloroethene	79-01-6	0.5	mg/kg	<0.5	1 mg/kg	96.2	76.0	110
EP074: Dibromomethane	74-95-3	0.5	mg/kg	<0.5	1 mg/kg	87.4	71.0	115
EP074: 1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	<0.5	1 mg/kg	96.5	73.0	117
EP074: 1.3-Dichloropropane	142-28-9	0.5	mg/kg	<0.5	1 mg/kg	90.0	71.0	119

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP074E: Halogenated Aliphatic Compounds (QCLot: 5183490) - continued								
EP074: Tetrachloroethene	127-18-4	0.5	mg/kg	<0.5	1 mg/kg	78.7	66.0	124
EP074: 1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	<0.5	1 mg/kg	93.0	70.0	130
EP074: trans-1.4-Dichloro-2-butene	110-57-6	0.5	mg/kg	<0.5	1 mg/kg	81.8	62.0	126
EP074: cis-1.4-Dichloro-2-butene	1476-11-5	0.5	mg/kg	<0.5	1 mg/kg	90.7	59.0	131
EP074: 1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	<0.5	1 mg/kg	94.0	46.0	138
EP074: 1.2.3-Trichloropropane	96-18-4	0.5	mg/kg	<0.5	1 mg/kg	95.0	70.0	122
EP074: Pentachloroethane	76-01-7	0.5	mg/kg	<0.5	1 mg/kg	96.9	38.0	146
EP074: 1.2-Dibromo-3-chloropropane	96-12-8	0.5	mg/kg	<0.5	1 mg/kg	90.2	58.0	132
EP074E: Halogenated Aliphatic Compounds (QCLot: 5183495)								
EP074: Dichlorodifluoromethane	75-71-8	5	mg/kg	<5	10 mg/kg	81.6	27.3	145
EP074: Chloromethane	74-87-3	5	mg/kg	<5	10 mg/kg	97.3	50.0	130
EP074: Vinyl chloride	75-01-4	5	mg/kg	<5	10 mg/kg	93.9	49.0	133
EP074: Bromomethane	74-83-9	5	mg/kg	<5	10 mg/kg	98.9	54.0	138
EP074: Chloroethane	75-00-3	5	mg/kg	<5	10 mg/kg	96.8	56.0	134
EP074: Trichlorofluoromethane	75-69-4	5	mg/kg	<5	10 mg/kg	94.0	60.0	124
EP074: 1.1-Dichloroethene	75-35-4	0.5	mg/kg	<0.5	1 mg/kg	92.0	65.0	117
EP074: Iodomethane	74-88-4	0.5	mg/kg	<0.5	1 mg/kg	98.8	50.0	140
EP074: trans-1.2-Dichloroethene	156-60-5	0.5	mg/kg	<0.5	1 mg/kg	92.0	68.0	116
EP074: 1.1-Dichloroethane	75-34-3	0.5	mg/kg	<0.5	1 mg/kg	91.7	72.0	112
EP074: cis-1.2-Dichloroethene	156-59-2	0.5	mg/kg	<0.5	1 mg/kg	91.6	72.0	112
EP074: 1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	<0.5	1 mg/kg	89.5	68.0	118
EP074: 1.1-Dichloropropylene	563-58-6	0.5	mg/kg	<0.5	1 mg/kg	91.5	69.0	117
EP074: Carbon Tetrachloride	56-23-5	0.5	mg/kg	<0.5	1 mg/kg	85.7	64.0	120
EP074: 1.2-Dichloroethane	107-06-2	0.5	mg/kg	<0.5	1 mg/kg	80.4	70.0	120
EP074: Trichloroethene	79-01-6	0.5	mg/kg	<0.5	1 mg/kg	93.7	76.0	110
EP074: Dibromomethane	74-95-3	0.5	mg/kg	<0.5	1 mg/kg	84.9	71.0	115
EP074: 1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	<0.5	1 mg/kg	97.2	73.0	117
EP074: 1.3-Dichloropropane	142-28-9	0.5	mg/kg	<0.5	1 mg/kg	89.3	71.0	119
EP074: Tetrachloroethene	127-18-4	0.5	mg/kg	<0.5	1 mg/kg	82.8	66.0	124
EP074: 1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	<0.5	1 mg/kg	85.4	70.0	130
EP074: trans-1.4-Dichloro-2-butene	110-57-6	0.5	mg/kg	<0.5	1 mg/kg	85.3	62.0	126
EP074: cis-1.4-Dichloro-2-butene	1476-11-5	0.5	mg/kg	<0.5	1 mg/kg	90.9	59.0	131
EP074: 1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	<0.5	1 mg/kg	98.0	46.0	138
EP074: 1.2.3-Trichloropropane	96-18-4	0.5	mg/kg	<0.5	1 mg/kg	98.5	70.0	122

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP074E: Halogenated Aliphatic Compounds (QCLot: 5183495) - continued								
EP074: Pentachloroethane	76-01-7	0.5	mg/kg	<0.5	1 mg/kg	88.1	38.0	146
EP074: 1.2-Dibromo-3-chloropropane	96-12-8	0.5	mg/kg	<0.5	1 mg/kg	88.6	58.0	132
EP074E: Halogenated Aliphatic Compounds (QCLot: 5184937)								
EP074: Dichlorodifluoromethane	75-71-8	5	mg/kg	<5	10 mg/kg	109	27.3	145
EP074: Chloromethane	74-87-3	5	mg/kg	<5	10 mg/kg	106	50.0	130
EP074: Vinyl chloride	75-01-4	5	mg/kg	<5	10 mg/kg	112	49.0	133
EP074: Bromomethane	74-83-9	5	mg/kg	<5	10 mg/kg	102	54.0	138
EP074: Chloroethane	75-00-3	5	mg/kg	<5	10 mg/kg	99.9	56.0	134
EP074: Trichlorofluoromethane	75-69-4	5	mg/kg	<5	10 mg/kg	102	60.0	124
EP074: 1.1-Dichloroethene	75-35-4	0.5	mg/kg	<0.5	1 mg/kg	101	65.0	117
EP074: Iodomethane	74-88-4	0.5	mg/kg	<0.5	1 mg/kg	104	50.0	140
EP074: trans-1.2-Dichloroethene	156-60-5	0.5	mg/kg	<0.5	1 mg/kg	97.1	68.0	116
EP074: 1.1-Dichloroethane	75-34-3	0.5	mg/kg	<0.5	1 mg/kg	95.4	72.0	112
EP074: cis-1.2-Dichloroethene	156-59-2	0.5	mg/kg	<0.5	1 mg/kg	92.4	72.0	112
EP074: 1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	<0.5	1 mg/kg	96.5	68.0	118
EP074: 1.1-Dichloropropylene	563-58-6	0.5	mg/kg	<0.5	1 mg/kg	99.1	69.0	117
EP074: Carbon Tetrachloride	56-23-5	0.5	mg/kg	<0.5	1 mg/kg	97.7	64.0	120
EP074: 1.2-Dichloroethane	107-06-2	0.5	mg/kg	<0.5	1 mg/kg	92.5	70.0	120
EP074: Trichloroethene	79-01-6	0.5	mg/kg	<0.5	1 mg/kg	99.9	76.0	110
EP074: Dibromomethane	74-95-3	0.5	mg/kg	<0.5	1 mg/kg	83.0	71.0	115
EP074: 1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	<0.5	1 mg/kg	99.5	73.0	117
EP074: 1.3-Dichloropropane	142-28-9	0.5	mg/kg	<0.5	1 mg/kg	98.6	71.0	119
EP074: Tetrachloroethene	127-18-4	0.5	mg/kg	<0.5	1 mg/kg	124	66.0	124
EP074: 1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	<0.5	1 mg/kg	101	70.0	130
EP074: trans-1.4-Dichloro-2-butene	110-57-6	0.5	mg/kg	<0.5	1 mg/kg	100	62.0	126
EP074: cis-1.4-Dichloro-2-butene	1476-11-5	0.5	mg/kg	<0.5	1 mg/kg	96.1	59.0	131
EP074: 1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	<0.5	1 mg/kg	97.1	46.0	138
EP074: 1.2.3-Trichloropropane	96-18-4	0.5	mg/kg	<0.5	1 mg/kg	95.1	70.0	122
EP074: Pentachloroethane	76-01-7	0.5	mg/kg	<0.5	1 mg/kg	99.2	38.0	146
EP074: 1.2-Dibromo-3-chloropropane	96-12-8	0.5	mg/kg	<0.5	1 mg/kg	93.8	58.0	132
EP074F: Halogenated Aromatic Compounds (QCLot: 5183490)								
EP074: Chlorobenzene	108-90-7	0.5	mg/kg	<0.5	1 mg/kg	96.5	77.0	111
EP074: Bromobenzene	108-86-1	0.5	mg/kg	<0.5	1 mg/kg	95.8	76.0	112
EP074: 2-Chlorotoluene	95-49-8	0.5	mg/kg	<0.5	1 mg/kg	103	61.0	127

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report		
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP074F: Halogenated Aromatic Compounds (QCLot: 5183490) - continued								
EP074: 4-Chlorotoluene	106-43-4	0.5	mg/kg	<0.5	1 mg/kg	100	67.0	121
EP074: 1.2.3-Trichlorobenzene	87-61-6	0.5	mg/kg	<0.5	1 mg/kg	101	71.0	123
EP074F: Halogenated Aromatic Compounds (QCLot: 5183495)								
EP074: Chlorobenzene	108-90-7	0.5	mg/kg	<0.5	1 mg/kg	97.1	77.0	111
EP074: Bromobenzene	108-86-1	0.5	mg/kg	<0.5	1 mg/kg	95.8	76.0	112
EP074: 2-Chlorotoluene	95-49-8	0.5	mg/kg	<0.5	1 mg/kg	95.5	61.0	127
EP074: 4-Chlorotoluene	106-43-4	0.5	mg/kg	<0.5	1 mg/kg	93.9	67.0	121
EP074: 1.2.3-Trichlorobenzene	87-61-6	0.5	mg/kg	<0.5	1 mg/kg	96.6	71.0	123
EP074F: Halogenated Aromatic Compounds (QCLot: 5184937)								
EP074: Chlorobenzene	108-90-7	0.5	mg/kg	<0.5	1 mg/kg	102	77.0	111
EP074: Bromobenzene	108-86-1	0.5	mg/kg	<0.5	1 mg/kg	96.8	76.0	112
EP074: 2-Chlorotoluene	95-49-8	0.5	mg/kg	<0.5	1 mg/kg	99.6	61.0	127
EP074: 4-Chlorotoluene	106-43-4	0.5	mg/kg	<0.5	1 mg/kg	99.8	67.0	121
EP074: 1.2.3-Trichlorobenzene	87-61-6	0.5	mg/kg	<0.5	1 mg/kg	92.7	71.0	123
EP074G: Trihalomethanes (QCLot: 5183490)								
EP074: Chloroform	67-66-3	0.5	mg/kg	<0.5	1 mg/kg	91.1	73.0	111
EP074: Bromodichloromethane	75-27-4	0.5	mg/kg	<0.5	1 mg/kg	88.3	66.0	118
EP074: Dibromochloromethane	124-48-1	0.5	mg/kg	<0.5	1 mg/kg	94.2	65.0	121
EP074: Bromoform	75-25-2	0.5	mg/kg	<0.5	1 mg/kg	91.5	62.0	124
EP074G: Trihalomethanes (QCLot: 5183495)								
EP074: Chloroform	67-66-3	0.5	mg/kg	<0.5	1 mg/kg	90.9	73.0	111
EP074: Bromodichloromethane	75-27-4	0.5	mg/kg	<0.5	1 mg/kg	84.0	66.0	118
EP074: Dibromochloromethane	124-48-1	0.5	mg/kg	<0.5	1 mg/kg	90.7	65.0	121
EP074: Bromoform	75-25-2	0.5	mg/kg	<0.5	1 mg/kg	87.5	62.0	124
EP074G: Trihalomethanes (QCLot: 5184937)								
EP074: Chloroform	67-66-3	0.5	mg/kg	<0.5	1 mg/kg	97.2	73.0	111
EP074: Bromodichloromethane	75-27-4	0.5	mg/kg	<0.5	1 mg/kg	96.4	66.0	118
EP074: Dibromochloromethane	124-48-1	0.5	mg/kg	<0.5	1 mg/kg	100	65.0	121
EP074: Bromoform	75-25-2	0.5	mg/kg	<0.5	1 mg/kg	101	62.0	124
EP075(SIM)A: Phenolic Compounds (QCLot: 5183508)								
EP075(SIM): Phenol	108-95-2	0.5	mg/kg	<0.5	3 mg/kg	76.9	61.0	125
EP075(SIM): 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	3 mg/kg	80.2	66.0	124
EP075(SIM): 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	3 mg/kg	85.5	62.0	126
EP075(SIM): 3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	6 mg/kg	88.8	63.0	129

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report		
					Spike	Spike Recovery (%)	Acceptable Limits (%)
				Result	Concentration	LCS	Low	High
EP075(SIM)A: Phenolic Compounds (QCLot: 5183508) - continued								
EP075(SIM): 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	3 mg/kg	61.9	61.0	131
EP075(SIM): 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	3 mg/kg	87.8	60.0	132
EP075(SIM): 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	3 mg/kg	81.7	63.0	131
EP075(SIM): 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	3 mg/kg	96.2	67.0	123
EP075(SIM): 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	3 mg/kg	81.4	65.0	125
EP075(SIM): 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	3 mg/kg	74.5	52.0	132
EP075(SIM): 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	3 mg/kg	74.0	64.0	130
EP075(SIM): Pentachlorophenol	87-86-5	2	mg/kg	<2	3 mg/kg	35.1	34.0	138
EP075(SIM)A: Phenolic Compounds (QCLot: 5183516)								
EP075(SIM): Phenol	108-95-2	0.5	mg/kg	<0.5	3 mg/kg	124	61.0	125
EP075(SIM): 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	3 mg/kg	110	66.0	124
EP075(SIM): 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	3 mg/kg	100	62.0	126
EP075(SIM): 3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	6 mg/kg	102	63.0	129
EP075(SIM): 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	3 mg/kg	106	61.0	131
EP075(SIM): 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	3 mg/kg	104	60.0	132
EP075(SIM): 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	3 mg/kg	91.1	63.0	131
EP075(SIM): 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	3 mg/kg	106	67.0	123
EP075(SIM): 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	3 mg/kg	116	65.0	125
EP075(SIM): 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	3 mg/kg	89.3	52.0	132
EP075(SIM): 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	3 mg/kg	89.7	64.0	130
EP075(SIM): Pentachlorophenol	87-86-5	2	mg/kg	<2	3 mg/kg	41.3	34.0	138
EP075(SIM)A: Phenolic Compounds (QCLot: 5184941)								
EP075(SIM): Phenol	108-95-2	0.5	mg/kg	<0.5	3 mg/kg	100	61.0	125
EP075(SIM): 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	3 mg/kg	104	66.0	124
EP075(SIM): 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	3 mg/kg	106	62.0	126
EP075(SIM): 3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	6 mg/kg	102	63.0	129
EP075(SIM): 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	3 mg/kg	104	61.0	131
EP075(SIM): 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	3 mg/kg	94.4	60.0	132
EP075(SIM): 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	3 mg/kg	98.6	63.0	131
EP075(SIM): 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	3 mg/kg	118	67.0	123
EP075(SIM): 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	3 mg/kg	104	65.0	125
EP075(SIM): 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	3 mg/kg	113	52.0	132
EP075(SIM): 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	3 mg/kg	93.5	64.0	130
EP075(SIM): Pentachlorophenol	87-86-5	2	mg/kg	<2	3 mg/kg	88.6	34.0	138

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 5183508)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	3 mg/kg	90.0	71.0	123
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	3 mg/kg	91.6	69.0	129
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	3 mg/kg	109	65.0	125
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	3 mg/kg	112	71.0	125
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	3 mg/kg	98.3	66.0	124
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	3 mg/kg	96.4	60.0	112
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	3 mg/kg	105	67.0	127
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	3 mg/kg	102	65.0	127
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	3 mg/kg	83.1	57.0	125
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	3 mg/kg	95.4	57.0	131
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	3 mg/kg	87.9	65.0	125
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	3 mg/kg	106	69.0	127
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	3 mg/kg	82.4	63.0	121
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	3 mg/kg	90.9	61.0	121
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	3 mg/kg	95.8	52.0	128
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	3 mg/kg	96.1	65.0	125
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 5183516)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	3 mg/kg	90.2	71.0	123
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	3 mg/kg	113	69.0	129
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	3 mg/kg	111	65.0	125
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	3 mg/kg	118	71.0	125
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	3 mg/kg	106	66.0	124
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	3 mg/kg	111	60.0	112
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	3 mg/kg	105	67.0	127
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	3 mg/kg	89.5	65.0	127
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	3 mg/kg	109	57.0	125
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	3 mg/kg	96.9	57.0	131
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	3 mg/kg	106	65.0	125
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	3 mg/kg	101	69.0	127
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	3 mg/kg	115	63.0	121
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	3 mg/kg	116	61.0	121
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	3 mg/kg	85.0	52.0	128
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	3 mg/kg	99.1	65.0	125

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 5184941)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	3 mg/kg	116	71.0	123
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	3 mg/kg	125	69.0	129
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	3 mg/kg	111	65.0	125
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	3 mg/kg	106	71.0	125
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	3 mg/kg	111	66.0	124
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	3 mg/kg	108	60.0	112
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	3 mg/kg	111	67.0	127
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	3 mg/kg	108	65.0	127
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	3 mg/kg	120	57.0	125
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	3 mg/kg	110	57.0	131
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	3 mg/kg	106	65.0	125
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	3 mg/kg	108	69.0	127
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	3 mg/kg	114	63.0	121
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	3 mg/kg	70.8	61.0	121
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	3 mg/kg	66.5	52.0	128
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	3 mg/kg	74.1	65.0	125
EP075A: Phenolic Compounds (QCLot: 5183510)								
EP075: Phenol	108-95-2	0.5	mg/kg	<0.5	1.5 mg/kg	90.3	59.0	135
EP075: 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	1.5 mg/kg	90.4	64.0	130
EP075: 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	1.5 mg/kg	81.9	53.0	137
EP075: 3- & 4-Methylphenol	1319-77-3	0.5	mg/kg	<0.5	1.5 mg/kg	82.4	62.0	134
EP075: 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	1.5 mg/kg	72.9	54.0	136
EP075: 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	1.5 mg/kg	77.8	48.0	136
EP075: 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	1.5 mg/kg	76.3	55.0	127
EP075: 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	1.5 mg/kg	91.5	56.0	114
EP075: 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	1.5 mg/kg	81.4	32.0	128
EP075: 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	1.5 mg/kg	72.5	49.0	113
EP075: 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	1.5 mg/kg	80.0	50.0	150
EP075: Pentachlorophenol	87-86-5	1	mg/kg	<1	1.5 mg/kg	36.8	23.0	117
EP075A: Phenolic Compounds (QCLot: 5183517)								
EP075: Phenol	108-95-2	0.5	mg/kg	<0.5	1.5 mg/kg	84.4	59.0	135
EP075: 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	1.5 mg/kg	82.9	64.0	130
EP075: 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	1.5 mg/kg	75.9	53.0	137

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report		
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075A: Phenolic Compounds (QCLot: 5183517) - continued								
EP075: 3- & 4-Methylphenol	1319-77-3	0.5	mg/kg	<0.5	1.5 mg/kg	76.4	62.0	134
EP075: 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	1.5 mg/kg	65.0	54.0	136
EP075: 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	1.5 mg/kg	71.9	48.0	136
EP075: 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	1.5 mg/kg	71.0	55.0	127
EP075: 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	1.5 mg/kg	83.1	56.0	114
EP075: 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	1.5 mg/kg	75.7	32.0	128
EP075: 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	1.5 mg/kg	64.7	49.0	113
EP075: 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	1.5 mg/kg	75.9	50.0	150
EP075: Pentachlorophenol	87-86-5	1	mg/kg	<1	1.5 mg/kg	27.9	23.0	117
EP075A: Phenolic Compounds (QCLot: 5184945)								
EP075: Phenol	108-95-2	0.5	mg/kg	<0.5	1.5 mg/kg	106	59.0	135
EP075: 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	1.5 mg/kg	104	64.0	130
EP075: 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	1.5 mg/kg	95.8	53.0	137
EP075: 3- & 4-Methylphenol	1319-77-3	0.5	mg/kg	<0.5	1.5 mg/kg	93.8	62.0	134
EP075: 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	1.5 mg/kg	82.4	54.0	136
EP075: 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	1.5 mg/kg	94.7	48.0	136
EP075: 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	1.5 mg/kg	89.4	55.0	127
EP075: 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	1.5 mg/kg	98.0	56.0	114
EP075: 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	1.5 mg/kg	90.4	32.0	128
EP075: 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	1.5 mg/kg	83.0	49.0	113
EP075: 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	1.5 mg/kg	94.9	50.0	150
EP075: Pentachlorophenol	87-86-5	1	mg/kg	<1	1.5 mg/kg	64.4	23.0	117
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 5183510)								
EP075: Naphthalene	91-20-3	0.5	mg/kg	<0.5	1.5 mg/kg	101	68.0	118
EP075: 2-Methylnaphthalene	91-57-6	0.5	mg/kg	<0.5	1.5 mg/kg	99.8	68.0	122
EP075: 2-Chloronaphthalene	91-58-7	0.5	mg/kg	<0.5	1.5 mg/kg	102	58.0	124
EP075: Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	1.5 mg/kg	94.0	64.0	122
EP075: Acenaphthene	83-32-9	0.5	mg/kg	<0.5	1.5 mg/kg	95.0	68.0	118
EP075: Fluorene	86-73-7	0.5	mg/kg	<0.5	1.5 mg/kg	92.8	67.0	119
EP075: Phenanthrene	85-01-8	0.5	mg/kg	<0.5	1.5 mg/kg	92.6	64.0	120
EP075: Anthracene	120-12-7	0.5	mg/kg	<0.5	1.5 mg/kg	89.6	65.0	119
EP075: Fluoranthene	206-44-0	0.5	mg/kg	<0.5	1.5 mg/kg	84.5	59.0	123
EP075: Pyrene	129-00-0	0.5	mg/kg	<0.5	1.5 mg/kg	88.2	62.0	124
EP075: N-2-Fluorenyl Acetamide	53-96-3	0.5	mg/kg	<0.5	1.5 mg/kg	62.2	33.0	123

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report		
					Spike	Spike Recovery (%)	Acceptable Limits (%)
				Result	Concentration	LCS	Low	High
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 5183510) - continued								
EP075: Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	1.5 mg/kg	87.2	49.0	129
EP075: Chrysene	218-01-9	0.5	mg/kg	<0.5	1.5 mg/kg	104	57.0	131
EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	<1	3 mg/kg	91.5	52.0	126
EP075: 7.12-Dimethylbenz(a)anthracene	57-97-6	0.5	mg/kg	<0.5	1.5 mg/kg	110	42.0	134
EP075: Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	1.5 mg/kg	82.0	51.0	123
EP075: 3-Methylcholanthrene	56-49-5	0.5	mg/kg	<0.5	1.5 mg/kg	82.2	46.0	122
EP075: Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	1.5 mg/kg	79.7	51.0	123
EP075: Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	1.5 mg/kg	78.1	49.0	121
EP075: Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	1.5 mg/kg	95.3	51.0	127
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 5183517)								
EP075: Naphthalene	91-20-3	0.5	mg/kg	<0.5	1.5 mg/kg	90.9	68.0	118
EP075: 2-Methylnaphthalene	91-57-6	0.5	mg/kg	<0.5	1.5 mg/kg	92.5	68.0	122
EP075: 2-Chloronaphthalene	91-58-7	0.5	mg/kg	<0.5	1.5 mg/kg	94.0	58.0	124
EP075: Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	1.5 mg/kg	86.6	64.0	122
EP075: Acenaphthene	83-32-9	0.5	mg/kg	<0.5	1.5 mg/kg	85.6	68.0	118
EP075: Fluorene	86-73-7	0.5	mg/kg	<0.5	1.5 mg/kg	81.3	67.0	119
EP075: Phenanthrene	85-01-8	0.5	mg/kg	<0.5	1.5 mg/kg	82.7	64.0	120
EP075: Anthracene	120-12-7	0.5	mg/kg	<0.5	1.5 mg/kg	87.1	65.0	119
EP075: Fluoranthene	206-44-0	0.5	mg/kg	<0.5	1.5 mg/kg	76.8	59.0	123
EP075: Pyrene	129-00-0	0.5	mg/kg	<0.5	1.5 mg/kg	78.3	62.0	124
EP075: N-2-Fluorenyl Acetamide	53-96-3	0.5	mg/kg	<0.5	1.5 mg/kg	51.6	33.0	123
EP075: Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	1.5 mg/kg	75.4	49.0	129
EP075: Chrysene	218-01-9	0.5	mg/kg	<0.5	1.5 mg/kg	89.0	57.0	131
EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	<1	3 mg/kg	87.2	52.0	126
EP075: 7.12-Dimethylbenz(a)anthracene	57-97-6	0.5	mg/kg	<0.5	1.5 mg/kg	104	42.0	134
EP075: Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	1.5 mg/kg	85.6	51.0	123
EP075: 3-Methylcholanthrene	56-49-5	0.5	mg/kg	<0.5	1.5 mg/kg	74.6	46.0	122
EP075: Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	1.5 mg/kg	73.2	51.0	123
EP075: Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	1.5 mg/kg	71.6	49.0	121
EP075: Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	1.5 mg/kg	89.3	51.0	127
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 5184945)								
EP075: Naphthalene	91-20-3	0.5	mg/kg	<0.5	1.5 mg/kg	108	68.0	118
EP075: 2-Methylnaphthalene	91-57-6	0.5	mg/kg	<0.5	1.5 mg/kg	103	68.0	122

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 5184945) - continued								
EP075: 2-Chloronaphthalene	91-58-7	0.5	mg/kg	<0.5	1.5 mg/kg	99.8	58.0	124
EP075: Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	1.5 mg/kg	96.6	64.0	122
EP075: Acenaphthene	83-32-9	0.5	mg/kg	<0.5	1.5 mg/kg	109	68.0	118
EP075: Fluorene	86-73-7	0.5	mg/kg	<0.5	1.5 mg/kg	104	67.0	119
EP075: Phenanthrene	85-01-8	0.5	mg/kg	<0.5	1.5 mg/kg	102	64.0	120
EP075: Anthracene	120-12-7	0.5	mg/kg	<0.5	1.5 mg/kg	101	65.0	119
EP075: Fluoranthene	206-44-0	0.5	mg/kg	<0.5	1.5 mg/kg	90.5	59.0	123
EP075: Pyrene	129-00-0	0.5	mg/kg	<0.5	1.5 mg/kg	91.8	62.0	124
EP075: N-2-Fluorenyl Acetamide	53-96-3	0.5	mg/kg	<0.5	1.5 mg/kg	60.9	33.0	123
EP075: Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	1.5 mg/kg	87.5	49.0	129
EP075: Chrysene	218-01-9	0.5	mg/kg	<0.5	1.5 mg/kg	99.4	57.0	131
EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	<1	3 mg/kg	99.5	52.0	126
EP075: 7.12-Dimethylbenz(a)anthracene	57-97-6	0.5	mg/kg	<0.5	1.5 mg/kg	128	42.0	134
EP075: Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	1.5 mg/kg	87.7	51.0	123
EP075: 3-Methylcholanthrene	56-49-5	0.5	mg/kg	<0.5	1.5 mg/kg	84.9	46.0	122
EP075: Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	1.5 mg/kg	82.8	51.0	123
EP075: Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	1.5 mg/kg	89.9	49.0	121
EP075: Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	1.5 mg/kg	94.3	51.0	127
EP075C: Phthalate Esters (QCLot: 5183510)								
EP075: Dimethyl phthalate	131-11-3	0.5	mg/kg	<0.5	1.5 mg/kg	97.0	60.0	126
EP075: Diethyl phthalate	84-66-2	0.5	mg/kg	<0.5	1.5 mg/kg	85.0	65.0	119
EP075: Di-n-butyl phthalate	84-74-2	0.5	mg/kg	<0.5	1.5 mg/kg	73.4	64.0	124
EP075: Butyl benzyl phthalate	85-68-7	0.5	mg/kg	<0.5	1.5 mg/kg	66.7	61.0	123
EP075: bis(2-ethylhexyl) phthalate	117-81-7	----	mg/kg	----	1.5 mg/kg	66.1	63.0	119
EP075: Di-n-octylphthalate	117-84-0	0.5	mg/kg	<0.5	1.5 mg/kg	56.2	54.0	130
EP075C: Phthalate Esters (QCLot: 5183517)								
EP075: Dimethyl phthalate	131-11-3	0.5	mg/kg	<0.5	1.5 mg/kg	86.8	60.0	126
EP075: Diethyl phthalate	84-66-2	0.5	mg/kg	<0.5	1.5 mg/kg	78.6	65.0	119
EP075: Di-n-butyl phthalate	84-74-2	0.5	mg/kg	<0.5	1.5 mg/kg	68.1	64.0	124
EP075: Butyl benzyl phthalate	85-68-7	0.5	mg/kg	<0.5	1.5 mg/kg	62.0	61.0	123
EP075: bis(2-ethylhexyl) phthalate	117-81-7	----	mg/kg	----	1.5 mg/kg	70.0	63.0	119
EP075: Di-n-octylphthalate	117-84-0	0.5	mg/kg	<0.5	1.5 mg/kg	55.2	54.0	130
EP075C: Phthalate Esters (QCLot: 5184945)								

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report		
					Spike	Spike Recovery (%)	Acceptable Limits (%)
				Result	Concentration	LCS	Low	High
EP075C: Phthalate Esters (QCLot: 5184945) - continued								
EP075: Dimethyl phthalate	131-11-3	0.5	mg/kg	<0.5	1.5 mg/kg	98.3	60.0	126
EP075: Diethyl phthalate	84-66-2	0.5	mg/kg	<0.5	1.5 mg/kg	96.6	65.0	119
EP075: Di-n-butyl phthalate	84-74-2	0.5	mg/kg	<0.5	1.5 mg/kg	77.4	64.0	124
EP075: Butyl benzyl phthalate	85-68-7	0.5	mg/kg	<0.5	1.5 mg/kg	69.6	61.0	123
EP075: bis(2-ethylhexyl) phthalate	117-81-7	----	mg/kg	----	1.5 mg/kg	82.9	63.0	119
EP075: Di-n-octylphthalate	117-84-0	0.5	mg/kg	<0.5	1.5 mg/kg	64.0	54.0	130
EP075D: Nitrosamines (QCLot: 5183510)								
EP075: N-Nitrosomethylethylamine	10595-95-6	0.5	mg/kg	<0.5	1.5 mg/kg	79.8	45.0	137
EP075: N-Nitrosodiethylamine	55-18-5	0.5	mg/kg	<0.5	1.5 mg/kg	78.4	53.0	129
EP075: N-Nitrosopyrrolidine	930-55-2	0.5	mg/kg	<0.5	1.5 mg/kg	71.3	49.0	141
EP075: N-Nitrosomorpholine	59-89-2	0.5	mg/kg	<0.5	1.5 mg/kg	83.5	49.0	143
EP075: N-Nitrosodi-n-propylamine	621-64-7	0.5	mg/kg	<0.5	1.5 mg/kg	81.8	48.0	146
EP075: N-Nitrosopiperidine	100-75-4	0.5	mg/kg	<0.5	1.5 mg/kg	81.4	54.0	138
EP075: N-Nitrosodibutylamine	924-16-3	0.5	mg/kg	<0.5	1.5 mg/kg	81.8	63.0	117
EP075: N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	0.5	mg/kg	<0.5	1.5 mg/kg	85.9	61.0	115
EP075: Methapyrilene	91-80-5	0.5	mg/kg	<0.5	1.5 mg/kg	144	4.00	190
EP075D: Nitrosamines (QCLot: 5183517)								
EP075: N-Nitrosomethylethylamine	10595-95-6	0.5	mg/kg	<0.5	1.5 mg/kg	68.0	45.0	137
EP075: N-Nitrosodiethylamine	55-18-5	0.5	mg/kg	<0.5	1.5 mg/kg	77.0	53.0	129
EP075: N-Nitrosopyrrolidine	930-55-2	0.5	mg/kg	<0.5	1.5 mg/kg	75.1	49.0	141
EP075: N-Nitrosomorpholine	59-89-2	0.5	mg/kg	<0.5	1.5 mg/kg	80.1	49.0	143
EP075: N-Nitrosodi-n-propylamine	621-64-7	0.5	mg/kg	<0.5	1.5 mg/kg	77.5	48.0	146
EP075: N-Nitrosopiperidine	100-75-4	0.5	mg/kg	<0.5	1.5 mg/kg	78.2	54.0	138
EP075: N-Nitrosodibutylamine	924-16-3	0.5	mg/kg	<0.5	1.5 mg/kg	80.3	63.0	117
EP075: N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	0.5	mg/kg	<0.5	1.5 mg/kg	78.5	61.0	115
EP075: Methapyrilene	91-80-5	0.5	mg/kg	<0.5	1.5 mg/kg	133	4.00	190
EP075D: Nitrosamines (QCLot: 5184945)								
EP075: N-Nitrosomethylethylamine	10595-95-6	0.5	mg/kg	<0.5	1.5 mg/kg	87.5	45.0	137
EP075: N-Nitrosodiethylamine	55-18-5	0.5	mg/kg	<0.5	1.5 mg/kg	91.5	53.0	129
EP075: N-Nitrosopyrrolidine	930-55-2	0.5	mg/kg	<0.5	1.5 mg/kg	87.3	49.0	141
EP075: N-Nitrosomorpholine	59-89-2	0.5	mg/kg	<0.5	1.5 mg/kg	102	49.0	143
EP075: N-Nitrosodi-n-propylamine	621-64-7	0.5	mg/kg	<0.5	1.5 mg/kg	94.0	48.0	146
EP075: N-Nitrosopiperidine	100-75-4	0.5	mg/kg	<0.5	1.5 mg/kg	96.3	54.0	138

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report		
				Result	Spike Concentration	Spike Recovery (%)	Acceptable Limits (%)
						LCS	Low	High
EP075D: Nitrosamines (QCLot: 5184945) - continued								
EP075: N-Nitrosodibutylamine	924-16-3	0.5	mg/kg	<0.5	1.5 mg/kg	89.7	63.0	117
EP075: N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	0.5	mg/kg	<0.5	1.5 mg/kg	102	61.0	115
EP075: Methapyrilene	91-80-5	0.5	mg/kg	<0.5	1.5 mg/kg	111	4.00	190
EP075E: Nitroaromatics and Ketones (QCLot: 5183510)								
EP075: 2-Picoline	109-06-8	0.5	mg/kg	<0.5	1.5 mg/kg	90.9	16.8	137
EP075: Acetophenone	98-86-2	0.5	mg/kg	<0.5	1.5 mg/kg	86.2	60.0	136
EP075: Nitrobenzene	98-95-3	0.5	mg/kg	<0.5	1.5 mg/kg	89.1	66.0	138
EP075: Isophorone	78-59-1	0.5	mg/kg	<0.5	1.5 mg/kg	82.5	60.0	138
EP075: 2.6-Dinitrotoluene	606-20-2	0.5	mg/kg	<0.5	1.5 mg/kg	82.0	56.0	122
EP075: 2.4-Dinitrotoluene	121-14-2	0.5	mg/kg	<0.5	1.5 mg/kg	64.3	57.0	105
EP075: 1-Naphthylamine	134-32-7	0.5	mg/kg	<0.5	1.5 mg/kg	67.2	5.90	80.0
EP075: 4-Nitroquinoline-N-oxide	56-57-5	0.5	mg/kg	<0.5	1.5 mg/kg	85.4	21.1	161
EP075: 5-Nitro-o-toluidine	99-55-8	0.5	mg/kg	<0.5	1.5 mg/kg	72.5	20.1	106
EP075: Azobenzene	103-33-3	1	mg/kg	<1	1.5 mg/kg	82.2	63.0	119
EP075: 1.3.5-Trinitrobenzene	99-35-4	0.5	mg/kg	<0.5	1.5 mg/kg	67.9	18.2	106
EP075: Phenacetin	62-44-2	0.5	mg/kg	<0.5	1.5 mg/kg	70.4	49.0	121
EP075: 4-Aminobiphenyl	92-67-1	0.5	mg/kg	<0.5	1.5 mg/kg	69.6	61.0	115
EP075: Pentachloronitrobenzene	82-68-8	0.5	mg/kg	<0.5	1.5 mg/kg	83.6	61.0	117
EP075: Pronamide	23950-58-5	0.5	mg/kg	<0.5	1.5 mg/kg	76.7	62.0	120
EP075: Dimethylaminoazobenzene	60-11-7	0.5	mg/kg	<0.5	1.5 mg/kg	68.2	47.0	125
EP075: Chlorobenzilate	510-15-6	0.5	mg/kg	<0.5	1.5 mg/kg	71.8	47.0	133
EP075E: Nitroaromatics and Ketones (QCLot: 5183517)								
EP075: 2-Picoline	109-06-8	0.5	mg/kg	<0.5	1.5 mg/kg	83.3	16.8	137
EP075: Acetophenone	98-86-2	0.5	mg/kg	<0.5	1.5 mg/kg	78.6	60.0	136
EP075: Nitrobenzene	98-95-3	0.5	mg/kg	<0.5	1.5 mg/kg	82.0	66.0	138
EP075: Isophorone	78-59-1	0.5	mg/kg	<0.5	1.5 mg/kg	77.1	60.0	138
EP075: 2.6-Dinitrotoluene	606-20-2	0.5	mg/kg	<0.5	1.5 mg/kg	74.7	56.0	122
EP075: 2.4-Dinitrotoluene	121-14-2	0.5	mg/kg	<0.5	1.5 mg/kg	61.9	57.0	105
EP075: 1-Naphthylamine	134-32-7	0.5	mg/kg	<0.5	1.5 mg/kg	64.3	5.90	80.0
EP075: 4-Nitroquinoline-N-oxide	56-57-5	0.5	mg/kg	<0.5	1.5 mg/kg	73.8	21.1	161
EP075: 5-Nitro-o-toluidine	99-55-8	0.5	mg/kg	<0.5	1.5 mg/kg	71.4	20.1	106
EP075: Azobenzene	103-33-3	1	mg/kg	<1	1.5 mg/kg	74.0	63.0	119
EP075: 1.3.5-Trinitrobenzene	99-35-4	0.5	mg/kg	<0.5	1.5 mg/kg	65.0	18.2	106

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075E: Nitroaromatics and Ketones (QCLot: 5183517) - continued								
EP075: Phenacetin	62-44-2	0.5	mg/kg	<0.5	1.5 mg/kg	57.5	49.0	121
EP075: 4-Aminobiphenyl	92-67-1	0.5	mg/kg	<0.5	1.5 mg/kg	77.5	61.0	115
EP075: Pentachloronitrobenzene	82-68-8	0.5	mg/kg	<0.5	1.5 mg/kg	68.5	61.0	117
EP075: Pronamide	23950-58-5	0.5	mg/kg	<0.5	1.5 mg/kg	70.0	62.0	120
EP075: Dimethylaminoazobenzene	60-11-7	0.5	mg/kg	<0.5	1.5 mg/kg	61.3	47.0	125
EP075: Chlorobenzilate	510-15-6	0.5	mg/kg	<0.5	1.5 mg/kg	63.0	47.0	133
EP075E: Nitroaromatics and Ketones (QCLot: 5184945)								
EP075: 2-Picoline	109-06-8	0.5	mg/kg	<0.5	1.5 mg/kg	110	16.8	137
EP075: Acetophenone	98-86-2	0.5	mg/kg	<0.5	1.5 mg/kg	99.1	60.0	136
EP075: Nitrobenzene	98-95-3	0.5	mg/kg	<0.5	1.5 mg/kg	95.7	66.0	138
EP075: Isophorone	78-59-1	0.5	mg/kg	<0.5	1.5 mg/kg	89.4	60.0	138
EP075: 2.6-Dinitrotoluene	606-20-2	0.5	mg/kg	<0.5	1.5 mg/kg	81.7	56.0	122
EP075: 2.4-Dinitrotoluene	121-14-2	0.5	mg/kg	<0.5	1.5 mg/kg	81.0	57.0	105
EP075: 1-Naphthylamine	134-32-7	0.5	mg/kg	<0.5	1.5 mg/kg	# 113	5.90	80.0
EP075: 4-Nitroquinoline-N-oxide	56-57-5	0.5	mg/kg	<0.5	1.5 mg/kg	# 173	21.1	161
EP075: 5-Nitro-o-toluidine	99-55-8	0.5	mg/kg	<0.5	1.5 mg/kg	88.9	20.1	106
EP075: Azobenzene	103-33-3	1	mg/kg	<1	1.5 mg/kg	92.9	63.0	119
EP075: 1.3.5-Trinitrobenzene	99-35-4	0.5	mg/kg	<0.5	1.5 mg/kg	64.7	18.2	106
EP075: Phenacetin	62-44-2	0.5	mg/kg	<0.5	1.5 mg/kg	68.8	49.0	121
EP075: 4-Aminobiphenyl	92-67-1	0.5	mg/kg	<0.5	1.5 mg/kg	79.4	61.0	115
EP075: Pentachloronitrobenzene	82-68-8	0.5	mg/kg	<0.5	1.5 mg/kg	86.6	61.0	117
EP075: Pronamide	23950-58-5	0.5	mg/kg	<0.5	1.5 mg/kg	82.8	62.0	120
EP075: Dimethylaminoazobenzene	60-11-7	0.5	mg/kg	<0.5	1.5 mg/kg	64.7	47.0	125
EP075: Chlorobenzilate	510-15-6	0.5	mg/kg	<0.5	1.5 mg/kg	72.0	47.0	133
EP075F: Haloethers (QCLot: 5183510)								
EP075: Bis(2-chloroethyl) ether	111-44-4	0.5	mg/kg	<0.5	1.5 mg/kg	90.2	50.0	144
EP075: Bis(2-chloroethoxy) methane	111-91-1	0.5	mg/kg	<0.5	1.5 mg/kg	90.0	49.0	141
EP075: 4-Chlorophenyl phenyl ether	7005-72-3	0.5	mg/kg	<0.5	1.5 mg/kg	94.6	65.0	119
EP075: 4-Bromophenyl phenyl ether	101-55-3	0.5	mg/kg	<0.5	1.5 mg/kg	90.8	60.0	122
EP075F: Haloethers (QCLot: 5183517)								
EP075: Bis(2-chloroethyl) ether	111-44-4	0.5	mg/kg	<0.5	1.5 mg/kg	82.2	50.0	144
EP075: Bis(2-chloroethoxy) methane	111-91-1	0.5	mg/kg	<0.5	1.5 mg/kg	83.5	49.0	141
EP075: 4-Chlorophenyl phenyl ether	7005-72-3	0.5	mg/kg	<0.5	1.5 mg/kg	84.9	65.0	119
EP075: 4-Bromophenyl phenyl ether	101-55-3	0.5	mg/kg	<0.5	1.5 mg/kg	82.0	60.0	122

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075F: Haloethers (QCLot: 5184945)								
EP075: Bis(2-chloroethyl) ether	111-44-4	0.5	mg/kg	<0.5	1.5 mg/kg	90.0	50.0	144
EP075: Bis(2-chloroethoxy) methane	111-91-1	0.5	mg/kg	<0.5	1.5 mg/kg	97.5	49.0	141
EP075: 4-Chlorophenyl phenyl ether	7005-72-3	0.5	mg/kg	<0.5	1.5 mg/kg	110	65.0	119
EP075: 4-Bromophenyl phenyl ether	101-55-3	0.5	mg/kg	<0.5	1.5 mg/kg	103	60.0	122
EP075G: Chlorinated Hydrocarbons (QCLot: 5183510)								
EP075: 1.3-Dichlorobenzene	541-73-1	0.5	mg/kg	<0.5	1.5 mg/kg	93.1	70.0	112
EP075: 1.4-Dichlorobenzene	106-46-7	0.5	mg/kg	<0.5	1.5 mg/kg	90.0	67.0	119
EP075: 1.2-Dichlorobenzene	95-50-1	0.5	mg/kg	<0.5	1.5 mg/kg	91.6	72.0	120
EP075: Hexachloroethane	67-72-1	0.5	mg/kg	<0.5	1.5 mg/kg	90.6	65.0	119
EP075: 1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg	<0.5	1.5 mg/kg	92.6	66.0	132
EP075: Hexachloropropylene	1888-71-7	0.5	mg/kg	<0.5	1.5 mg/kg	94.5	43.0	129
EP075: Hexachlorobutadiene	87-68-3	0.5	mg/kg	<0.5	1.5 mg/kg	98.2	64.0	124
EP075: Hexachlorocyclopentadiene	77-47-4	2.5	mg/kg	<2.5	1.5 mg/kg	67.3	6.60	103
EP075: Pentachlorobenzene	608-93-5	0.5	mg/kg	<0.5	1.5 mg/kg	98.2	67.0	117
EP075: Hexachlorobenzene (HCB)	118-74-1	0.5	mg/kg	<0.5	1.5 mg/kg	94.6	55.0	123
EP075G: Chlorinated Hydrocarbons (QCLot: 5183517)								
EP075: 1.3-Dichlorobenzene	541-73-1	0.5	mg/kg	<0.5	1.5 mg/kg	85.8	70.0	112
EP075: 1.4-Dichlorobenzene	106-46-7	0.5	mg/kg	<0.5	1.5 mg/kg	83.1	67.0	119
EP075: 1.2-Dichlorobenzene	95-50-1	0.5	mg/kg	<0.5	1.5 mg/kg	87.4	72.0	120
EP075: Hexachloroethane	67-72-1	0.5	mg/kg	<0.5	1.5 mg/kg	84.0	65.0	119
EP075: 1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg	<0.5	1.5 mg/kg	83.9	66.0	132
EP075: Hexachloropropylene	1888-71-7	0.5	mg/kg	<0.5	1.5 mg/kg	88.2	43.0	129
EP075: Hexachlorobutadiene	87-68-3	0.5	mg/kg	<0.5	1.5 mg/kg	91.9	64.0	124
EP075: Hexachlorocyclopentadiene	77-47-4	2.5	mg/kg	<2.5	1.5 mg/kg	61.2	6.60	103
EP075: Pentachlorobenzene	608-93-5	0.5	mg/kg	<0.5	1.5 mg/kg	89.0	67.0	117
EP075: Hexachlorobenzene (HCB)	118-74-1	0.5	mg/kg	<0.5	1.5 mg/kg	85.0	55.0	123
EP075G: Chlorinated Hydrocarbons (QCLot: 5184945)								
EP075: 1.3-Dichlorobenzene	541-73-1	0.5	mg/kg	<0.5	1.5 mg/kg	107	70.0	112
EP075: 1.4-Dichlorobenzene	106-46-7	0.5	mg/kg	<0.5	1.5 mg/kg	100.0	67.0	119
EP075: 1.2-Dichlorobenzene	95-50-1	0.5	mg/kg	<0.5	1.5 mg/kg	102	72.0	120
EP075: Hexachloroethane	67-72-1	0.5	mg/kg	<0.5	1.5 mg/kg	100	65.0	119
EP075: 1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg	<0.5	1.5 mg/kg	101	66.0	132
EP075: Hexachloropropylene	1888-71-7	0.5	mg/kg	<0.5	1.5 mg/kg	90.2	43.0	129
EP075: Hexachlorobutadiene	87-68-3	0.5	mg/kg	<0.5	1.5 mg/kg	108	64.0	124

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075G: Chlorinated Hydrocarbons (QCLot: 5184945) - continued								
EP075: Hexachlorocyclopentadiene	77-47-4	2.5	mg/kg	<2.5	1.5 mg/kg	67.2	6.60	103
EP075: Pentachlorobenzene	608-93-5	0.5	mg/kg	<0.5	1.5 mg/kg	106	67.0	117
EP075: Hexachlorobenzene (HCB)	118-74-1	0.5	mg/kg	<0.5	1.5 mg/kg	108	55.0	123
EP075H: Anilines and Benzidines (QCLot: 5183510)								
EP075: Aniline	62-53-3	0.5	mg/kg	<0.5	1.5 mg/kg	79.0	32.0	144
EP075: 4-Chloroaniline	106-47-8	0.5	mg/kg	<0.5	1.5 mg/kg	# 85.5	13.9	74.0
EP075: 2-Nitroaniline	88-74-4	0.5	mg/kg	<0.5	1.5 mg/kg	77.0	50.0	150
EP075: 3-Nitroaniline	99-09-2	0.5	mg/kg	<0.5	1.5 mg/kg	85.9	3.90	116
EP075: Dibenzofuran	132-64-9	0.5	mg/kg	<0.5	1.5 mg/kg	96.3	69.0	115
EP075: 4-Nitroaniline	100-01-6	0.5	mg/kg	<0.5	1.5 mg/kg	86.5	39.0	125
EP075: Carbazole	86-74-8	0.5	mg/kg	<0.5	1.5 mg/kg	96.8	65.0	123
EP075: 3.3`-Dichlorobenzidine	91-94-1	0.5	mg/kg	<0.5	1.5 mg/kg	101	33.0	101
EP075H: Anilines and Benzidines (QCLot: 5183517)								
EP075: Aniline	62-53-3	0.5	mg/kg	<0.5	1.5 mg/kg	73.5	32.0	144
EP075: 4-Chloroaniline	106-47-8	0.5	mg/kg	<0.5	1.5 mg/kg	# 80.9	13.9	74.0
EP075: 2-Nitroaniline	88-74-4	0.5	mg/kg	<0.5	1.5 mg/kg	72.7	50.0	150
EP075: 3-Nitroaniline	99-09-2	0.5	mg/kg	<0.5	1.5 mg/kg	70.9	3.90	116
EP075: Dibenzofuran	132-64-9	0.5	mg/kg	<0.5	1.5 mg/kg	86.6	69.0	115
EP075: 4-Nitroaniline	100-01-6	0.5	mg/kg	<0.5	1.5 mg/kg	81.0	39.0	125
EP075: Carbazole	86-74-8	0.5	mg/kg	<0.5	1.5 mg/kg	84.4	65.0	123
EP075: 3.3`-Dichlorobenzidine	91-94-1	0.5	mg/kg	<0.5	1.5 mg/kg	93.6	33.0	101
EP075H: Anilines and Benzidines (QCLot: 5184945)								
EP075: Aniline	62-53-3	0.5	mg/kg	<0.5	1.5 mg/kg	91.1	32.0	144
EP075: 4-Chloroaniline	106-47-8	0.5	mg/kg	<0.5	1.5 mg/kg	# 86.6	13.9	74.0
EP075: 2-Nitroaniline	88-74-4	0.5	mg/kg	<0.5	1.5 mg/kg	82.2	50.0	150
EP075: 3-Nitroaniline	99-09-2	0.5	mg/kg	<0.5	1.5 mg/kg	80.9	3.90	116
EP075: Dibenzofuran	132-64-9	0.5	mg/kg	<0.5	1.5 mg/kg	109	69.0	115
EP075: 4-Nitroaniline	100-01-6	0.5	mg/kg	<0.5	1.5 mg/kg	95.9	39.0	125
EP075: Carbazole	86-74-8	0.5	mg/kg	<0.5	1.5 mg/kg	104	65.0	123
EP075: 3.3`-Dichlorobenzidine	91-94-1	0.5	mg/kg	<0.5	1.5 mg/kg	94.9	33.0	101
EP075I: Organochlorine Pesticides (QCLot: 5183510)								
EP075: alpha-BHC	319-84-6	0.5	mg/kg	<0.5	1.5 mg/kg	85.2	60.0	124
EP075: beta-BHC	319-85-7	0.5	mg/kg	<0.5	1.5 mg/kg	96.4	50.0	150
EP075: gamma-BHC	58-89-9	0.5	mg/kg	<0.5	1.5 mg/kg	93.4	50.0	150

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report		
					Spike	Spike Recovery (%)	Acceptable Limits (%)
				Result	Concentration	LCS	Low	High
EP075I: Organochlorine Pesticides (QCLot: 5183510) - continued								
EP075: delta-BHC	319-86-8	0.5	mg/kg	<0.5	1.5 mg/kg	88.3	64.0	122
EP075: Heptachlor	76-44-8	0.5	mg/kg	<0.5	1.5 mg/kg	85.2	52.0	124
EP075: Aldrin	309-00-2	0.5	mg/kg	<0.5	1.5 mg/kg	88.2	66.0	130
EP075: Heptachlor epoxide	1024-57-3	0.5	mg/kg	<0.5	1.5 mg/kg	86.4	52.0	132
EP075: alpha-Endosulfan	959-98-8	0.5	mg/kg	<0.5	1.5 mg/kg	88.6	50.0	150
EP075: 4.4`-DDE	72-55-9	0.5	mg/kg	<0.5	1.5 mg/kg	85.1	63.0	127
EP075: Dieldrin	60-57-1	0.5	mg/kg	<0.5	1.5 mg/kg	85.6	62.0	130
EP075: Endrin	72-20-8	0.5	mg/kg	<0.5	1.5 mg/kg	87.8	48.0	132
EP075: beta-Endosulfan	33213-65-9	0.5	mg/kg	<0.5	1.5 mg/kg	84.3	50.0	150
EP075: 4.4`-DDD	72-54-8	0.5	mg/kg	<0.5	1.5 mg/kg	85.2	63.0	129
EP075: Endosulfan sulfate	1031-07-8	0.5	mg/kg	<0.5	1.5 mg/kg	87.4	46.0	140
EP075: 4.4`-DDT	50-29-3	0.5	mg/kg	<0.5	1.5 mg/kg	81.9	5.50	156
EP075I: Organochlorine Pesticides (QCLot: 5183517)								
EP075: alpha-BHC	319-84-6	0.5	mg/kg	<0.5	1.5 mg/kg	76.4	60.0	124
EP075: beta-BHC	319-85-7	0.5	mg/kg	<0.5	1.5 mg/kg	80.1	50.0	150
EP075: gamma-BHC	58-89-9	0.5	mg/kg	<0.5	1.5 mg/kg	80.7	50.0	150
EP075: delta-BHC	319-86-8	0.5	mg/kg	<0.5	1.5 mg/kg	82.7	64.0	122
EP075: Heptachlor	76-44-8	0.5	mg/kg	<0.5	1.5 mg/kg	76.0	52.0	124
EP075: Aldrin	309-00-2	0.5	mg/kg	<0.5	1.5 mg/kg	79.3	66.0	130
EP075: Heptachlor epoxide	1024-57-3	0.5	mg/kg	<0.5	1.5 mg/kg	79.4	52.0	132
EP075: alpha-Endosulfan	959-98-8	0.5	mg/kg	<0.5	1.5 mg/kg	85.0	50.0	150
EP075: 4.4`-DDE	72-55-9	0.5	mg/kg	<0.5	1.5 mg/kg	75.6	63.0	127
EP075: Dieldrin	60-57-1	0.5	mg/kg	<0.5	1.5 mg/kg	77.8	62.0	130
EP075: Endrin	72-20-8	0.5	mg/kg	<0.5	1.5 mg/kg	78.9	48.0	132
EP075: beta-Endosulfan	33213-65-9	0.5	mg/kg	<0.5	1.5 mg/kg	73.6	50.0	150
EP075: 4.4`-DDD	72-54-8	0.5	mg/kg	<0.5	1.5 mg/kg	77.1	63.0	129
EP075: Endosulfan sulfate	1031-07-8	0.5	mg/kg	<0.5	1.5 mg/kg	75.3	46.0	140
EP075: 4.4`-DDT	50-29-3	0.5	mg/kg	<0.5	1.5 mg/kg	73.5	5.50	156
EP075I: Organochlorine Pesticides (QCLot: 5184945)								
EP075: alpha-BHC	319-84-6	0.5	mg/kg	<0.5	1.5 mg/kg	67.6	60.0	124
EP075: beta-BHC	319-85-7	0.5	mg/kg	<0.5	1.5 mg/kg	101	50.0	150
EP075: gamma-BHC	58-89-9	0.5	mg/kg	<0.5	1.5 mg/kg	102	50.0	150
EP075: delta-BHC	319-86-8	0.5	mg/kg	<0.5	1.5 mg/kg	101	64.0	122
EP075: Heptachlor	76-44-8	0.5	mg/kg	<0.5	1.5 mg/kg	89.8	52.0	124

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075I: Organochlorine Pesticides (QCLot: 5184945) - continued								
EP075: Aldrin	309-00-2	0.5	mg/kg	<0.5	1.5 mg/kg	99.7	66.0	130
EP075: Heptachlor epoxide	1024-57-3	0.5	mg/kg	<0.5	1.5 mg/kg	95.8	52.0	132
EP075: alpha-Endosulfan	959-98-8	0.5	mg/kg	<0.5	1.5 mg/kg	98.7	50.0	150
EP075: 4.4`-DDE	72-55-9	0.5	mg/kg	<0.5	1.5 mg/kg	97.1	63.0	127
EP075: Dieldrin	60-57-1	0.5	mg/kg	<0.5	1.5 mg/kg	93.0	62.0	130
EP075: Endrin	72-20-8	0.5	mg/kg	<0.5	1.5 mg/kg	80.4	48.0	132
EP075: beta-Endosulfan	33213-65-9	0.5	mg/kg	<0.5	1.5 mg/kg	97.1	50.0	150
EP075: 4.4`-DDD	72-54-8	0.5	mg/kg	<0.5	1.5 mg/kg	94.4	63.0	129
EP075: Endosulfan sulfate	1031-07-8	0.5	mg/kg	<0.5	1.5 mg/kg	93.4	46.0	140
EP075: 4.4`-DDT	50-29-3	0.5	mg/kg	<0.5	1.5 mg/kg	79.1	5.50	156
EP075J: Organophosphorus Pesticides (QCLot: 5183510)								
EP075: Dichlorvos	62-73-7	0.5	mg/kg	<0.5	1.5 mg/kg	66.0	63.0	121
EP075: Dimethoate	60-51-5	0.5	mg/kg	<0.5	1.5 mg/kg	62.1	29.0	127
EP075: Diazinon	333-41-5	0.5	mg/kg	<0.5	1.5 mg/kg	83.8	62.0	128
EP075: Chlorpyrifos-methyl	5598-13-0	0.5	mg/kg	<0.5	1.5 mg/kg	86.2	50.0	150
EP075: Malathion	121-75-5	0.5	mg/kg	<0.5	1.5 mg/kg	69.4	50.0	150
EP075: Fenthion	55-38-9	0.5	mg/kg	<0.5	1.5 mg/kg	84.3	50.0	150
EP075: Chlorpyrifos	2921-88-2	0.5	mg/kg	<0.5	1.5 mg/kg	80.6	61.0	123
EP075: Pirimphos-ethyl	23505-41-1	0.5	mg/kg	<0.5	1.5 mg/kg	76.1	63.0	125
EP075: Chlorfenvinphos	470-90-6	0.5	mg/kg	<0.5	1.5 mg/kg	62.5	50.0	150
EP075: Prothiofos	34643-46-4	0.5	mg/kg	<0.5	1.5 mg/kg	79.8	58.0	126
EP075: Ethion	563-12-2	0.5	mg/kg	<0.5	1.5 mg/kg	69.2	55.0	131
EP075J: Organophosphorus Pesticides (QCLot: 5183517)								
EP075: Dichlorvos	62-73-7	0.5	mg/kg	<0.5	1.5 mg/kg	66.6	63.0	121
EP075: Dimethoate	60-51-5	0.5	mg/kg	<0.5	1.5 mg/kg	60.8	29.0	127
EP075: Diazinon	333-41-5	0.5	mg/kg	<0.5	1.5 mg/kg	74.4	62.0	128
EP075: Chlorpyrifos-methyl	5598-13-0	0.5	mg/kg	<0.5	1.5 mg/kg	76.4	50.0	150
EP075: Malathion	121-75-5	0.5	mg/kg	<0.5	1.5 mg/kg	61.5	50.0	150
EP075: Fenthion	55-38-9	0.5	mg/kg	<0.5	1.5 mg/kg	75.6	50.0	150
EP075: Chlorpyrifos	2921-88-2	0.5	mg/kg	<0.5	1.5 mg/kg	70.0	61.0	123
EP075: Pirimphos-ethyl	23505-41-1	0.5	mg/kg	<0.5	1.5 mg/kg	75.6	63.0	125
EP075: Chlorfenvinphos	470-90-6	0.5	mg/kg	<0.5	1.5 mg/kg	62.2	50.0	150
EP075: Prothiofos	34643-46-4	0.5	mg/kg	<0.5	1.5 mg/kg	71.2	58.0	126
EP075: Ethion	563-12-2	0.5	mg/kg	<0.5	1.5 mg/kg	60.6	55.0	131

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075J: Organophosphorus Pesticides (QCLot: 5184945)								
EP075: Dichlorvos	62-73-7	0.5	mg/kg	<0.5	1.5 mg/kg	86.4	63.0	121
EP075: Dimethoate	60-51-5	0.5	mg/kg	<0.5	1.5 mg/kg	70.7	29.0	127
EP075: Diazinon	333-41-5	0.5	mg/kg	<0.5	1.5 mg/kg	87.4	62.0	128
EP075: Chlorpyrifos-methyl	5598-13-0	0.5	mg/kg	<0.5	1.5 mg/kg	89.7	50.0	150
EP075: Malathion	121-75-5	0.5	mg/kg	<0.5	1.5 mg/kg	75.7	50.0	150
EP075: Fenthion	55-38-9	0.5	mg/kg	<0.5	1.5 mg/kg	90.0	50.0	150
EP075: Chlorpyrifos	2921-88-2	0.5	mg/kg	<0.5	1.5 mg/kg	85.6	61.0	123
EP075: Pirimphos-ethyl	23505-41-1	0.5	mg/kg	<0.5	1.5 mg/kg	82.6	63.0	125
EP075: Chlorfenvinphos	470-90-6	0.5	mg/kg	<0.5	1.5 mg/kg	73.5	50.0	150
EP075: Prothiofos	34643-46-4	0.5	mg/kg	<0.5	1.5 mg/kg	82.4	58.0	126
EP075: Ethion	563-12-2	0.5	mg/kg	<0.5	1.5 mg/kg	73.2	55.0	131
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5183489)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	35 mg/kg	108	66.0	122
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5183496)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	35 mg/kg	104	66.0	122
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5183507)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	1303 mg/kg	109	70.0	111
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	2379 mg/kg	108	71.9	109
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	336 mg/kg	102	63.8	118
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5183515)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	1303 mg/kg	106	70.0	111
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	2379 mg/kg	103	71.9	109
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	336 mg/kg	96.5	63.8	118
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5184936)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	35 mg/kg	118	66.0	122
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5184943)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	1303 mg/kg	104	70.0	111
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	2379 mg/kg	100.0	71.9	109
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	336 mg/kg	101	63.8	118
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5190120)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	35 mg/kg	91.0	66.0	122
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5190125)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	1303 mg/kg	103	70.0	111
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	2379 mg/kg	93.0	71.9	109

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5190125) - continued								
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	336 mg/kg	94.8	63.8	118
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5183489)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	45 mg/kg	103	66.0	122
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5183496)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	45 mg/kg	99.9	66.0	122
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5183507)								
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	1797 mg/kg	108	72.8	110
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	2060 mg/kg	111	67.8	114
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	100 mg/kg	93.0	50.3	123
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5183515)								
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	1797 mg/kg	104	72.8	110
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	2060 mg/kg	103	67.8	114
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	100 mg/kg	86.5	50.3	123
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5184936)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	45 mg/kg	114	66.0	122
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5184943)								
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	1797 mg/kg	104	72.8	110
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	2060 mg/kg	100	67.8	114
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	100 mg/kg	108	50.3	123
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5190120)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	45 mg/kg	88.5	66.0	122
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5190125)								
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	1797 mg/kg	101	72.8	110
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	2060 mg/kg	91.4	67.8	114
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	100 mg/kg	98.4	50.3	123
EP080: BTEXN (QCLot: 5183489)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	2 mg/kg	101	72.0	122
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	2 mg/kg	104	75.0	119
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	2 mg/kg	108	73.0	121
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	4 mg/kg	109	74.0	122
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	2 mg/kg	110	75.0	121
EP080: Naphthalene	91-20-3	1	mg/kg	<1	0.5 mg/kg	97.5	64.0	126
EP080: BTEXN (QCLot: 5183496)								

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP080: BTEXN (QCLot: 5183496) - continued								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	2 mg/kg	100	72.0	122
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	2 mg/kg	102	75.0	119
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	2 mg/kg	105	73.0	121
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	4 mg/kg	104	74.0	122
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	2 mg/kg	104	75.0	121
EP080: Naphthalene	91-20-3	1	mg/kg	<1	0.5 mg/kg	97.4	64.0	126
EP080: BTEXN (QCLot: 5184936)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	2 mg/kg	92.4	72.0	122
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	2 mg/kg	107	75.0	119
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	2 mg/kg	111	73.0	121
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	4 mg/kg	114	74.0	122
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	2 mg/kg	115	75.0	121
EP080: Naphthalene	91-20-3	1	mg/kg	<1	0.5 mg/kg	99.1	64.0	126
EP080: BTEXN (QCLot: 5190120)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	2 mg/kg	110	72.0	122
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	2 mg/kg	102	75.0	119
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	2 mg/kg	99.7	73.0	121
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	4 mg/kg	100	74.0	122
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	2 mg/kg	99.9	75.0	121
EP080: Naphthalene	91-20-3	1	mg/kg	<1	0.5 mg/kg	79.9	64.0	126

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 5196768)								
EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	0.02 mg/L	85.8	73.2	141
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	100	90.3	113
EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	102	84.6	123
EG020A-F: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	101	88.5	110
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	98.1	89.7	108
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	101	87.3	107
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	95.1	88.8	109
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	94.8	88.9	108

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 5196768) - continued								
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	98.2	89.4	106
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	96.5	87.6	106
EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	0.1 mg/L	99.0	91.1	111
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	101	87.2	108
EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	88.2	83.8	102
EG020A-F: Tin	7440-31-5	0.001	mg/L	<0.001	0.1 mg/L	102	92.9	120
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	99.8	89.5	112
EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	97.7	82.8	125
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 5182598)								
EP074: Benzene	71-43-2	1	µg/L	<1	10 µg/L	103	86.8	112
EP074: Toluene	108-88-3	2	µg/L	<2	10 µg/L	104	87.0	111
EP074: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	104	86.5	112
EP074: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	20 µg/L	103	84.5	113
EP074: Styrene	100-42-5	5	µg/L	<5	10 µg/L	102	80.0	118
EP074: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	103	88.1	110
EP074: Isopropylbenzene	98-82-8	5	µg/L	<5	10 µg/L	103	86.6	113
EP074: n-Propylbenzene	103-65-1	5	µg/L	<5	10 µg/L	97.7	78.3	120
EP074: 1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	10 µg/L	94.8	84.2	114
EP074: sec-Butylbenzene	135-98-8	5	µg/L	<5	10 µg/L	103	82.3	117
EP074: 1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	10 µg/L	94.4	83.0	116
EP074: tert-Butylbenzene	98-06-6	5	µg/L	<5	10 µg/L	103	83.9	115
EP074: p-Isopropyltoluene	99-87-6	5	µg/L	<5	10 µg/L	100	80.3	120
EP074: n-Butylbenzene	104-51-8	5	µg/L	<5	10 µg/L	97.0	77.5	122
EP074B: Oxygenated Compounds (QCLot: 5182598)								
EP074: Vinyl Acetate	108-05-4	50	µg/L	<50	100 µg/L	104	78.7	121
EP074: 2-Butanone (MEK)	78-93-3	50	µg/L	<50	100 µg/L	104	64.0	142
EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	100 µg/L	106	73.8	126
EP074: 2-Hexanone (MBK)	591-78-6	50	µg/L	<50	100 µg/L	109	62.7	142
EP074C: Sulfonated Compounds (QCLot: 5182598)								
EP074: Carbon disulfide	75-15-0	5	µg/L	<5	10 µg/L	107	77.5	123
EP074D: Fumigants (QCLot: 5182598)								
EP074: 2.2-Dichloropropane	594-20-7	5	µg/L	<5	10 µg/L	105	77.0	123
EP074: 1.2-Dichloropropane	78-87-5	5	µg/L	<5	10 µg/L	103	85.9	113

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report		
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP074D: Fumigants (QCLot: 5182598) - continued								
EP074: cis-1.3-Dichloropropylene	10061-01-5	5	µg/L	<5	10 µg/L	102	84.4	115
EP074: trans-1.3-Dichloropropylene	10061-02-6	5	µg/L	<5	10 µg/L	105	79.9	119
EP074: 1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	10 µg/L	98.9	82.8	116
EP074E: Halogenated Aliphatic Compounds (QCLot: 5182598)								
EP074: Dichlorodifluoromethane	75-71-8	50	µg/L	<50	100 µg/L	112	74.3	125
EP074: Chloromethane	74-87-3	50	µg/L	<50	100 µg/L	111	76.8	123
EP074: Vinyl chloride	75-01-4	50	µg/L	<50	100 µg/L	106	70.8	128
EP074: Bromomethane	74-83-9	50	µg/L	<50	100 µg/L	115	77.4	125
EP074: Chloroethane	75-00-3	50	µg/L	<50	100 µg/L	110	77.6	121
EP074: Trichlorofluoromethane	75-69-4	50	µg/L	<50	100 µg/L	107	79.8	120
EP074: 1.1-Dichloroethene	75-35-4	5	µg/L	<5	10 µg/L	105	80.0	118
EP074: Iodomethane	74-88-4	5	µg/L	<5	10 µg/L	102	62.8	129
EP074: trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	10 µg/L	103	83.6	115
EP074: 1.1-Dichloroethane	75-34-3	5	µg/L	<5	10 µg/L	106	83.7	116
EP074: cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	10 µg/L	103	83.6	115
EP074: 1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	10 µg/L	103	84.5	116
EP074: 1.1-Dichloropropylene	563-58-6	5	µg/L	<5	10 µg/L	101	85.4	113
EP074: Carbon Tetrachloride	56-23-5	5	µg/L	<5	10 µg/L	103	82.4	119
EP074: 1.2-Dichloroethane	107-06-2	5	µg/L	<5	10 µg/L	106	77.3	121
EP074: Trichloroethene	79-01-6	5	µg/L	<5	10 µg/L	102	86.4	112
EP074: Dibromomethane	74-95-3	5	µg/L	<5	10 µg/L	106	77.6	122
EP074: 1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	10 µg/L	103	83.4	116
EP074: 1.3-Dichloropropane	142-28-9	5	µg/L	<5	10 µg/L	107	83.8	114
EP074: Tetrachloroethene	127-18-4	5	µg/L	<5	10 µg/L	# 123	78.9	121
EP074: 1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	10 µg/L	99.9	70.0	130
EP074: trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	10 µg/L	106	76.1	126
EP074: cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	10 µg/L	106	75.4	127
EP074: 1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	10 µg/L	106	72.3	125
EP074: 1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	10 µg/L	106	79.8	121
EP074: Pentachloroethane	76-01-7	5	µg/L	<5	10 µg/L	108	67.7	133
EP074: 1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	10 µg/L	106	71.8	130
EP074F: Halogenated Aromatic Compounds (QCLot: 5182598)								
EP074: Chlorobenzene	108-90-7	5	µg/L	<5	10 µg/L	105	89.8	110
EP074: Bromobenzene	108-86-1	5	µg/L	<5	10 µg/L	101	88.4	111

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP074F: Halogenated Aromatic Compounds (QCLot: 5182598) - continued								
EP074: 2-Chlorotoluene	95-49-8	5	µg/L	<5	10 µg/L	104	76.4	120
EP074: 4-Chlorotoluene	106-43-4	5	µg/L	<5	10 µg/L	# 119	84.2	115
EP074: 1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	10 µg/L	105	84.6	116
EP074G: Trihalomethanes (QCLot: 5182598)								
EP074: Chloroform	67-66-3	5	µg/L	<5	10 µg/L	105	83.0	116
EP074: Bromodichloromethane	75-27-4	5	µg/L	<5	10 µg/L	100	79.2	121
EP074: Dibromochloromethane	124-48-1	5	µg/L	<5	10 µg/L	104	77.8	123
EP074: Bromoform	75-25-2	5	µg/L	<5	10 µg/L	107	75.5	125
EP075A: Phenolic Compounds (QCLot: 5183750)								
EP075: Phenol	108-95-2	2	µg/L	<2	10 µg/L	21.7	10.0	50.2
EP075: 2-Chlorophenol	95-57-8	2	µg/L	<2	10 µg/L	42.8	36.5	88.0
EP075: 2-Methylphenol	95-48-7	2	µg/L	<2	10 µg/L	41.0	27.2	89.7
EP075: 3- & 4-Methylphenol	1319-77-3	2	µg/L	<2	10 µg/L	44.0	18.1	91.9
EP075: 2-Nitrophenol	88-75-5	2	µg/L	<2	10 µg/L	39.5	24.5	101
EP075: 2.4-Dimethylphenol	105-67-9	2	µg/L	<2	10 µg/L	42.9	31.6	101
EP075: 2.4-Dichlorophenol	120-83-2	2	µg/L	<2	10 µg/L	43.2	31.3	92.3
EP075: 2.6-Dichlorophenol	87-65-0	2	µg/L	<2	10 µg/L	42.2	38.0	93.2
EP075: 4-Chloro-3-methylphenol	59-50-7	2	µg/L	<2	10 µg/L	45.0	18.2	111
EP075: 2.4.6-Trichlorophenol	88-06-2	2	µg/L	<2	10 µg/L	38.1	31.0	94.9
EP075: 2.4.5-Trichlorophenol	95-95-4	2	µg/L	<2	10 µg/L	50.6	50.0	150
EP075: Pentachlorophenol	87-86-5	4	µg/L	<4	10 µg/L	18.4	10.0	102
EP075A: Phenolic Compounds (QCLot: 5195366)								
EP075: Phenol	108-95-2	2	µg/L	<2	10 µg/L	23.7	10.0	50.2
EP075: 2-Chlorophenol	95-57-8	2	µg/L	<2	10 µg/L	46.7	36.5	88.0
EP075: 2-Methylphenol	95-48-7	2	µg/L	<2	10 µg/L	38.2	27.2	89.7
EP075: 3- & 4-Methylphenol	1319-77-3	2	µg/L	<2	10 µg/L	49.2	18.1	91.9
EP075: 2-Nitrophenol	88-75-5	2	µg/L	<2	10 µg/L	44.0	24.5	101
EP075: 2.4-Dimethylphenol	105-67-9	2	µg/L	<2	10 µg/L	48.6	31.6	101
EP075: 2.4-Dichlorophenol	120-83-2	2	µg/L	<2	10 µg/L	45.7	31.3	92.3
EP075: 2.6-Dichlorophenol	87-65-0	2	µg/L	<2	10 µg/L	46.0	38.0	93.2
EP075: 4-Chloro-3-methylphenol	59-50-7	2	µg/L	<2	10 µg/L	49.1	18.2	111
EP075: 2.4.6-Trichlorophenol	88-06-2	2	µg/L	<2	10 µg/L	41.0	31.0	94.9
EP075: 2.4.5-Trichlorophenol	95-95-4	2	µg/L	<2	10 µg/L	55.5	50.0	150
EP075: Pentachlorophenol	87-86-5	4	µg/L	<4	10 µg/L	27.6	10.0	102

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 5183750)								
EP075: Naphthalene	91-20-3	2	µg/L	<2	10 µg/L	48.3	38.7	95.6
EP075: 2-Methylnaphthalene	91-57-6	2	µg/L	<2	10 µg/L	50.3	35.6	100
EP075: 2-Chloronaphthalene	91-58-7	2	µg/L	<2	10 µg/L	46.9	34.1	100
EP075: Acenaphthylene	208-96-8	2	µg/L	<2	10 µg/L	52.6	36.7	107
EP075: Acenaphthene	83-32-9	2	µg/L	<2	10 µg/L	61.1	39.8	104
EP075: Fluorene	86-73-7	2	µg/L	<2	10 µg/L	57.4	39.3	106
EP075: Phenanthrene	85-01-8	2	µg/L	<2	10 µg/L	73.4	43.4	112
EP075: Anthracene	120-12-7	2	µg/L	<2	10 µg/L	76.6	41.4	112
EP075: Fluoranthene	206-44-0	2	µg/L	<2	10 µg/L	74.4	46.1	117
EP075: Pyrene	129-00-0	2	µg/L	<2	10 µg/L	75.9	48.6	116
EP075: N-2-Fluorenyl Acetamide	53-96-3	2	µg/L	<2	10 µg/L	48.9	31.7	108
EP075: Benz(a)anthracene	56-55-3	2	µg/L	<2	10 µg/L	74.1	40.7	120
EP075: Chrysene	218-01-9	2	µg/L	<2	10 µg/L	78.8	41.6	122
EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L	<4	20 µg/L	81.8	10.0	140
EP075: 7.12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L	<2	10 µg/L	90.0	37.9	123
EP075: Benzo(a)pyrene	50-32-8	2	µg/L	<2	10 µg/L	78.3	43.2	117
EP075: 3-Methylcholanthrene	56-49-5	2	µg/L	<2	10 µg/L	42.8	35.6	116
EP075: Indeno(1.2.3.cd)pyrene	193-39-5	2	µg/L	<2	10 µg/L	45.9	37.3	116
EP075: Dibenz(a.h)anthracene	53-70-3	2	µg/L	<2	10 µg/L	47.0	38.0	113
EP075: Benzo(g.h.i)perylene	191-24-2	2	µg/L	<2	10 µg/L	48.6	41.8	116
EP075: Benzo(a)pyrene TEQ (zero)	----	2	µg/L	<2	----	----	----	----
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 5195366)								
EP075: Naphthalene	91-20-3	2	µg/L	<2	10 µg/L	51.2	38.7	95.6
EP075: 2-Methylnaphthalene	91-57-6	2	µg/L	<2	10 µg/L	52.8	35.6	100
EP075: 2-Chloronaphthalene	91-58-7	2	µg/L	<2	10 µg/L	51.4	34.1	100
EP075: Acenaphthylene	208-96-8	2	µg/L	<2	10 µg/L	55.8	36.7	107
EP075: Acenaphthene	83-32-9	2	µg/L	<2	10 µg/L	61.1	39.8	104
EP075: Fluorene	86-73-7	2	µg/L	<2	10 µg/L	63.0	39.3	106
EP075: Phenanthrene	85-01-8	2	µg/L	<2	10 µg/L	77.2	43.4	112
EP075: Anthracene	120-12-7	2	µg/L	<2	10 µg/L	81.6	41.4	112
EP075: Fluoranthene	206-44-0	2	µg/L	<2	10 µg/L	84.4	46.1	117
EP075: Pyrene	129-00-0	2	µg/L	<2	10 µg/L	85.7	48.6	116
EP075: N-2-Fluorenyl Acetamide	53-96-3	2	µg/L	<2	10 µg/L	58.2	31.7	108
EP075: Benz(a)anthracene	56-55-3	2	µg/L	<2	10 µg/L	86.9	40.7	120

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 5195366) - continued								
EP075: Chrysene	218-01-9	2	µg/L	<2	10 µg/L	91.1	41.6	122
EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L	<4	20 µg/L	84.6	10.0	140
EP075: 7.12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L	<2	10 µg/L	95.4	37.9	123
EP075: Benzo(a)pyrene	50-32-8	2	µg/L	<2	10 µg/L	82.0	43.2	117
EP075: 3-Methylcholanthrene	56-49-5	2	µg/L	<2	10 µg/L	78.4	35.6	116
EP075: Indeno(1.2.3.cd)pyrene	193-39-5	2	µg/L	<2	10 µg/L	80.9	37.3	116
EP075: Dibenz(a.h)anthracene	53-70-3	2	µg/L	<2	10 µg/L	81.3	38.0	113
EP075: Benzo(g.h.i)perylene	191-24-2	2	µg/L	<2	10 µg/L	85.5	41.8	116
EP075: Benzo(a)pyrene TEQ (zero)	----	2	µg/L	<2	----	----	----	----
EP075C: Phthalate Esters (QCLot: 5183750)								
EP075: Dimethyl phthalate	131-11-3	2	µg/L	<2	10 µg/L	61.7	37.6	112
EP075: Diethyl phthalate	84-66-2	2	µg/L	<2	10 µg/L	65.2	41.2	118
EP075: Di-n-butyl phthalate	84-74-2	2	µg/L	<2	10 µg/L	72.8	55.5	122
EP075: Butyl benzyl phthalate	85-68-7	2	µg/L	<2	10 µg/L	62.4	40.1	126
EP075: bis(2-ethylhexyl) phthalate	117-81-7	10	µg/L	<10	10 µg/L	67.9	55.2	122
EP075: Di-n-octylphthalate	117-84-0	2	µg/L	<2	10 µg/L	55.6	44.6	115
EP075C: Phthalate Esters (QCLot: 5195366)								
EP075: Dimethyl phthalate	131-11-3	2	µg/L	<2	10 µg/L	64.4	37.6	112
EP075: Diethyl phthalate	84-66-2	2	µg/L	<2	10 µg/L	73.0	41.2	118
EP075: Di-n-butyl phthalate	84-74-2	2	µg/L	<2	10 µg/L	83.2	55.5	122
EP075: Butyl benzyl phthalate	85-68-7	2	µg/L	<2	10 µg/L	77.8	40.1	126
EP075: bis(2-ethylhexyl) phthalate	117-81-7	10	µg/L	<10	10 µg/L	76.6	55.2	122
EP075: Di-n-octylphthalate	117-84-0	2	µg/L	<2	10 µg/L	64.1	44.6	115
EP075D: Nitrosamines (QCLot: 5183750)								
EP075: N-Nitrosomethylethylamine	10595-95-6	2	µg/L	<2	10 µg/L	38.4	25.6	82.4
EP075: N-Nitrosodiethylamine	55-18-5	2	µg/L	<2	10 µg/L	44.0	32.6	94.5
EP075: N-Nitrosopyrrolidine	930-55-2	4	µg/L	<4	10 µg/L	33.5	26.5	71.9
EP075: N-Nitrosomorpholine	59-89-2	2	µg/L	<2	10 µg/L	41.3	26.5	75.6
EP075: N-Nitrosodi-n-propylamine	621-64-7	2	µg/L	<2	10 µg/L	49.0	38.7	106
EP075: N-Nitrosopiperidine	100-75-4	2	µg/L	<2	10 µg/L	48.0	37.2	101
EP075: N-Nitrosodibutylamine	924-16-3	2	µg/L	<2	10 µg/L	51.5	41.0	103
EP075: N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	4	µg/L	<4	10 µg/L	60.6	37.0	111
EP075: Methapyrilene	91-80-5	2	µg/L	<2	10 µg/L	# 4.2	10.0	127

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075D: Nitrosamines (QCLot: 5195366)								
EP075: N-Nitrosomethylethylamine	10595-95-6	2	µg/L	<2	10 µg/L	37.4	25.6	82.4
EP075: N-Nitrosodiethylamine	55-18-5	2	µg/L	<2	10 µg/L	47.4	32.6	94.5
EP075: N-Nitrosopyrrolidine	930-55-2	4	µg/L	<4	10 µg/L	35.9	26.5	71.9
EP075: N-Nitrosomorpholine	59-89-2	2	µg/L	<2	10 µg/L	41.5	26.5	75.6
EP075: N-Nitrosodi-n-propylamine	621-64-7	2	µg/L	<2	10 µg/L	51.2	38.7	106
EP075: N-Nitrosopiperidine	100-75-4	2	µg/L	<2	10 µg/L	52.6	37.2	101
EP075: N-Nitrosodibutylamine	924-16-3	2	µg/L	<2	10 µg/L	51.3	41.0	103
EP075: N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	4	µg/L	<4	10 µg/L	67.6	37.0	111
EP075: Methapyrilene	91-80-5	2	µg/L	<2	10 µg/L	# 3.8	10.0	127
EP075E: Nitroaromatics and Ketones (QCLot: 5183750)								
EP075: 2-Picoline	109-06-8	2	µg/L	<2	10 µg/L	29.8	27.2	76.9
EP075: Acetophenone	98-86-2	2	µg/L	<2	10 µg/L	49.0	39.2	100
EP075: Nitrobenzene	98-95-3	2	µg/L	<2	10 µg/L	50.4	35.5	101
EP075: Isophorone	78-59-1	2	µg/L	<2	10 µg/L	45.2	42.0	102
EP075: 2.6-Dinitrotoluene	606-20-2	4	µg/L	<4	10 µg/L	53.6	32.4	109
EP075: 2.4-Dinitrotoluene	121-14-2	4	µg/L	<4	10 µg/L	47.5	31.9	95.8
EP075: 1-Naphthylamine	134-32-7	2	µg/L	<2	10 µg/L	54.0	10.0	147
EP075: 4-Nitroquinoline-N-oxide	56-57-5	2	µg/L	<2	10 µg/L	53.6	27.3	162
EP075: 5-Nitro-o-toluidine	99-55-8	2	µg/L	<2	10 µg/L	50.0	17.1	114
EP075: Azobenzene	103-33-3	2	µg/L	<2	10 µg/L	55.4	39.8	105
EP075: 1.3.5-Trinitrobenzene	99-35-4	2	µg/L	<2	10 µg/L	49.8	13.6	92.4
EP075: Phenacetin	62-44-2	2	µg/L	<2	10 µg/L	68.4	33.8	91.9
EP075: 4-Aminobiphenyl	92-67-1	2	µg/L	<2	10 µg/L	97.3	36.5	112
EP075: Pentachloronitrobenzene	82-68-8	2	µg/L	<2	10 µg/L	63.3	33.7	110
EP075: Pronamide	23950-58-5	2	µg/L	<2	10 µg/L	74.9	42.4	116
EP075: Dimethylaminoazobenzene	60-11-7	2	µg/L	<2	10 µg/L	63.7	34.3	110
EP075: Chlorobenzilate	510-15-6	2	µg/L	<2	10 µg/L	67.6	44.6	116
EP075E: Nitroaromatics and Ketones (QCLot: 5195366)								
EP075: 2-Picoline	109-06-8	2	µg/L	<2	10 µg/L	32.2	27.2	76.9
EP075: Acetophenone	98-86-2	2	µg/L	<2	10 µg/L	50.7	39.2	100
EP075: Nitrobenzene	98-95-3	2	µg/L	<2	10 µg/L	49.3	35.5	101
EP075: Isophorone	78-59-1	2	µg/L	<2	10 µg/L	51.4	42.0	102
EP075: 2.6-Dinitrotoluene	606-20-2	4	µg/L	<4	10 µg/L	59.7	32.4	109

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP075E: Nitroaromatics and Ketones (QCLot: 5195366) - continued								
EP075: 2.4-Dinitrotoluene	121-14-2	4	µg/L	<4	10 µg/L	59.2	31.9	95.8
EP075: 1-Naphthylamine	134-32-7	2	µg/L	<2	10 µg/L	63.7	10.0	147
EP075: 4-Nitroquinoline-N-oxide	56-57-5	2	µg/L	<2	10 µg/L	63.8	27.3	162
EP075: 5-Nitro-o-toluidine	99-55-8	2	µg/L	<2	10 µg/L	59.6	17.1	114
EP075: Azobenzene	103-33-3	2	µg/L	<2	10 µg/L	61.7	39.8	105
EP075: 1.3.5-Trinitrobenzene	99-35-4	2	µg/L	<2	10 µg/L	70.0	13.6	92.4
EP075: Phenacetin	62-44-2	2	µg/L	<2	10 µg/L	56.3	33.8	91.9
EP075: 4-Aminobiphenyl	92-67-1	2	µg/L	<2	10 µg/L	98.2	36.5	112
EP075: Pentachloronitrobenzene	82-68-8	2	µg/L	<2	10 µg/L	75.9	33.7	110
EP075: Pronamide	23950-58-5	2	µg/L	<2	10 µg/L	83.3	42.4	116
EP075: Dimethylaminoazobenzene	60-11-7	2	µg/L	<2	10 µg/L	72.6	34.3	110
EP075: Chlorobenzilate	510-15-6	2	µg/L	<2	10 µg/L	82.5	44.6	116
EP075F: Haloethers (QCLot: 5183750)								
EP075: Bis(2-chloroethyl) ether	111-44-4	2	µg/L	<2	10 µg/L	46.8	28.1	102
EP075: Bis(2-chloroethoxy) methane	111-91-1	2	µg/L	<2	10 µg/L	50.6	40.4	101
EP075: 4-Chlorophenyl phenyl ether	7005-72-3	2	µg/L	<2	10 µg/L	58.8	37.7	105
EP075: 4-Bromophenyl phenyl ether	101-55-3	2	µg/L	<2	10 µg/L	61.5	38.7	105
EP075F: Haloethers (QCLot: 5195366)								
EP075: Bis(2-chloroethyl) ether	111-44-4	2	µg/L	<2	10 µg/L	49.5	28.1	102
EP075: Bis(2-chloroethoxy) methane	111-91-1	2	µg/L	<2	10 µg/L	55.0	40.4	101
EP075: 4-Chlorophenyl phenyl ether	7005-72-3	2	µg/L	<2	10 µg/L	64.4	37.7	105
EP075: 4-Bromophenyl phenyl ether	101-55-3	2	µg/L	<2	10 µg/L	68.0	38.7	105
EP075G: Chlorinated Hydrocarbons (QCLot: 5183750)								
EP075: 1.4-Dichlorobenzene	106-46-7	2	µg/L	<2	10 µg/L	50.0	34.6	87.6
EP075: 1.3-Dichlorobenzene	541-73-1	2	µg/L	<2	10 µg/L	49.3	33.8	88.4
EP075: 1.2-Dichlorobenzene	95-50-1	2	µg/L	<2	10 µg/L	51.2	35.4	89.4
EP075: Hexachloroethane	67-72-1	2	µg/L	<2	10 µg/L	46.9	29.0	89.2
EP075: 1.2.4-Trichlorobenzene	120-82-1	2	µg/L	<2	10 µg/L	47.6	35.7	87.6
EP075: Hexachloropropylene	1888-71-7	2	µg/L	<2	10 µg/L	44.8	14.5	90.4
EP075: Hexachlorobutadiene	87-68-3	2	µg/L	<2	10 µg/L	48.1	29.6	91.9
EP075: Hexachlorocyclopentadiene	77-47-4	10	µg/L	<10	10 µg/L	30.7	10.0	83.2
EP075: Pentachlorobenzene	608-93-5	2	µg/L	<2	10 µg/L	56.6	35.3	101
EP075: Hexachlorobenzene (HCB)	118-74-1	4	µg/L	<4	10 µg/L	65.1	38.9	105
EP075G: Chlorinated Hydrocarbons (QCLot: 5195366)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report		
				Result	Spike Concentration	Spike Recovery (%)	Acceptable Limits (%)
						LCS	Low	High
EP075G: Chlorinated Hydrocarbons (QCLot: 5195366) - continued								
EP075: 1.4-Dichlorobenzene	106-46-7	2	µg/L	<2	10 µg/L	50.9	34.6	87.6
EP075: 1.3-Dichlorobenzene	541-73-1	2	µg/L	<2	10 µg/L	53.3	33.8	88.4
EP075: 1.2-Dichlorobenzene	95-50-1	2	µg/L	<2	10 µg/L	53.1	35.4	89.4
EP075: Hexachloroethane	67-72-1	2	µg/L	<2	10 µg/L	51.9	29.0	89.2
EP075: 1.2.4-Trichlorobenzene	120-82-1	2	µg/L	<2	10 µg/L	51.0	35.7	87.6
EP075: Hexachloropropylene	1888-71-7	2	µg/L	<2	10 µg/L	47.7	14.5	90.4
EP075: Hexachlorobutadiene	87-68-3	2	µg/L	<2	10 µg/L	52.1	29.6	91.9
EP075: Hexachlorocyclopentadiene	77-47-4	10	µg/L	<10	10 µg/L	33.1	10.0	83.2
EP075: Pentachlorobenzene	608-93-5	2	µg/L	<2	10 µg/L	60.8	35.3	101
EP075: Hexachlorobenzene (HCB)	118-74-1	4	µg/L	<4	10 µg/L	69.3	38.9	105
EP075H: Anilines and Benzidines (QCLot: 5183750)								
EP075: Aniline	62-53-3	2	µg/L	<2	10 µg/L	45.0	24.5	85.1
EP075: 4-Chloroaniline	106-47-8	2	µg/L	<2	10 µg/L	43.8	10.0	107
EP075: 2-Nitroaniline	88-74-4	4	µg/L	<4	10 µg/L	50.4	50.0	150
EP075: 3-Nitroaniline	99-09-2	4	µg/L	<4	10 µg/L	56.4	10.0	139
EP075: Dibenzofuran	132-64-9	2	µg/L	<2	10 µg/L	57.4	39.0	104
EP075: 4-Nitroaniline	100-01-6	2	µg/L	<2	10 µg/L	49.4	17.5	112
EP075: Carbazole	86-74-8	2	µg/L	<2	10 µg/L	78.8	39.5	119
EP075: 3.3`-Dichlorobenzidine	91-94-1	2	µg/L	<2	10 µg/L	68.7	17.3	149
EP075H: Anilines and Benzidines (QCLot: 5195366)								
EP075: Aniline	62-53-3	2	µg/L	<2	10 µg/L	48.9	24.5	85.1
EP075: 4-Chloroaniline	106-47-8	2	µg/L	<2	10 µg/L	45.3	10.0	107
EP075: 2-Nitroaniline	88-74-4	4	µg/L	<4	10 µg/L	50.8	50.0	150
EP075: 3-Nitroaniline	99-09-2	4	µg/L	<4	10 µg/L	59.7	10.0	139
EP075: Dibenzofuran	132-64-9	2	µg/L	<2	10 µg/L	61.0	39.0	104
EP075: 4-Nitroaniline	100-01-6	2	µg/L	<2	10 µg/L	62.4	17.5	112
EP075: Carbazole	86-74-8	2	µg/L	<2	10 µg/L	89.1	39.5	119
EP075: 3.3`-Dichlorobenzidine	91-94-1	2	µg/L	<2	10 µg/L	78.7	17.3	149
EP075I: Organochlorine Pesticides (QCLot: 5183750)								
EP075: alpha-BHC	319-84-6	2	µg/L	<2	10 µg/L	64.3	40.3	120
EP075: beta-BHC	319-85-7	2	µg/L	<2	10 µg/L	70.5	50.0	150
EP075: gamma-BHC	58-89-9	2	µg/L	<2	10 µg/L	66.8	50.0	150
EP075: delta-BHC	319-86-8	2	µg/L	<2	10 µg/L	80.3	44.4	119
EP075: Heptachlor	76-44-8	2	µg/L	<2	10 µg/L	75.5	38.7	110

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report		
					Spike	Spike Recovery (%)	Acceptable Limits (%)
				Result	Concentration	LCS	Low	High
EP075I: Organochlorine Pesticides (QCLot: 5183750) - continued								
EP075: Aldrin	309-00-2	2	µg/L	<2	10 µg/L	75.3	47.2	122
EP075: Heptachlor epoxide	1024-57-3	2	µg/L	<2	10 µg/L	77.6	42.9	114
EP075: alpha-Endosulfan	959-98-8	2	µg/L	<2	10 µg/L	77.6	50.0	150
EP075: 4.4`-DDE	72-55-9	2	µg/L	<2	10 µg/L	76.6	45.3	118
EP075: Dieldrin	60-57-1	2	µg/L	<2	10 µg/L	81.5	48.4	119
EP075: Endrin	72-20-8	2	µg/L	<2	10 µg/L	84.3	33.6	116
EP075: beta-Endosulfan	33213-65-9	2	µg/L	<2	10 µg/L	78.3	50.0	150
EP075: 4.4`-DDD	72-54-8	2	µg/L	<2	10 µg/L	76.4	40.9	123
EP075: Endosulfan sulfate	1031-07-8	2	µg/L	<2	10 µg/L	76.8	36.7	130
EP075: 4.4`-DDT	50-29-3	4	µg/L	<4	10 µg/L	71.2	19.8	117
EP075: Sum of Aldrin + Dieldrin	309-00-2/60-57-1	4	µg/L	<4	----	----	----	----
EP075: Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	4	µg/L	<4	----	----	----	----
EP075I: Organochlorine Pesticides (QCLot: 5195366)								
EP075: alpha-BHC	319-84-6	2	µg/L	<2	10 µg/L	68.8	40.3	120
EP075: beta-BHC	319-85-7	2	µg/L	<2	10 µg/L	82.5	50.0	150
EP075: gamma-BHC	58-89-9	2	µg/L	<2	10 µg/L	72.6	50.0	150
EP075: delta-BHC	319-86-8	2	µg/L	<2	10 µg/L	90.3	44.4	119
EP075: Heptachlor	76-44-8	2	µg/L	<2	10 µg/L	78.3	38.7	110
EP075: Aldrin	309-00-2	2	µg/L	<2	10 µg/L	78.3	47.2	122
EP075: Heptachlor epoxide	1024-57-3	2	µg/L	<2	10 µg/L	87.1	42.9	114
EP075: alpha-Endosulfan	959-98-8	2	µg/L	<2	10 µg/L	100	50.0	150
EP075: 4.4`-DDE	72-55-9	2	µg/L	<2	10 µg/L	86.2	45.3	118
EP075: Dieldrin	60-57-1	2	µg/L	<2	10 µg/L	88.6	48.4	119
EP075: Endrin	72-20-8	2	µg/L	<2	10 µg/L	89.2	33.6	116
EP075: beta-Endosulfan	33213-65-9	2	µg/L	<2	10 µg/L	87.1	50.0	150
EP075: 4.4`-DDD	72-54-8	2	µg/L	<2	10 µg/L	85.0	40.9	123
EP075: Endosulfan sulfate	1031-07-8	2	µg/L	<2	10 µg/L	89.1	36.7	130
EP075: 4.4`-DDT	50-29-3	4	µg/L	<4	10 µg/L	86.2	19.8	117
EP075: Sum of Aldrin + Dieldrin	309-00-2/60-57-1	4	µg/L	<4	----	----	----	----
EP075: Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	4	µg/L	<4	----	----	----	----
EP075J: Organophosphorus Pesticides (QCLot: 5183750)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report		
					Spike	Spike Recovery (%)	Acceptable Limits (%)
				Result	Concentration	LCS	Low	High
EP075J: Organophosphorus Pesticides (QCLot: 5183750) - continued								
EP075: Dichlorvos	62-73-7	2	µg/L	<2	10 µg/L	46.2	34.9	104
EP075: Dimethoate	60-51-5	2	µg/L	<2	10 µg/L	44.6	23.5	107
EP075: Diazinon	333-41-5	2	µg/L	<2	10 µg/L	75.1	41.9	125
EP075: Chlorpyrifos-methyl	5598-13-0	2	µg/L	<2	10 µg/L	76.5	50.0	150
EP075: Malathion	121-75-5	2	µg/L	<2	10 µg/L	70.3	50.0	150
EP075: Fenthion	55-38-9	2	µg/L	<2	10 µg/L	74.9	50.0	150
EP075: Chlorpyrifos	2921-88-2	2	µg/L	<2	10 µg/L	77.6	41.6	118
EP075: Pirimphos-ethyl	23505-41-1	2	µg/L	<2	10 µg/L	77.1	41.7	121
EP075: Chlorfenvinphos	470-90-6	2	µg/L	<2	10 µg/L	62.7	50.0	150
EP075: Prothiofos	34643-46-4	2	µg/L	<2	10 µg/L	76.4	40.5	120
EP075: Ethion	563-12-2	2	µg/L	<2	10 µg/L	65.7	36.6	121
EP075J: Organophosphorus Pesticides (QCLot: 5195366)								
EP075: Dichlorvos	62-73-7	2	µg/L	<2	10 µg/L	52.3	34.9	104
EP075: Dimethoate	60-51-5	2	µg/L	<2	10 µg/L	56.7	23.5	107
EP075: Diazinon	333-41-5	2	µg/L	<2	10 µg/L	82.5	41.9	125
EP075: Chlorpyrifos-methyl	5598-13-0	2	µg/L	<2	10 µg/L	84.3	50.0	150
EP075: Malathion	121-75-5	2	µg/L	<2	10 µg/L	78.0	50.0	150
EP075: Fenthion	55-38-9	2	µg/L	<2	10 µg/L	87.2	50.0	150
EP075: Chlorpyrifos	2921-88-2	2	µg/L	<2	10 µg/L	87.9	41.6	118
EP075: Pirimphos-ethyl	23505-41-1	2	µg/L	<2	10 µg/L	85.5	41.7	121
EP075: Chlorfenvinphos	470-90-6	2	µg/L	<2	10 µg/L	74.0	50.0	150
EP075: Prothiofos	34643-46-4	2	µg/L	<2	10 µg/L	82.2	40.5	120
EP075: Ethion	563-12-2	2	µg/L	<2	10 µg/L	80.7	36.6	121
EP080: BTEXN (QCLot: 5182599)								
EP080: Benzene	71-43-2	1	µg/L	<1	20 µg/L	# 117	84.1	114
EP080: Toluene	108-88-3	2	µg/L	<2	20 µg/L	115	81.0	115
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	20 µg/L	# 120	84.4	113
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	40 µg/L	# 118	84.3	114
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	20 µg/L	# 119	86.5	111
EP080: Naphthalene	91-20-3	5	µg/L	<5	5 µg/L	104	77.0	118

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 5191196)							
EP2309599-002	SED01	EG005T: Arsenic	7440-38-2	50 mg/kg	99.9	70.0	130
		EG005T: Barium	7440-39-3	50 mg/kg	94.6	70.0	130
		EG005T: Beryllium	7440-41-7	50 mg/kg	103	70.0	130
		EG005T: Cadmium	7440-43-9	12.5 mg/kg	93.6	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	92.6	70.0	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	95.2	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	92.8	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	95.1	70.0	130
		EG005T: Manganese	7439-96-5	50 mg/kg	# Not Determined	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	94.3	70.0	130
		EG005T: Zinc	7440-66-6	50 mg/kg	# Not Determined	70.0	130
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 5198928)							
EP2309599-053	TP03_0-0.15	EG005T: Arsenic	7440-38-2	50 mg/kg	107	70.0	130
		EG005T: Barium	7440-39-3	50 mg/kg	102	70.0	130
		EG005T: Beryllium	7440-41-7	50 mg/kg	112	70.0	130
		EG005T: Cadmium	7440-43-9	12.5 mg/kg	100.0	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	101	70.0	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	102	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	105	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	104	70.0	130
		EG005T: Manganese	7439-96-5	50 mg/kg	# Not Determined	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	102	70.0	130
		EG005T: Zinc	7440-66-6	50 mg/kg	109	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 5191197)							
EP2309599-002	SED01	EG035T: Mercury	7439-97-6	1 mg/kg	89.0	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 5198929)							
EP2309599-053	TP03_0-0.15	EG035T: Mercury	7439-97-6	1 mg/kg	92.8	70.0	130
EP068A: Organochlorine Pesticides (OC) (QCLot: 5183509)							
EP2309599-006	TP33_0-0.15	EP068: gamma-BHC	58-89-9	0.5 mg/kg	104	57.9	124
		EP068: Heptachlor	76-44-8	0.5 mg/kg	81.6	57.4	135
		EP068: Aldrin	309-00-2	0.5 mg/kg	116	59.6	125
		EP068: Dieldrin	60-57-1	0.5 mg/kg	104	62.2	131
		EP068: Endrin	72-20-8	0.5 mg/kg	116	55.8	138

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP068A: Organochlorine Pesticides (OC) (QCLot: 5183509) - continued							
EP2309599-006	TP33_0-0.15	EP068: 4.4`-DDT	50-29-3	0.5 mg/kg	84.8	50.5	145
EP068A: Organochlorine Pesticides (OC) (QCLot: 5183514)							
EP2309599-078	TP15_0-0.15	EP068: gamma-BHC	58-89-9	0.5 mg/kg	92.2	57.9	124
		EP068: Heptachlor	76-44-8	0.5 mg/kg	74.4	57.4	135
		EP068: Aldrin	309-00-2	0.5 mg/kg	103	59.6	125
		EP068: Dieldrin	60-57-1	0.5 mg/kg	96.6	62.2	131
		EP068: Endrin	72-20-8	0.5 mg/kg	112	55.8	138
		EP068: 4.4`-DDT	50-29-3	0.5 mg/kg	82.3	50.5	145
EP068A: Organochlorine Pesticides (OC) (QCLot: 5184944)							
EP2309599-050	TP02_0-0.15	EP068: gamma-BHC	58-89-9	0.5 mg/kg	111	57.9	124
		EP068: Heptachlor	76-44-8	0.5 mg/kg	112	57.4	135
		EP068: Aldrin	309-00-2	0.5 mg/kg	125	59.6	125
		EP068: Dieldrin	60-57-1	0.5 mg/kg	122	62.2	131
		EP068: Endrin	72-20-8	0.5 mg/kg	124	55.8	138
		EP068: 4.4`-DDT	50-29-3	0.5 mg/kg	86.8	50.5	145
EP068B: Organophosphorus Pesticides (OP) (QCLot: 5183509)							
EP2309599-006	TP33_0-0.15	EP068: Diazinon	333-41-5	1 mg/kg	110	59.5	128
		EP068: Chlorpyrifos-methyl	5598-13-0	1 mg/kg	112	60.3	128
		EP068: Pirimphos-ethyl	23505-41-1	1 mg/kg	103	58.8	127
		EP068: Bromophos-ethyl	4824-78-6	1 mg/kg	124	60.7	128
		EP068: Prothiofos	34643-46-4	1 mg/kg	99.1	60.0	129
EP068B: Organophosphorus Pesticides (OP) (QCLot: 5183514)							
EP2309599-078	TP15_0-0.15	EP068: Diazinon	333-41-5	1 mg/kg	101	59.5	128
		EP068: Chlorpyrifos-methyl	5598-13-0	1 mg/kg	101	60.3	128
		EP068: Pirimphos-ethyl	23505-41-1	1 mg/kg	92.4	58.8	127
		EP068: Bromophos-ethyl	4824-78-6	1 mg/kg	119	60.7	128
		EP068: Prothiofos	34643-46-4	1 mg/kg	94.6	60.0	129
EP068B: Organophosphorus Pesticides (OP) (QCLot: 5184944)							
EP2309599-050	TP02_0-0.15	EP068: Diazinon	333-41-5	1 mg/kg	119	59.5	128
		EP068: Chlorpyrifos-methyl	5598-13-0	1 mg/kg	112	60.3	128
		EP068: Pirimphos-ethyl	23505-41-1	1 mg/kg	115	58.8	127
		EP068: Bromophos-ethyl	4824-78-6	1 mg/kg	120	60.7	128
		EP068: Prothiofos	34643-46-4	1 mg/kg	112	60.0	129
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 5183490)							
EP2309599-006	TP33_0-0.15	EP074: Benzene	71-43-2	2 mg/kg	88.9	80.6	115
		EP074: Toluene	108-88-3	2 mg/kg	91.6	78.1	119
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 5183495)							

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 5183495) - continued							
EP2309599-078	TP15_0-0.15	EP074: Benzene	71-43-2	2 mg/kg	94.6	80.6	115
		EP074: Toluene	108-88-3	2 mg/kg	93.7	78.1	119
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 5184937)							
EP2309599-050	TP02_0-0.15	EP074: Benzene	71-43-2	2 mg/kg	84.2	80.6	115
		EP074: Toluene	108-88-3	2 mg/kg	79.0	78.1	119
EP074E: Halogenated Aliphatic Compounds (QCLot: 5183490)							
EP2309599-006	TP33_0-0.15	EP074: 1.1-Dichloroethene	75-35-4	2 mg/kg	72.0	68.4	125
		EP074: Trichloroethene	79-01-6	2 mg/kg	82.6	77.4	119
EP074E: Halogenated Aliphatic Compounds (QCLot: 5183495)							
EP2309599-078	TP15_0-0.15	EP074: 1.1-Dichloroethene	75-35-4	2 mg/kg	77.4	68.4	125
		EP074: Trichloroethene	79-01-6	2 mg/kg	89.0	77.4	119
EP074E: Halogenated Aliphatic Compounds (QCLot: 5184937)							
EP2309599-050	TP02_0-0.15	EP074: 1.1-Dichloroethene	75-35-4	2 mg/kg	103	68.4	125
		EP074: Trichloroethene	79-01-6	2 mg/kg	96.8	77.4	119
EP074F: Halogenated Aromatic Compounds (QCLot: 5183490)							
EP2309599-006	TP33_0-0.15	EP074: Chlorobenzene	108-90-7	2 mg/kg	91.8	80.1	117
EP074F: Halogenated Aromatic Compounds (QCLot: 5183495)							
EP2309599-078	TP15_0-0.15	EP074: Chlorobenzene	108-90-7	2 mg/kg	93.2	80.1	117
EP074F: Halogenated Aromatic Compounds (QCLot: 5184937)							
EP2309599-050	TP02_0-0.15	EP074: Chlorobenzene	108-90-7	2 mg/kg	88.7	80.1	117
EP075(SIM)A: Phenolic Compounds (QCLot: 5183508)							
EP2309599-006	TP33_0-0.15	EP075(SIM): Phenol	108-95-2	3 mg/kg	82.7	73.4	135
		EP075(SIM): 2-Chlorophenol	95-57-8	3 mg/kg	85.8	71.7	136
		EP075(SIM): 2-Nitrophenol	88-75-5	3 mg/kg	71.2	62.8	137
		EP075(SIM): 4-Chloro-3-methylphenol	59-50-7	3 mg/kg	75.7	73.6	128
		EP075(SIM): Pentachlorophenol	87-86-5	3 mg/kg	53.6	18.0	152
EP075(SIM)A: Phenolic Compounds (QCLot: 5183516)							
EP2309599-078	TP15_0-0.15	EP075(SIM): Phenol	108-95-2	3 mg/kg	119	73.4	135
		EP075(SIM): 2-Chlorophenol	95-57-8	3 mg/kg	127	71.7	136
		EP075(SIM): 2-Nitrophenol	88-75-5	3 mg/kg	101	62.8	137
		EP075(SIM): 4-Chloro-3-methylphenol	59-50-7	3 mg/kg	109	73.6	128
		EP075(SIM): Pentachlorophenol	87-86-5	3 mg/kg	60.4	18.0	152
EP075(SIM)A: Phenolic Compounds (QCLot: 5184941)							
EP2309599-047	TP01_0-0.15	EP075(SIM): Phenol	108-95-2	3 mg/kg	79.0	73.4	135
		EP075(SIM): 2-Chlorophenol	95-57-8	3 mg/kg	81.0	71.7	136

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP075(SIM)A: Phenolic Compounds (QCLot: 5184941) - continued							
EP2309599-047	TP01_0-0.15	EP075(SIM): 2-Nitrophenol	88-75-5	3 mg/kg	87.5	62.8	137
		EP075(SIM): 4-Chloro-3-methylphenol	59-50-7	3 mg/kg	94.6	73.6	128
		EP075(SIM): Pentachlorophenol	87-86-5	3 mg/kg	122	18.0	152
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 5183508)							
EP2309599-006	TP33_0-0.15	EP075(SIM): Acenaphthene	83-32-9	3 mg/kg	98.1	73.5	125
		EP075(SIM): Pyrene	129-00-0	3 mg/kg	91.2	70.8	125
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 5183516)							
EP2309599-078	TP15_0-0.15	EP075(SIM): Acenaphthene	83-32-9	3 mg/kg	110	73.5	125
		EP075(SIM): Pyrene	129-00-0	3 mg/kg	93.0	70.8	125
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 5184941)							
EP2309599-047	TP01_0-0.15	EP075(SIM): Acenaphthene	83-32-9	3 mg/kg	99.5	73.5	125
		EP075(SIM): Pyrene	129-00-0	3 mg/kg	102	70.8	125
EP075A: Phenolic Compounds (QCLot: 5183510)							
EP2309599-009	TP20_0-0.15	EP075: Phenol	108-95-2	1.5 mg/kg	97.4	61.5	143
		EP075: 2-Chlorophenol	95-57-8	1.5 mg/kg	99.3	59.6	144
		EP075: 2-Nitrophenol	88-75-5	1.5 mg/kg	81.6	62.6	153
		EP075: 4-Chloro-3-methylphenol	59-50-7	1.5 mg/kg	75.8	63.2	141
		EP075: Pentachlorophenol	87-86-5	1.5 mg/kg	78.7	39.6	156
EP075A: Phenolic Compounds (QCLot: 5184945)							
EP2309599-053	TP03_0-0.15	EP075: Phenol	108-95-2	1.5 mg/kg	100	61.5	143
		EP075: 2-Chlorophenol	95-57-8	1.5 mg/kg	102	59.6	144
		EP075: 2-Nitrophenol	88-75-5	1.5 mg/kg	85.4	62.6	153
		EP075: 4-Chloro-3-methylphenol	59-50-7	1.5 mg/kg	85.7	63.2	141
		EP075: Pentachlorophenol	87-86-5	1.5 mg/kg	85.8	39.6	156
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 5183510)							
EP2309599-009	TP20_0-0.15	EP075: Acenaphthene	83-32-9	1.5 mg/kg	98.1	68.0	140
		EP075: Pyrene	129-00-0	1.5 mg/kg	135	69.9	142
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 5184945)							
EP2309599-053	TP03_0-0.15	EP075: Acenaphthene	83-32-9	1.5 mg/kg	102	68.0	140
		EP075: Pyrene	129-00-0	1.5 mg/kg	97.8	69.9	142
EP075D: Nitrosamines (QCLot: 5183510)							
EP2309599-009	TP20_0-0.15	EP075: N-Nitrosodi-n-propylamine	621-64-7	1.5 mg/kg	88.4	43.8	148
EP075D: Nitrosamines (QCLot: 5184945)							
EP2309599-053	TP03_0-0.15	EP075: N-Nitrosodi-n-propylamine	621-64-7	1.5 mg/kg	94.1	43.8	148
EP075E: Nitroaromatics and Ketones (QCLot: 5183510)							
EP2309599-009	TP20_0-0.15						

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP075E: Nitroaromatics and Ketones (QCLot: 5183510) - continued							
EP2309599-009	TP20_0-0.15	EP075: 2.4-Dinitrotoluene	121-14-2	1.5 mg/kg	68.0	66.7	141
EP075E: Nitroaromatics and Ketones (QCLot: 5184945)							
EP2309599-053	TP03_0-0.15	EP075: 2.4-Dinitrotoluene	121-14-2	1.5 mg/kg	70.1	66.7	141
EP075G: Chlorinated Hydrocarbons (QCLot: 5183510)							
EP2309599-009	TP20_0-0.15	EP075: 1.4-Dichlorobenzene	106-46-7	1.5 mg/kg	96.3	52.5	139
		EP075: 1.2.4-Trichlorobenzene	120-82-1	1.5 mg/kg	98.2	64.0	140
EP075G: Chlorinated Hydrocarbons (QCLot: 5184945)							
EP2309599-053	TP03_0-0.15	EP075: 1.4-Dichlorobenzene	106-46-7	1.5 mg/kg	97.1	52.5	139
		EP075: 1.2.4-Trichlorobenzene	120-82-1	1.5 mg/kg	100	64.0	140
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5183489)							
EP2309599-006	TP33_0-0.15	EP080: C6 - C9 Fraction	----	24 mg/kg	89.7	69.1	135
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5183496)							
EP2309599-078	TP15_0-0.15	EP080: C6 - C9 Fraction	----	24 mg/kg	93.3	69.1	135
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5183507)							
EP2309599-006	TP33_0-0.15	EP071: C10 - C14 Fraction	----	1303 mg/kg	104	64.7	126
		EP071: C15 - C28 Fraction	----	2379 mg/kg	101	61.7	124
		EP071: C29 - C36 Fraction	----	336 mg/kg	97.9	64.6	131
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5183515)							
EP2309599-078	TP15_0-0.15	EP071: C10 - C14 Fraction	----	1303 mg/kg	105	64.7	126
		EP071: C15 - C28 Fraction	----	2379 mg/kg	102	61.7	124
		EP071: C29 - C36 Fraction	----	336 mg/kg	99.7	64.6	131
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5184936)							
EP2309599-050	TP02_0-0.15	EP080: C6 - C9 Fraction	----	24 mg/kg	87.0	69.1	135
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5184943)							
EP2309599-047	TP01_0-0.15	EP071: C10 - C14 Fraction	----	1303 mg/kg	104	64.7	126
		EP071: C15 - C28 Fraction	----	2379 mg/kg	100	61.7	124
		EP071: C29 - C36 Fraction	----	336 mg/kg	109	64.6	131
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5190120)							
EP2309710-005	Anonymous	EP080: C6 - C9 Fraction	----	24 mg/kg	79.7	69.1	135
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5190125)							
EP2309599-072	Dup03	EP071: C10 - C14 Fraction	----	1303 mg/kg	116	64.7	126
		EP071: C15 - C28 Fraction	----	2379 mg/kg	108	61.7	124
		EP071: C29 - C36 Fraction	----	336 mg/kg	122	64.6	131
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5183489)							
EP2309599-006	TP33_0-0.15	EP080: C6 - C10 Fraction	C6_C10	29 mg/kg	84.1	69.1	135

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Matrix Spike (MS) Report: Acceptable Limits (%) Low	Matrix Spike (MS) Report: Acceptable Limits (%) High
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5183496)							
EP2309599-078	TP15_0-0.15	EP080: C6 - C10 Fraction	C6_C10	29 mg/kg	87.8	69.1	135
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5183507)							
EP2309599-006	TP33_0-0.15	EP071: >C10 - C16 Fraction	----	1797 mg/kg	103	64.7	126
		EP071: >C16 - C34 Fraction	----	2060 mg/kg	102	61.7	124
		EP071: >C34 - C40 Fraction	----	100 mg/kg	97.8	64.6	131
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5183515)							
EP2309599-078	TP15_0-0.15	EP071: >C10 - C16 Fraction	----	1797 mg/kg	104	64.7	126
		EP071: >C16 - C34 Fraction	----	2060 mg/kg	102	61.7	124
		EP071: >C34 - C40 Fraction	----	100 mg/kg	97.2	64.6	131
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5184936)							
EP2309599-050	TP02_0-0.15	EP080: C6 - C10 Fraction	C6_C10	29 mg/kg	84.7	69.1	135
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5184943)							
EP2309599-047	TP01_0-0.15	EP071: >C10 - C16 Fraction	----	1797 mg/kg	104	64.7	126
		EP071: >C16 - C34 Fraction	----	2060 mg/kg	102	61.7	124
		EP071: >C34 - C40 Fraction	----	100 mg/kg	126	64.6	131
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5190120)							
EP2309710-005	Anonymous	EP080: C6 - C10 Fraction	C6_C10	29 mg/kg	77.4	69.1	135
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5190125)							
EP2309599-072	Dup03	EP071: >C10 - C16 Fraction	----	1797 mg/kg	113	64.7	126
		EP071: >C16 - C34 Fraction	----	2060 mg/kg	109	61.7	124
		EP071: >C34 - C40 Fraction	----	100 mg/kg	118	64.6	131
EP080: BTEXN (QCLot: 5183489)							
EP2309599-006	TP33_0-0.15	EP080: Benzene	71-43-2	2 mg/kg	94.7	76.4	118
		EP080: Toluene	108-88-3	2 mg/kg	99.6	67.4	112
EP080: BTEXN (QCLot: 5183496)							
EP2309599-078	TP15_0-0.15	EP080: Benzene	71-43-2	2 mg/kg	101	76.4	118
		EP080: Toluene	108-88-3	2 mg/kg	101	67.4	112
EP080: BTEXN (QCLot: 5184936)							
EP2309599-050	TP02_0-0.15	EP080: Benzene	71-43-2	2 mg/kg	99.5	76.4	118
		EP080: Toluene	108-88-3	2 mg/kg	71.8	67.4	112
EP080: BTEXN (QCLot: 5190120)							
EP2309710-005	Anonymous	EP080: Benzene	71-43-2	2 mg/kg	95.4	76.4	118
		EP080: Toluene	108-88-3	2 mg/kg	85.4	67.4	112

Sub-Matrix: **WATER**

Matrix Spike (MS) Report: Spike	Matrix Spike (MS) Report: SpikeRecovery(%)	Matrix Spike (MS) Report: Acceptable Limits (%)

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 5196768)							
EP2309599-071	RN/FB02	EG020A-F: Arsenic	7440-38-2	0.2 mg/L	90.0	70.0	130
		EG020A-F: Beryllium	7440-41-7	0.2 mg/L	98.4	70.0	130
		EG020A-F: Barium	7440-39-3	0.2 mg/L	88.1	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	94.2	70.0	130
		EG020A-F: Chromium	7440-47-3	0.2 mg/L	97.1	70.0	130
		EG020A-F: Cobalt	7440-48-4	0.2 mg/L	93.0	70.0	130
		EG020A-F: Copper	7440-50-8	0.2 mg/L	91.1	70.0	130
		EG020A-F: Lead	7439-92-1	0.2 mg/L	86.2	70.0	130
		EG020A-F: Manganese	7439-96-5	0.2 mg/L	96.2	70.0	130
		EG020A-F: Nickel	7440-02-0	0.2 mg/L	93.6	70.0	130
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	91.2	70.0	130
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 5182598)							
EP2309599-071	RN/FB02	EP074: Benzene	71-43-2	20 µg/L	112	82.7	115
		EP074: Toluene	108-88-3	20 µg/L	107	77.1	118
EP074E: Halogenated Aliphatic Compounds (QCLot: 5182598)							
EP2309599-071	RN/FB02	EP074: 1.1-Dichloroethene	75-35-4	20 µg/L	106	73.7	126
		EP074: Trichloroethene	79-01-6	20 µg/L	101	79.1	120
EP074F: Halogenated Aromatic Compounds (QCLot: 5182598)							
EP2309599-071	RN/FB02	EP074: Chlorobenzene	108-90-7	20 µg/L	105	81.4	115
EP080: BTEXN (QCLot: 5182599)							
EP2309599-071	RN/FB02	EP080: Benzene	71-43-2	20 µg/L	111	77.0	122
		EP080: Toluene	108-88-3	20 µg/L	116	73.5	126

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP2309599**	Page	: 1 of 21
Client	: **WESTERN ENVIRONMENTAL P/L**	Laboratory	: Environmental Division Perth
Contact	: Louis Grogan	Telephone	: +61-8-9406 1301
Project	: P22.142	Date Samples Received	: 14-Jul-2023
Site	: ----	Issue Date	: 31-Jul-2023
Sampler	: JADE DENNIS, Louis Grogan	No. of samples received	: 113
Order number	: P22.114	No. of samples analysed	: 41

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **Laboratory Control outliers exist - please see following pages for full details.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Laboratory Control Spike (LCS) Recoveries							
EP075E: Nitroaromatics and Ketones	QC-5184945-002	----	**1-Naphthylamine**	134-32-7	113 %	5.90-80.0%	**Recovery greater than upper control limit**
EP075E: Nitroaromatics and Ketones	QC-5184945-002	----	**4-Nitroquinoline-N-oxide**	56-57-5	173 %	21.1-161%	**Recovery greater than upper control limit**
EP075H: Anilines and Benzidines	QC-5183510-002	----	**4-Chloroaniline**	106-47-8	85.5 %	13.9-74.0%	**Recovery greater than upper control limit**
EP075H: Anilines and Benzidines	QC-5183517-002	----	**4-Chloroaniline**	106-47-8	80.9 %	13.9-74.0%	**Recovery greater than upper control limit**
EP075H: Anilines and Benzidines	QC-5184945-002	----	**4-Chloroaniline**	106-47-8	86.6 %	13.9-74.0%	**Recovery greater than upper control limit**
Matrix Spike (MS) Recoveries							
EG005(ED093)T: Total Metals by ICP-AES	EP2309599--002	SED01	**Manganese**	7439-96-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EG005(ED093)T: Total Metals by ICP-AES	EP2309599--053	TP03_0-0.15	**Manganese**	7439-96-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EG005(ED093)T: Total Metals by ICP-AES	EP2309599--002	SED01	**Zinc**	7440-66-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Laboratory Control Spike (LCS) Recoveries							
EP074E: Halogenated Aliphatic Compounds	QC-5182598-002	----	**Tetrachloroethene**	127-18-4	123 %	78.9-121%	**Recovery greater than upper control limit**
EP074F: Halogenated Aromatic Compounds	QC-5182598-002	----	**4-Chlorotoluene**	106-43-4	119 %	84.2-115%	**Recovery greater than upper control limit**
EP075D: Nitrosamines	QC-5183750-002	----	**Methapyrilene**	91-80-5	4.2 %	10.0-127%	**Recovery less than lower control limit**
EP075D: Nitrosamines	QC-5195366-002	----	**Methapyrilene**	91-80-5	3.8 %	10.0-127%	**Recovery less than lower control limit**
EP080: BTEXN	QC-5182599-001	----	**Benzene**	71-43-2	117 %	84.1-114%	**Recovery greater than upper control limit**
EP080: BTEXN	QC-5182599-001	----	**Ethylbenzene**	100-41-4	120 %	84.4-113%	**Recovery greater than upper control limit**
EP080: BTEXN	QC-5182599-001	----	**meta- & para-Xylene**	108-38-3 106-42-3	118 %	84.3-114%	**Recovery greater than upper control limit**
EP080: BTEXN	QC-5182599-001	----	**ortho-Xylene**	95-47-6	119 %	86.5-111%	**Recovery greater than upper control limit**

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Days overdue	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Days overdue
EA002: pH 1:5 (Soils)						
Soil Glass Jar - Unpreserved						
BG01	28-Jul-2023	20-Jul-2023	**8**	----	----	----
EP074A: Monocyclic Aromatic Hydrocarbons						
Soil Glass Jar - Unpreserved						
TP02_0-0.15, TP03_0-0.15, TP05_0-0.15, TP06_0-0.15, Dup03	----	----	----	22-Jul-2023	21-Jul-2023	**1**
EP074B: Oxygenated Compounds						
Soil Glass Jar - Unpreserved						
TP02_0-0.15, TP03_0-0.15, TP05_0-0.15, TP06_0-0.15, Dup03	----	----	----	22-Jul-2023	21-Jul-2023	**1**
EP074C: Sulfonated Compounds						
Soil Glass Jar - Unpreserved						
TP02_0-0.15, TP03_0-0.15, TP05_0-0.15, TP06_0-0.15, Dup03	----	----	----	22-Jul-2023	21-Jul-2023	**1**
EP074D: Fumigants						
Soil Glass Jar - Unpreserved						
TP02_0-0.15, TP03_0-0.15, TP05_0-0.15, TP06_0-0.15, Dup03	----	----	----	22-Jul-2023	21-Jul-2023	**1**
EP074E: Halogenated Aliphatic Compounds						
Soil Glass Jar - Unpreserved						
TP02_0-0.15, TP03_0-0.15, TP05_0-0.15, TP06_0-0.15, Dup03	----	----	----	22-Jul-2023	21-Jul-2023	**1**
EP074F: Halogenated Aromatic Compounds						
Soil Glass Jar - Unpreserved						
TP02_0-0.15, TP03_0-0.15, TP05_0-0.15, TP06_0-0.15, Dup03	----	----	----	22-Jul-2023	21-Jul-2023	**1**
EP074G: Trihalomethanes						
Soil Glass Jar - Unpreserved						
TP02_0-0.15, TP03_0-0.15, TP05_0-0.15, TP06_0-0.15, Dup03	----	----	----	22-Jul-2023	21-Jul-2023	**1**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
	0				
Matrix Spikes (MS)					
Semivolatile Organic Compounds	0	2	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / *Container* / Client Sample ID(s)	*Sample Date*	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EA002: pH 1:5 (Soils)							
Soil Glass Jar - Unpreserved (EA002)							
BG01	**13-Jul-2023**	**28-Jul-2023**	20-Jul-2023	×	**28-Jul-2023**	28-Jul-2023	✓
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055)							
TP25_0-0.15	**13-Jul-2023**	**----**	----	----	**20-Jul-2023**	27-Jul-2023	✓
Soil Glass Jar - Unpreserved (EA055)							
SED01, TB01, Dup01, TP33_0-0.15, TP20_0-0.15, TP34_0-0.15, TP26_0-0.15, TP27_0-0.15, TP12_0-0.15, TP11_0-0.15, TP13_0-0.15, TP07_0-0.15, TP10_0-0.15, TP08_0-0.15, TP09_0-0.15	**13-Jul-2023**	**----**	----	----	**24-Jul-2023**	27-Jul-2023	✓
Soil Glass Jar - Unpreserved (EA055)							
TP14_0-0.15, TP15_0-0.15, TP16_0-0.15, TP17_0-0.15, TP18_0-0.15, TP19_0-0.15, TP21_0-0.15, TP22_0-0.15, TP28_0-0.15, TP29_0-0.15, TP30_0-0.15, TP31_0-0.15, TP32_0-0.15	**13-Jul-2023**	**----**	----	----	**25-Jul-2023**	27-Jul-2023	✓
Soil Glass Jar - Unpreserved (EA055)							
BG01	**13-Jul-2023**	**----**	----	----	**26-Jul-2023**	27-Jul-2023	✓
Soil Glass Jar - Unpreserved (EA055)							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C) - Continued							
TP01_0-0.15, TP02_0-0.15, TP03_0-0.15, TP04_0-0.15, TP05_0-0.15, TP06_0-0.15, TP23_0-0.15, TP24_0-0.15, Dup03	**14-Jul-2023**	**----**	----	**----**	**24-Jul-2023**	28-Jul-2023	✓
EA150: Soil Classification based on Particle Size							
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H)							
BG01	**13-Jul-2023**	**----**	----	**----**	**28-Jul-2023**	09-Jan-2024	✓
EA152: Soil Particle Density							
Snap Lock Bag - Friable Asbestos/PSD Bag (EA152)							
BG01	**13-Jul-2023**	**----**	----	**----**	**28-Jul-2023**	09-Jan-2024	✓
ED007: Exchangeable Cations							
Soil Glass Jar - Unpreserved (ED007)							
BG01	**13-Jul-2023**	**28-Jul-2023**	10-Aug-2023	✓	**31-Jul-2023**	10-Aug-2023	✓
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
SED01, Dup01, TP33_0-0.15, TP20_0-0.15, TP34_0-0.15, TP26_0-0.15, TP27_0-0.15, TP12_0-0.15, TP11_0-0.15, TP13_0-0.15, TP07_0-0.15, TP10_0-0.15, TP08_0-0.15, TP09_0-0.15, TP25_0-0.15, BG01, TP14_0-0.15, TP15_0-0.15, TP16_0-0.15, TP17_0-0.15, TP18_0-0.15, TP19_0-0.15, TP21_0-0.15, TP22_0-0.15, TP28_0-0.15, TP29_0-0.15, TP30_0-0.15, TP31_0-0.15, TP32_0-0.15	**13-Jul-2023**	**28-Jul-2023**	09-Jan-2024	✓	**31-Jul-2023**	09-Jan-2024	✓
Soil Glass Jar - Unpreserved (EG005T)							
TP01_0-0.15, TP02_0-0.15, TP03_0-0.15, TP04_0-0.15, TP05_0-0.15, TP06_0-0.15, TP23_0-0.15, TP24_0-0.15, Dup03	**14-Jul-2023**	**28-Jul-2023**	10-Jan-2024	✓	**31-Jul-2023**	10-Jan-2024	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
SED01, TP33_0-0.15, TP20_0-0.15, TP34_0-0.15, TP26_0-0.15, TP27_0-0.15, TP13_0-0.15, TP07_0-0.15, TP10_0-0.15, TP08_0-0.15, TP09_0-0.15, TP25_0-0.15, TP16_0-0.15, TP17_0-0.15, TP28_0-0.15, TP29_0-0.15, TP30_0-0.15, TP31_0-0.15, TP32_0-0.15	**13-Jul-2023**	**28-Jul-2023**	10-Aug-2023	✓	**28-Jul-2023**	10-Aug-2023	✓
Soil Glass Jar - Unpreserved (EG035T)							
TP02_0-0.15, TP03_0-0.15, TP04_0-0.15, TP05_0-0.15, TP06_0-0.15, TP23_0-0.15, TP24_0-0.15	**14-Jul-2023**	**28-Jul-2023**	11-Aug-2023	✓	**28-Jul-2023**	11-Aug-2023	✓
EP004: Organic Matter							
Soil Glass Jar - Unpreserved (EP004)							
BG01	**13-Jul-2023**	**28-Jul-2023**	10-Aug-2023	✓	**28-Jul-2023**	10-Aug-2023	✓
EP068A: Organochlorine Pesticides (OC)							
Soil Glass Jar - Unpreserved (EP068)							
TP33_0-0.15, TP34_0-0.15, TP26_0-0.15, TP27_0-0.15, TP12_0-0.15, TP11_0-0.15, TP07_0-0.15, TP09_0-0.15, TP25_0-0.15, TP14_0-0.15, TP15_0-0.15, TP17_0-0.15, TP22_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP068)							
TP18_0-0.15, TP19_0-0.15, TP21_0-0.15, TP28_0-0.15, TP29_0-0.15, TP30_0-0.15, TP31_0-0.15, TP32_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP068)							
TP01_0-0.15, TP04_0-0.15, TP23_0-0.15, TP24_0-0.15	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**25-Jul-2023**	02-Sep-2023	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP068B: Organophosphorus Pesticides (OP)							
Soil Glass Jar - Unpreserved (EP068)							
TP33_0-0.15, TP34_0-0.15, TP26_0-0.15, TP27_0-0.15, TP12_0-0.15, TP11_0-0.15, TP07_0-0.15, TP09_0-0.15, TP25_0-0.15, TP14_0-0.15, TP15_0-0.15, TP17_0-0.15, TP22_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP068)							
TP18_0-0.15, TP19_0-0.15, TP21_0-0.15, TP28_0-0.15, TP29_0-0.15, TP30_0-0.15, TP31_0-0.15, TP32_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP068)							
TP01_0-0.15, TP04_0-0.15, TP23_0-0.15, TP24_0-0.15	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**25-Jul-2023**	02-Sep-2023	✓
EP074A: Monocyclic Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP074)							
Dup01, TP20_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP16_0-0.15	**13-Jul-2023**	**20-Jul-2023**	20-Jul-2023	✓	**20-Jul-2023**	20-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP074)							
TP02_0-0.15, TP03_0-0.15, TP05_0-0.15, TP06_0-0.15, Dup03	**14-Jul-2023**	**21-Jul-2023**	21-Jul-2023	✓	**22-Jul-2023**	21-Jul-2023	×
EP074B: Oxygenated Compounds							
Soil Glass Jar - Unpreserved (EP074)							
Dup01, TP20_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP16_0-0.15	**13-Jul-2023**	**20-Jul-2023**	20-Jul-2023	✓	**20-Jul-2023**	20-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP074)							
TP02_0-0.15, TP03_0-0.15, TP05_0-0.15, TP06_0-0.15, Dup03	**14-Jul-2023**	**21-Jul-2023**	21-Jul-2023	✓	**22-Jul-2023**	21-Jul-2023	×

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP074C: Sulfonated Compounds							
Soil Glass Jar - Unpreserved (EP074)							
Dup01, TP20_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP16_0-0.15	**13-Jul-2023**	**20-Jul-2023**	20-Jul-2023	✓	**20-Jul-2023**	20-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP074)							
TP02_0-0.15, TP03_0-0.15, TP05_0-0.15, TP06_0-0.15, Dup03	**14-Jul-2023**	**21-Jul-2023**	21-Jul-2023	✓	**22-Jul-2023**	21-Jul-2023	×
EP074D: Fumigants							
Soil Glass Jar - Unpreserved (EP074)							
Dup01, TP20_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP16_0-0.15	**13-Jul-2023**	**20-Jul-2023**	20-Jul-2023	✓	**20-Jul-2023**	20-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP074)							
TP02_0-0.15, TP03_0-0.15, TP05_0-0.15, TP06_0-0.15, Dup03	**14-Jul-2023**	**21-Jul-2023**	21-Jul-2023	✓	**22-Jul-2023**	21-Jul-2023	×
EP074E: Halogenated Aliphatic Compounds							
Soil Glass Jar - Unpreserved (EP074)							
Dup01, TP20_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP16_0-0.15	**13-Jul-2023**	**20-Jul-2023**	20-Jul-2023	✓	**20-Jul-2023**	20-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP074)							
TP02_0-0.15, TP03_0-0.15, TP05_0-0.15, TP06_0-0.15, Dup03	**14-Jul-2023**	**21-Jul-2023**	21-Jul-2023	✓	**22-Jul-2023**	21-Jul-2023	×
EP074F: Halogenated Aromatic Compounds							
Soil Glass Jar - Unpreserved (EP074)							
Dup01, TP20_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP16_0-0.15	**13-Jul-2023**	**20-Jul-2023**	20-Jul-2023	✓	**20-Jul-2023**	20-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP074)							
TP02_0-0.15, TP03_0-0.15, TP05_0-0.15, TP06_0-0.15, Dup03	**14-Jul-2023**	**21-Jul-2023**	21-Jul-2023	✓	**22-Jul-2023**	21-Jul-2023	×

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP074G: Trihalomethanes							
Soil Glass Jar - Unpreserved (EP074)							
Dup01, TP20_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP16_0-0.15	**13-Jul-2023**	**20-Jul-2023**	20-Jul-2023	✓	**20-Jul-2023**	20-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP074)							
TP02_0-0.15, TP03_0-0.15, TP05_0-0.15, TP06_0-0.15, Dup03	**14-Jul-2023**	**21-Jul-2023**	21-Jul-2023	✓	**22-Jul-2023**	21-Jul-2023	×
EP075(SIM)A: Phenolic Compounds							
Soil Glass Jar - Unpreserved (EP075(SIM))							
TP12_0-0.15, TP11_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075(SIM))							
TP14_0-0.15, TP15_0-0.15, TP18_0-0.15, TP19_0-0.15, TP21_0-0.15, TP22_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**24-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075(SIM))							
SED01	**13-Jul-2023**	**24-Jul-2023**	27-Jul-2023	✓	**26-Jul-2023**	02-Sep-2023	✓
Soil Glass Jar - Unpreserved (EP075(SIM))							
TP01_0-0.15	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**26-Jul-2023**	02-Sep-2023	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))							
TP12_0-0.15, TP11_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075(SIM))							
TP14_0-0.15, TP15_0-0.15, TP18_0-0.15, TP19_0-0.15, TP21_0-0.15, TP22_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**24-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075(SIM))							
SED01	**13-Jul-2023**	**24-Jul-2023**	27-Jul-2023	✓	**26-Jul-2023**	02-Sep-2023	✓
Soil Glass Jar - Unpreserved (EP075(SIM))							
TP01_0-0.15	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**26-Jul-2023**	02-Sep-2023	✓
EP075A: Phenolic Compounds							
Soil Glass Jar - Unpreserved (EP075)							
Dup01	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075)							
TP20_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP16_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075)							
TP02_0-0.15, TP03_0-0.15, TP05_0-0.15	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**25-Jul-2023**	02-Sep-2023	✓
Soil Glass Jar - Unpreserved (EP075)							
TP06_0-0.15, Dup03	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**26-Jul-2023**	02-Sep-2023	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075) Dup01	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP20_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP16_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP02_0-0.15, TP03_0-0.15, TP05_0-0.15	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**25-Jul-2023**	02-Sep-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP06_0-0.15, Dup03	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**26-Jul-2023**	02-Sep-2023	✓
EP075C: Phthalate Esters							
Soil Glass Jar - Unpreserved (EP075) Dup01	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP20_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP16_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP02_0-0.15, TP03_0-0.15, TP05_0-0.15	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**25-Jul-2023**	02-Sep-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP06_0-0.15, Dup03	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**26-Jul-2023**	02-Sep-2023	✓
EP075D: Nitrosamines							
Soil Glass Jar - Unpreserved (EP075) Dup01	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP20_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP16_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP02_0-0.15, TP03_0-0.15, TP05_0-0.15	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**25-Jul-2023**	02-Sep-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP06_0-0.15, Dup03	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**26-Jul-2023**	02-Sep-2023	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075E: Nitroaromatics and Ketones							
Soil Glass Jar - Unpreserved (EP075) Dup01	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP20_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP16_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP02_0-0.15, TP03_0-0.15, TP05_0-0.15	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**25-Jul-2023**	02-Sep-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP06_0-0.15, Dup03	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**26-Jul-2023**	02-Sep-2023	✓
EP075F: Haloethers							
Soil Glass Jar - Unpreserved (EP075) Dup01	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP20_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP16_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP02_0-0.15, TP03_0-0.15, TP05_0-0.15	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**25-Jul-2023**	02-Sep-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP06_0-0.15, Dup03	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**26-Jul-2023**	02-Sep-2023	✓
EP075G: Chlorinated Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075) Dup01	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP20_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP16_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP02_0-0.15, TP03_0-0.15, TP05_0-0.15	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**25-Jul-2023**	02-Sep-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP06_0-0.15, Dup03	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**26-Jul-2023**	02-Sep-2023	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075H: Anilines and Benzidines							
Soil Glass Jar - Unpreserved (EP075) Dup01	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP20_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP16_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP02_0-0.15, TP03_0-0.15, TP05_0-0.15	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**25-Jul-2023**	02-Sep-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP06_0-0.15, Dup03	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**26-Jul-2023**	02-Sep-2023	✓
EP075I: Organochlorine Pesticides							
Soil Glass Jar - Unpreserved (EP075) Dup01	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP20_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP16_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP02_0-0.15, TP03_0-0.15, TP05_0-0.15	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**25-Jul-2023**	02-Sep-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP06_0-0.15, Dup03	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**26-Jul-2023**	02-Sep-2023	✓
EP075J: Organophosphorus Pesticides							
Soil Glass Jar - Unpreserved (EP075) Dup01	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP20_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP16_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP02_0-0.15, TP03_0-0.15, TP05_0-0.15	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**25-Jul-2023**	02-Sep-2023	✓
Soil Glass Jar - Unpreserved (EP075) TP06_0-0.15, Dup03	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**26-Jul-2023**	02-Sep-2023	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080)							
Dup01, TP20_0-0.15, TP12_0-0.15, TP11_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP14_0-0.15, TP15_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**20-Jul-2023**	27-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP080)							
TP10_0-0.15, TP08_0-0.15, TP14_0-0.15, TP15_0-0.15, TP18_0-0.15, TP19_0-0.15, TP21_0-0.15, TP22_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	27-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP071)							
Dup01, TP20_0-0.15, TP12_0-0.15, TP11_0-0.15, TP13_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP080)							
SED01, TB01	**13-Jul-2023**	**21-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	27-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP071)							
SED01	**13-Jul-2023**	**24-Jul-2023**	27-Jul-2023	✓	**25-Jul-2023**	02-Sep-2023	✓
Soil Glass Jar - Unpreserved (EP080)							
TP16_0-0.15	**13-Jul-2023**	**25-Jul-2023**	27-Jul-2023	✓	**26-Jul-2023**	27-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP071)							
TP16_0-0.15	**13-Jul-2023**	**26-Jul-2023**	27-Jul-2023	✓	**26-Jul-2023**	04-Sep-2023	✓
Soil Glass Jar - Unpreserved (EP080)							
TP01_0-0.15, TP02_0-0.15, TP03_0-0.15, TP05_0-0.15	**14-Jul-2023**	**21-Jul-2023**	28-Jul-2023	✓	**22-Jul-2023**	28-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP071)							
TP01_0-0.15, TP02_0-0.15, TP03_0-0.15, TP05_0-0.15	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**25-Jul-2023**	02-Sep-2023	✓
Soil Glass Jar - Unpreserved (EP080)							
TP06_0-0.15, Dup03	**14-Jul-2023**	**25-Jul-2023**	28-Jul-2023	✓	**26-Jul-2023**	28-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP071)							
TP06_0-0.15, Dup03	**14-Jul-2023**	**26-Jul-2023**	28-Jul-2023	✓	**26-Jul-2023**	04-Sep-2023	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP080)							
Dup01, TP20_0-0.15, TP12_0-0.15, TP11_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP14_0-0.15, TP15_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**20-Jul-2023**	27-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP080)							
TP10_0-0.15, TP08_0-0.15, TP14_0-0.15, TP15_0-0.15, TP18_0-0.15, TP19_0-0.15, TP21_0-0.15, TP22_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	27-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP071)							
Dup01, TP20_0-0.15, TP12_0-0.15, TP11_0-0.15, TP13_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	29-Aug-2023	✓
Soil Glass Jar - Unpreserved (EP080)							
SED01, TB01	**13-Jul-2023**	**21-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	27-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP071)							
SED01	**13-Jul-2023**	**24-Jul-2023**	27-Jul-2023	✓	**25-Jul-2023**	02-Sep-2023	✓
Soil Glass Jar - Unpreserved (EP080)							
TP16_0-0.15	**13-Jul-2023**	**25-Jul-2023**	27-Jul-2023	✓	**26-Jul-2023**	27-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP071)							
TP16_0-0.15	**13-Jul-2023**	**26-Jul-2023**	27-Jul-2023	✓	**26-Jul-2023**	04-Sep-2023	✓
Soil Glass Jar - Unpreserved (EP080)							
TP01_0-0.15, TP02_0-0.15, TP03_0-0.15, TP05_0-0.15	**14-Jul-2023**	**21-Jul-2023**	28-Jul-2023	✓	**22-Jul-2023**	28-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP071)							
TP01_0-0.15, TP02_0-0.15, TP03_0-0.15, TP05_0-0.15	**14-Jul-2023**	**24-Jul-2023**	28-Jul-2023	✓	**25-Jul-2023**	02-Sep-2023	✓
Soil Glass Jar - Unpreserved (EP080)							
TP06_0-0.15, Dup03	**14-Jul-2023**	**25-Jul-2023**	28-Jul-2023	✓	**26-Jul-2023**	28-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP071)							
TP06_0-0.15, Dup03	**14-Jul-2023**	**26-Jul-2023**	28-Jul-2023	✓	**26-Jul-2023**	04-Sep-2023	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080) Dup01, TP20_0-0.15, TP12_0-0.15, TP11_0-0.15, TP13_0-0.15, TP10_0-0.15, TP08_0-0.15, TP14_0-0.15, TP15_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**20-Jul-2023**	27-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP080) TP18_0-0.15, TP19_0-0.15, TP21_0-0.15, TP22_0-0.15	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	27-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP080) SED01, TB01	**13-Jul-2023**	**21-Jul-2023**	27-Jul-2023	✓	**22-Jul-2023**	27-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP080) TP16_0-0.15	**13-Jul-2023**	**25-Jul-2023**	27-Jul-2023	✓	**26-Jul-2023**	27-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP080) TP01_0-0.15, TP02_0-0.15, TP03_0-0.15, TP05_0-0.15	**14-Jul-2023**	**21-Jul-2023**	28-Jul-2023	✓	**22-Jul-2023**	28-Jul-2023	✓
Soil Glass Jar - Unpreserved (EP080) TP06_0-0.15, Dup03	**14-Jul-2023**	**25-Jul-2023**	28-Jul-2023	✓	**26-Jul-2023**	28-Jul-2023	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020F: Dissolved Metals by ICP-MS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG020A-F) RN/FB01	**13-Jul-2023**	**----**	----	----	**28-Jul-2023**	09-Jan-2024	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG020A-F) RN/FB02	**14-Jul-2023**	**----**	----	----	**28-Jul-2023**	10-Jan-2024	✓
EP074A: Monocyclic Aromatic Hydrocarbons							
Amber VOC Vial - Sulfuric Acid (EP074) RN/FB01	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	27-Jul-2023	✓
Amber VOC Vial - Sulfuric Acid (EP074) RN/FB02	**14-Jul-2023**	**20-Jul-2023**	28-Jul-2023	✓	**21-Jul-2023**	28-Jul-2023	✓
EP074B: Oxygenated Compounds							
Amber VOC Vial - Sulfuric Acid (EP074) RN/FB01	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	27-Jul-2023	✓
Amber VOC Vial - Sulfuric Acid (EP074) RN/FB02	**14-Jul-2023**	**20-Jul-2023**	28-Jul-2023	✓	**21-Jul-2023**	28-Jul-2023	✓
EP074C: Sulfonated Compounds							
Amber VOC Vial - Sulfuric Acid (EP074) RN/FB01	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	27-Jul-2023	✓
Amber VOC Vial - Sulfuric Acid (EP074) RN/FB02	**14-Jul-2023**	**20-Jul-2023**	28-Jul-2023	✓	**21-Jul-2023**	28-Jul-2023	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP074D: Fumigants							
Amber VOC Vial - Sulfuric Acid (EP074) RN/FB01	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	27-Jul-2023	✓
Amber VOC Vial - Sulfuric Acid (EP074) RN/FB02	**14-Jul-2023**	**20-Jul-2023**	28-Jul-2023	✓	**21-Jul-2023**	28-Jul-2023	✓
EP074E: Halogenated Aliphatic Compounds							
Amber VOC Vial - Sulfuric Acid (EP074) RN/FB01	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	27-Jul-2023	✓
Amber VOC Vial - Sulfuric Acid (EP074) RN/FB02	**14-Jul-2023**	**20-Jul-2023**	28-Jul-2023	✓	**21-Jul-2023**	28-Jul-2023	✓
EP074F: Halogenated Aromatic Compounds							
Amber VOC Vial - Sulfuric Acid (EP074) RN/FB01	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	27-Jul-2023	✓
Amber VOC Vial - Sulfuric Acid (EP074) RN/FB02	**14-Jul-2023**	**20-Jul-2023**	28-Jul-2023	✓	**21-Jul-2023**	28-Jul-2023	✓
EP074G: Trihalomethanes							
Amber VOC Vial - Sulfuric Acid (EP074) RN/FB01	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	27-Jul-2023	✓
Amber VOC Vial - Sulfuric Acid (EP074) RN/FB02	**14-Jul-2023**	**20-Jul-2023**	28-Jul-2023	✓	**21-Jul-2023**	28-Jul-2023	✓
EP075A: Phenolic Compounds							
Amber Glass Bottle - Unpreserved (EP075) RN/FB01	**13-Jul-2023**	**20-Jul-2023**	20-Jul-2023	✓	**27-Jul-2023**	29-Aug-2023	✓
Amber Glass Bottle - Unpreserved (EP075) RN/FB02	**14-Jul-2023**	**21-Jul-2023**	21-Jul-2023	✓	**27-Jul-2023**	30-Aug-2023	✓
EP075B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075) RN/FB01	**13-Jul-2023**	**20-Jul-2023**	20-Jul-2023	✓	**27-Jul-2023**	29-Aug-2023	✓
Amber Glass Bottle - Unpreserved (EP075) RN/FB02	**14-Jul-2023**	**21-Jul-2023**	21-Jul-2023	✓	**27-Jul-2023**	30-Aug-2023	✓
EP075C: Phthalate Esters							
Amber Glass Bottle - Unpreserved (EP075) RN/FB01	**13-Jul-2023**	**20-Jul-2023**	20-Jul-2023	✓	**27-Jul-2023**	29-Aug-2023	✓
Amber Glass Bottle - Unpreserved (EP075) RN/FB02	**14-Jul-2023**	**21-Jul-2023**	21-Jul-2023	✓	**27-Jul-2023**	30-Aug-2023	✓
EP075D: Nitrosamines							
Amber Glass Bottle - Unpreserved (EP075) RN/FB01	**13-Jul-2023**	**20-Jul-2023**	20-Jul-2023	✓	**27-Jul-2023**	29-Aug-2023	✓
Amber Glass Bottle - Unpreserved (EP075) RN/FB02	**14-Jul-2023**	**21-Jul-2023**	21-Jul-2023	✓	**27-Jul-2023**	30-Aug-2023	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075E: Nitroaromatics and Ketones							
Amber Glass Bottle - Unpreserved (EP075) RN/FB01	**13-Jul-2023**	**20-Jul-2023**	20-Jul-2023	✓	**27-Jul-2023**	29-Aug-2023	✓
Amber Glass Bottle - Unpreserved (EP075) RN/FB02	**14-Jul-2023**	**21-Jul-2023**	21-Jul-2023	✓	**27-Jul-2023**	30-Aug-2023	✓
EP075F: Haloethers							
Amber Glass Bottle - Unpreserved (EP075) RN/FB01	**13-Jul-2023**	**20-Jul-2023**	20-Jul-2023	✓	**27-Jul-2023**	29-Aug-2023	✓
Amber Glass Bottle - Unpreserved (EP075) RN/FB02	**14-Jul-2023**	**21-Jul-2023**	21-Jul-2023	✓	**27-Jul-2023**	30-Aug-2023	✓
EP075G: Chlorinated Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075) RN/FB01	**13-Jul-2023**	**20-Jul-2023**	20-Jul-2023	✓	**27-Jul-2023**	29-Aug-2023	✓
Amber Glass Bottle - Unpreserved (EP075) RN/FB02	**14-Jul-2023**	**21-Jul-2023**	21-Jul-2023	✓	**27-Jul-2023**	30-Aug-2023	✓
EP075H: Anilines and Benzidines							
Amber Glass Bottle - Unpreserved (EP075) RN/FB01	**13-Jul-2023**	**20-Jul-2023**	20-Jul-2023	✓	**27-Jul-2023**	29-Aug-2023	✓
Amber Glass Bottle - Unpreserved (EP075) RN/FB02	**14-Jul-2023**	**21-Jul-2023**	21-Jul-2023	✓	**27-Jul-2023**	30-Aug-2023	✓
EP075I: Organochlorine Pesticides							
Amber Glass Bottle - Unpreserved (EP075) RN/FB01	**13-Jul-2023**	**20-Jul-2023**	20-Jul-2023	✓	**27-Jul-2023**	29-Aug-2023	✓
Amber Glass Bottle - Unpreserved (EP075) RN/FB02	**14-Jul-2023**	**21-Jul-2023**	21-Jul-2023	✓	**27-Jul-2023**	30-Aug-2023	✓
EP075J: Organophosphorus Pesticides							
Amber Glass Bottle - Unpreserved (EP075) RN/FB01	**13-Jul-2023**	**20-Jul-2023**	20-Jul-2023	✓	**27-Jul-2023**	29-Aug-2023	✓
Amber Glass Bottle - Unpreserved (EP075) RN/FB02	**14-Jul-2023**	**21-Jul-2023**	21-Jul-2023	✓	**27-Jul-2023**	30-Aug-2023	✓
EP080: BTEXN							
Amber VOC Vial - Sulfuric Acid (EP080) RN/FB01	**13-Jul-2023**	**20-Jul-2023**	27-Jul-2023	✓	**21-Jul-2023**	27-Jul-2023	✓
Amber VOC Vial - Sulfuric Acid (EP080) RN/FB02	**14-Jul-2023**	**20-Jul-2023**	28-Jul-2023	✓	**21-Jul-2023**	28-Jul-2023	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Exchangeable Cations	ED007	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	7	40	**17.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organic Matter	EP004	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	5	18	**27.78**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	5	25	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	3	11	**27.27**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	4	26	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	5	38	**13.16**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	7	37	**18.92**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	7	47	**14.89**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	5	25	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Exchangeable Cations	ED007	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organic Matter	EP004	2	4	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	3	18	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	3	25	**12.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	3	**66.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	3	11	**27.27**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	38	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	4	37	**10.81**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	4	47	**8.51**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	3	25	**12.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Exchangeable Cations	ED007	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organic Matter	EP004	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	3	18	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	3	25	**12.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	3	11	**27.27**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	38	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	4	37	**10.81**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	4	47	**8.51**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	3	25	**12.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Matrix Spikes (MS) - Continued							
PAH/Phenols (SIM)	EP075(SIM)	3	18	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	3	25	**12.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	2	11	**18.18**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	38	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	4	37	**10.81**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	4	47	**8.51**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	3	25	**12.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	2	2	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	2	2	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	0	2	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	In house: Referenced to Rayment and Lyons 4A1 and APHA 4500H+. pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM Schedule B(3).
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1: Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
Exchangeable Cations	ED007	SOIL	In house: Referenced to Rayment & Lyons Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
Organic Matter	EP004	SOIL	In house: Referenced to AS1289.4.1.1. Dichromate oxidation method after Walkley and Black. This method is compliant with NEPM Schedule B(3)
Pesticides by GCMS	EP068	SOIL	In house: Referenced to USEPA SW 846 - 8270 Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM Schedule B(3).
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015 Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM Schedule B(3).
Volatile Organic Compounds	EP074	SOIL	In house: Referenced to USEPA SW 846 - 8260 Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3).
Semivolatile Organic Compounds	EP075	SOIL	In house: Referenced to USEPA SW 846 - 8270 Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM Schedule B(3).
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270. Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM Schedule B(3) amended.
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Volatile Organic Compounds	EP074	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
Semivolatile Organic Compounds	EP075	WATER	In house: Referenced to USEPA SW 846 - 8270 Sample extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Exchangeable Cations Preparation Method	ED007PR	SOIL	In house: Referenced to Rayment & Lyons method 15A1. A 1M NH4Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Organic Matter	EP004-PR	SOIL	In house: Referenced to AS1289.4.1.1. Dichromate oxidation method after Walkley and Black. This method is compliant with NEPM Schedule B(3).
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.

Elea Gauliris

From: Robin Anderson <robin.a@westenv.com.au>
Sent: Wednesday, 9 August 2023 4:28 PM
To: ALS Enviro Perth; Samples Perth
Subject: RE: [EXTERNAL] - WO EP2309599

Follow Up Flag: Follow up
Flag Status: Flagged

Categories: Rebatch

Environmental Division Perth
Work Order Reference
EP2310835

Telephone : -- 61-8-9406 1301

Thanks Genevieve,
Can I please request the following analysis:

- BG01: Aluminium, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Selenium, Tin, Zinc.
- TP18_0.5: S4
- TP20_0.5: PAHs
- TP04_0.5: OCP

I don't mind whether it is rebatched as a new WO or added to the existing WO. Whatever is easiest for you guys.

Kind Regards
Robin Anderson

Principal Environmental Scientist
BSc (Hons)

Unit 5, 162 Colin St, West Perth WA 6005
Boorloo, Whadjuk Noongar Boodjar
P: (08) 6162 8980 **M:** 0435 273 846
E: robin.a@westenv.com.au

We acknowledge the Traditional Owners of country throughout Australia and recognise their continuing connection to land, wate
We pay our respects to their Elders past, present and emerging.

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If you are not the intended recipient, any use, disclosure or copying of this information is unauthorised.
If you have received this email in error, please notify the sender immediately by return email and then delete it from your system.
Please consider the environment before printing this email.

From: ALS Enviro Perth <ALSEnviro.Perth@ALSGlobal.com>
Sent: Wednesday, August 9, 2023 2:09 PM
To: Robin Anderson <robin.a@westenv.com.au>
Subject: RE: [EXTERNAL] - WO EP2309599

Hi Robin,

We still have the samples from the workorder. Can you please confirm the analysis you wish to test and we will let you know if we have sufficient volume remaining.

Kind Regards,

CHAIN OF CUSTODY RECORD

WESTERN

Company Name :	WESTERN ENVIRONMENTAL PTY LTD WA	Project Number / Purchase Order :	22.142
Office Address :	Unit 5, 162 Colin St, West Perth WA 6005	Contact Name : Louis Grogan	Project Manager: Louis Grogan
Quote ID :	#N/A		

Laboratory Address :
ALS Pty Ltd
26 Rigali Way
Wangara WA 6065
Contact: David Brennan 0409 335 212
Email: David.Brennan@alsglobal.com, samples.perth@alsglobal.com

Email for results: louis.g@westenv.com.au
CC1: robin.a@westenv.com.au
CC2: jade.d@westenv.com.au
westenv@esdat.com.au

Special Directions & Comments :

#	Sample ID	Type	Sample Date	Matrix	Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn)	S-23	S-27	S-2	S-12	S-24	W-23	TRH (C6-C10) & BTEXN			HOLD	Container: Glass Jar	ACM Bag	Amber glass	Vial	100ml Red Plastic	Plastic Bag		
3	TB01	Trip_B	13/07/2023	Soil								X				1							
4	DUP01	Field_D	13/07/2023	Soil	X	X										1							
2	SED01	Normal	13/07/2023	Sediment			X									1							
6	TP33_0-0.15	Normal	13/07/2023	Soil				X	X							1							
7	TP33_0.5	Normal	13/07/2023	Soil											✓	1							
8	TP33_1.0	Normal	13/07/2023	Soil											✓	1							
9	TP20_0-0.15	Normal	13/07/2023	Soil		X		X								1							
10	TP20_0.5	Normal	13/07/2023	Soil											✓	1							
11	TP20_1.0	Normal	13/07/2023	Soil											✓	1							
12	TP34_0.15	Normal	13/07/2023	Soil				X	X							1							
13	TP34_0.5	Normal	13/07/2023	Soil											✓	1							
14	TP34_1.0	Normal	13/07/2023	Soil											✓	1							
15	TP26_0-0.5	Normal	13/07/2023	Soil				X	X							1							
16	TP26_0.5	Normal	13/07/2023	Soil											✓	1							
17	TP26_1.0	Normal	13/07/2023	Soil											✓	1							

Environmental Division
Perth
Work Order Reference
EP2309599

Relinquished By:	Louis Grogan	Received By:	JS
Date & Time:	14/07/2023	Date & Time:	19/7 11:20Am
Signature:	Louis	Signature:	
		Report Number :	

Turn around Time :

Comments :

Method Of Shipment : Hand Delivered

CHAIN OF CUSTODY RECORD

Company Name:	WESTERN ENVIRONMENTAL PTY LTD WA	Project Number / Purchase Order:	22.142
Office Address:	Unit 5, 162 Colin St, West Perth WA 6005	Contact Name: Louis Grogan	Project Manager: Louis Grogan — Quote ID: #N/A
Laboratory Address:		Email for results: louis.g@westenv.com.au	CC1: robin.a@westenv.com.au; CC2: jade.d@westenv.com.au; westenv@asdat.com.au
ALS Pty Ltd 26 Rigali Way Wangara WA 6065 Contact: David Brennan 0409 355 212 Email: David.Brennan@alsglobal.com, samples.perth@alsglobal.com			Special Directions & Comments:

#	Sample ID	Type	Sample Date	Matrix	Analytes: Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn)	S-23	S-27	S-2	S-12	S-24	W-23				HOLD	Container: Glass Jar	ACM Bag	Amber glass	Vial	100ml Red Plastic			
18	TP27_0-0.15	Normal	13/07/2023	Soil				X	X							1							
19	TP27_0.5	Normal	13/07/2023	Soil											✓	1							
20	TP27_1.0	Normal	13/07/2023	Soil											✓	1							
21	TP12_0-0.15	Normal	13/07/2023	Soil	X				X	X						1							
22	TP12_0.5	Normal	13/07/2023	Soil											✓	1							
23	TP12_1.0	Normal	13/07/2023	Soil											✓	1							
24	TP11_0-0.15	Normal	13/07/2023	Soil	X				X	X						1							
25	TP11_0.5	Normal	13/07/2023	Soil											✓	1							
26	TP11_1.0	Normal	13/07/2023	Soil											✓	1							
27	TP13_0-0.15	Normal	13/07/2023	Soil		X		X								1							
28	TP13_0.5	Normal	13/07/2023	Soil											✓	1							
29	TP13_1.0	Normal	13/07/2023	Soil											✓	1							
30	TP07_0-0.15	Normal	13/07/2023	Soil				X	X							1							
31	TP07_0.5	Normal	13/07/2023	Soil											✓	1							
32	TP07_1.0	Normal	13/07/2023	Soil											✓	1							

Relinquished By:	Louis Grogan	Received By:	Turn around Time:	Method Of Shipment: Hand Delivered
Date & Time:	14/07/2023	Date & Time:		
Signature:	Louis	Signature:	Comments:	
		Report Number:		

CHAIN OF CUSTODY RECORD

Company Name :	WESTERN ENVIRONMENTAL PTY LTD WA	Project Number / Purchase Order :	22.142
Office Address :	Unit 5, 162 Colin St, West Perth WA 6005	Contact Name :	Louis Grogan
Project Manager:	Louis Grogan	Quote ID :	#N/A
Laboratory Address :		Email for results:	louis.g@westenv.com.au
CC1:	robin.a@westenv.com.au		
ALS Pty Ltd		CC2:	jade.d@westenv.com.au
26 Rigali Way			westenv@esdat.com.au
Wangara WA 6065			
Contact: David Brennan 0409 355 212			
Email: David.Brennan@alsglobal.com, samples.perth@alsglobal.com			

#	Sample ID	Type	Sample Date	Matrix	Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn)	S-23	S-27	S-2	S-12	S-24	W-23				HOLD	Container: Glass Jar	ACM Bag	Amber glass	Vial	100 ml Red Plastic			
33	TP10_0-0.15	Normal	13/07/2023	Soil		X		X								1						
34	TP10_0.5	Normal	13/07/2023	Soil											✓	1						
35	TP10_1.0	Normal	13/07/2023	Soil											✓	1						
36	TP08_0-0.15	Normal	13/07/2023	Soil		X		X								1						
37	TP08_0.5	Normal	13/07/2023	Soil											✓	1						
38	TP08_1.0	Normal	13/07/2023	Soil											✓	1						
39	TP09_0-0.15	Normal	13/07/2023	Soil				X	X							1						
40	TP09_0.5	Normal	13/07/2023	Soil											✓	1						
41	TP09_1.0	Normal	13/07/2023	Soil											✓	1						
42	TP25_0-0.15	Normal	13/07/2023	Soil				X	X							1						
43	TP25_0.5	Normal	13/07/2023	Soil											✓	1						
44	TP25_1.0	Normal	13/07/2023	Soil											✓	1						
47	TP01_0-0.15	Normal	14/07/2023	Soil	X				X	X						1						
48	TP01_0.5	Normal	14/07/2023	Soil											✓	1						
49	TP01_1.0	Normal	14/07/2023	Soil											✓	1						

Analytes

Special Directions & Comments :

Relinquished By:	Louis Grogan	Received By:	
Date & Time:	14/07/2023	Date & Time:	
Signature:		Signature:	
		Report Number :	

Turn around Time :

Comments :

Method Of Shipment : Hand Delivered

CHAIN OF CUSTODY RECORD

WESTERN ENVIRONMENTAL

Company Name :	WESTERN ENVIRONMENTAL PTY LTD WA	Project Number / Purchase Order :	22.142
Office Address :	Unit 5, 162 Colin St, West Perth WA 6005	Contact Name :	Louis Grogan Project Manager:
Laboratory Address :	ALS Pty Ltd 26 Rigali Way Wangara WA 6065 Contact: David Brennan 0409 355 212 Email: David.Brennan@alsglobal.com, samples.perth@alsglobal.com	Email for results:	louis.g@westenv.com.au
Quote ID :	#N/A	CC1:	robin.a@westenv.com.au
		CC2:	jade.d@westenv.com.au
			Louis Grogan
			westenv@esdat.com.au

Special Directions & Comments :

#	Sample ID	Type	Sample Date	Matrix	Analytes: Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn)	S-23	S-27	S-2	S-12	S-24	W-23				HOLD	Container: Glass Jar	ACM Bag	Amber glass	Vial	100 ml Red Plastic	Plastic bag		
50	TP02_0-0.15	Normal	14/07/2023	Soil		X		X								1							
51	TP02_0.5	Normal	14/07/2023	Soil											✓	1							
52	TP02_1.0	Normal	14/07/2023	Soil											✓	1							
53	TP03_0-0.15	Normal	14/07/2023	Soil		X		X								1					1		
54	TP03_0.5	Normal	14/07/2023	Soil											✓	1							
55	TP03_1.0	Normal	14/07/2023	Soil											✓	1							
56	TP04_0-0.15	Normal	14/07/2023	Soil				X	X							1	1						
57	TP04_0.5	Normal	14/07/2023	Soil											✓	1							
58	TP04_1.0	Normal	14/07/2023	Soil											✓	1							
59	TP05_0-0.15	Normal	14/07/2023	Soil		X		X								1							
60	TP05_0.5	Normal	14/07/2023	Soil											✓	1							
61	TP05_1.0	Normal	14/07/2023	Soil											✓	1							
62	TP06_0-0.15	Normal	14/07/2023	Soil		X		X								1							
63	TP06_0.5	Normal	14/07/2023	Soil											✓	1							
64	TP06_1.0	Normal	14/07/2023	Soil											✓	1							

Relinquished By:	Louis Grogan	Received By:	
Date & Time:	14/07/2023	Date & Time :	
Signature:		Signature:	
		Report Number :	

Turn around Time :

Comments :

Method Of Shipment :

Hand Delivered

CHAIN OF CUSTODY RECORD

WESTERN ENVIRONMENTAL

Company Name :	WESTERN ENVIRONMENTAL PTY LTD WA	Project Number / Purchase Order :	22.142
Office Address :	Unit 5, 162 Colin St, West Perth WA 6005	Contact Name : Louis Grogan	Project Manager: Louis Grogan
Laboratory Address :		Email for results: louis.g@westenv.com.au	CC1: robin.a@westenv.com.au; CC2: jade.d@westenv.com.au
ALS Pty Ltd 26 Rigali Way Wangara WA 6065 Contact: David Brennan 0409 855 212 Email: David.Brennan@alsglobal.com, samples.perth@alsglobal.com		Quote ID : #N/A	westenv@esdat.com.au

#	Sample ID	Type	Sample Date	Matrix	Analytes: Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn)	S-23	S-27	S-2	S-12	S-24	W-23				HOLD	Container: Glass Jar	ACM Bag	Amber glass	Vial	100 ml Red Plastic			
65	TP23_0-0.15	Normal	14/07/2023	Soil				X	X							1							
66	TP23_0.5	Normal	14/07/2023	Soil											✓	1							
67	TP23_1.0	Normal	14/07/2023	Soil											✓	1							
68	TP24_0-0.15	Normal	14/07/2023	Soil				X	X							1							
69	TP24_0.5	Normal	14/07/2023	Soil											✓	1							
70	TP24_1.0	Normal	14/07/2023	Soil											✓	1							
75	TP14_0-0.15	Normal	13/07/2023	Soil	X				X	X						1							
76	TP14_0.5	Normal	13/07/2023	Soil											✓	1							
77	TP14_1.0	Normal	13/07/2023	Soil											✓	1							
78	TP15_0-0.15	Normal	13/07/2023	Soil	X				X	X						1							
79	TP15_0.5	Normal	13/07/2023	Soil											✓	1							
80	TP15_1.0	Normal	13/07/2023	Soil											✓	1							
81	TP16_0-0.15	Normal	13/07/2023	Soil		X		X								1							
82	TP16_0.5	Normal	13/07/2023	Soil											✓	1							
83	TP16_1.0	Normal	13/07/2023	Soil											✓	1							

Special Directions & Comments :

Relinquished By:	Louis Grogan	Received By:	Turn around Time :
Date & Time:	14/07/2023	Date & Time :	Method Of Shipment : Hand Delivered
Signature:	Louis	Signature:	Comments :
		Report Number :	

WESTERN

CHAIN OF CUSTODY RECORD

Company Name :	WESTERN ENVIRONMENTAL PTY LTD WA	Project Number / Purchase Order :	22.142
Office Address :	Unit 5, 162 Colin St, West Perth WA 6005	Contact Name : Louis Grogan	Project Manager: Louis Grogan
Quote ID :	#N/A		

Laboratory Address :
ALS Pty Ltd
26 Rigali Way
Wangara WA 6065
Contact: David Brennan 0409 355 212
Email: David.Brennan@alsglobal.com, samples.perth@alsglobal.com

Email for results: louis.g@westenv.com.au
CC1: robin.a@westenv.com.au
CC2: jade.d@westenv.com.au
westenv@esdat.com.au

Special Directions & Comments :

#	Sample ID	Type	Sample Date	Matrix	Analytes: Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn)	S-23	S-27	S-2	S-12	S-24	W-23				HOLD	Container: Glass Jar	ACM Bag	Amber glass	Vial	100 ml Red Plastic			
84	TP17_0-0.15	Normal	13/07/2023	Soil				X	X							1							
85	TP17_0.5	Normal	13/07/2023	Soil											✓	1							
86	TP17_1.0	Normal	13/07/2023	Soil											✓	1							
87	TP18_0-0.15	Normal	13/07/2023	Soil	X				X	X						1							
88	TP18_0.5	Normal	13/07/2023	Soil											✓	1							
89	TP18_1.0	Normal	13/07/2023	Soil											✓	1							
90	TP19_0-0.15	Normal	13/07/2023	Soil	X				X	X						1							
91	TP19_0.5	Normal	13/07/2023	Soil											✓	1							
92	TP19_1.0	Normal	13/07/2023	Soil											✓	1							
93	TP21_0-0.15	Normal	13/07/2023	Soil	X				X	X						1							
94	TP21_0.5	Normal	13/07/2023	Soil											✓	1							
95	TP21_1.0	Normal	13/07/2023	Soil											✓	1							
96	TP22_0-0.15	Normal	13/07/2023	Soil	X				X	X						1							
97	TP22_0.5	Normal	13/07/2023	Soil											✓	1							
98	TP22_1.0	Normal	13/07/2023	Soil											✓	1							

Relinquished By:	Louis Grogan	Received By:	Turn around Time :
Date & Time:	14/07/2023	Date & Time :	Method Of Shipment : Hand Delivered
Signature:	Louis	Signature:	Comments :
		Report Number :	

CHAIN OF CUSTODY RECORD

WESTERN ENVIRONMENTAL

Company Name:	WESTERN ENVIRONMENTAL PTY LTD WA	Project Number / Purchase Order:	22.142
Office Address:	Unit 5, 162 Colin St, West Perth WA 6005	Contact Name:	Louis Grogan
Project Manager:	Louis Grogan	Quote ID:	#N/A

Laboratory Address:
ALS Pty Ltd
26 Rigali Way
Wangara WA 6065
Contact: David Brennan 0409 355 212
Email: David.Brennan@alsglobal.com, samples.perth@alsglobal.com

Email for results: louis.g@westenv.com.au
CC1: robin.s@westenv.com.au
CC2: jade.d@westenv.com.au
westenv@esdat.com.au

Special Directions & Comments:

#	Sample ID	Type	Sample Date	Matrix	Analytes: Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn)	S-23	S-27	S-2	S-12	S-24	W-23				HOLD	Container: Glass Jar	ACM Bag	Amber glass	Vial	100 ml Red Plastic			
94	99 TP28_0-0.15	Normal	13/07/2023	Soil				X	X														
95	100 TP28_0.5	Normal	13/07/2023	Soil											✓								
96	101 TP28_1.0	Normal	13/07/2023	Soil											✓								
97	102 TP29_0-0.15	Normal	13/07/2023	Soil				X	X														
98	103 TP29_0.5	Normal	13/07/2023	Soil											✓								
99	104 TP29_1.0	Normal	13/07/2023	Soil											✓								
100	105 TP30_0-0.15	Normal	13/07/2023	Soil				X	X														
101	106 TP30_0.5	Normal	13/07/2023	Soil											✓								
102	107 TP30_1.0	Normal	13/07/2023	Soil											✓								
103	108 TP31_0-0.15	Normal	13/07/2023	Soil				X	X														
104	109 TP31_0.5	Normal	13/07/2023	Soil											✓								
105	110 TP31_1.0	Normal	13/07/2023	Soil											✓								
106	111 TP32_0-0.15	Normal	13/07/2023	Soil				X	X														
107	112 TP32_0.5	Normal	13/07/2023	Soil											✓								
108	113 TP32_1.0	Normal	13/07/2023	Soil											✓								

Relinquished By: Louis Grogan
Date & Time: 14/07/2023
Signature:

Received By:
Date & Time:
Signature:
Report Number:

Turn around Time:
Comments:

Method Of Shipment: Hand Delivered

CHAIN OF CUSTODY RECORD

Page 1 of 6

Company Name :	WESTERN ENVIRONMENTAL PTY LTD WA	Project Number / Purchase Order :	22.142
Office Address :	Unit 5, 162 Colin St, West Perth WA 6005	Contact Name :	Louis Grogan
Laboratory Address :	ALS Pty Ltd 26 Rigali Way Wangara WA 6065 Contact: David Brennan 0409 358 212 Email: David.Brennan@alsglobal.com, samples.perth@alsglobal.com	Project Manager:	Louis Grogan
Email for results:	louis.g@westenv.com.au	CC1:	robin.a@westenv.com.au
		CC2:	jade.d@westenv.com.au
Quote ID :	#N/A		westenv@esdat.com.au

Special Directions & Comments :

#	Sample ID	Type	Sample Date	Matrix	Analytes: Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn)	S-23	S-27	S-2	S-22	S-24	W-23	Ell Soil Characteristics (CEC, TOC, % Clay, pH and Iron)	Please send to Eurofins with sent COC		HOLD	Container: Glass Jar	ACM Bag	Amber glass	Vial	100 ml Red Plastic			
105 46	BG01	Normal	13/07/2023	Soil												1							
107 72	DUP03	Field_D	14/07/2023	Soil	X	X						X											
108 1	RN/FB01	Rinsate	13/07/2023	Soil	X											1							
109 71	RN/FB02	Rinsate	14/07/2023	Soil	X						X							3	2	1			
110 5	DUP02	Field_D	13/07/2023	Soil							X							1	2	1			
111 114	TB02	Trip_B	14/07/2023	Soil											✓	1							
112 —	Trip01	Interlab_D	13/07/2023	Soil											✓	1							
113 —	Trip02	Interlab_D	13/07/2023	Soil									X			1							
114 —	Trip03	Interlab_D	14/07/2023	Soil									X			1							
													X			1							

Relinquished By:	Louis Grogan	Received By:	
Date & Time:	14/07/2023	Date & Time :	
Signature:	Louis	Signature:	
		Report Number :	

Turn around Time :

Comments :

Method Of Shipment : Hand Delivered

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EP2310835**

Client	: **WESTERN ENVIRONMENTAL P/L**	Laboratory	: Environmental Division Perth
Contact	: Louis Grogan	Contact	: Customer Services EP
Address	: Unit 5, 162 Colin Street West Perth 6005	Address	: 26 Rigali Way Wangara WA Australia 6065
E-mail	: louis.g@westenv.com.au	E-mail	: ALSEnviro.Perth@alsglobal.com
Telephone	: ----	Telephone	: +61-8-9406 1301
Facsimile	: ----	Facsimile	: +61-8-9406 1399
Project	: 22.142	Page	: 1 of 3
Order number	: ----	Quote number	: EP2020WESENV0004 (EN/110)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	:		

Dates

Date Samples Received	: 19-Jul-2023 11:20	Issue Date	: 10-Aug-2023
Client Requested Due Date	: 16-Aug-2023	Scheduled Reporting Date	: **16-Aug-2023**

Delivery Details

Mode of Delivery	: Samples On Hand	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: ----
Receipt Detail	:	No. of samples received / analysed	: 4 / 4

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- Please see scanned COC for sample discrepencies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- This workorder is a rebatch of EP2309599.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	SOIL - EA055-103 Moisture Content	SOIL - ED093T Cations - Total	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EP068A (solids) Organochlorine Pesticides by GCMS	SOIL - EP075 SIM PAH only SIM - PAH only	SOIL - S-02 8 Metals (incl. Digestion)	SOIL - S-04 TRH/BTEXN
EP2310835-001	14-Jul-2023 00:00	BG01	✓	✓	✓			✓	
EP2310835-002	14-Jul-2023 00:00	TP18_0.5	✓						✓
EP2310835-003	14-Jul-2023 00:00	TP20_0.5	✓				✓		
EP2310835-004	14-Jul-2023 00:00	TP04_0.5	✓			✓			

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

Matrix: **SOIL** Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Client Sample ID(s)	Container	Due for extraction	Due for analysis	Samples Received		Instructions Received	
				Date	Evaluation	Date	Evaluation
EA055: Moisture Content							
BG01	Soil Glass Jar - Unpreserved	----	28-Jul-2023	19-Jul-2023	✓	09-Aug-2023	×
TP04_0.5	Soil Glass Jar - Unpreserved	----	28-Jul-2023	19-Jul-2023	✓	09-Aug-2023	×
TP18_0.5	Soil Glass Jar - Unpreserved	----	28-Jul-2023	19-Jul-2023	✓	09-Aug-2023	×
TP20_0.5	Soil Glass Jar - Unpreserved	----	28-Jul-2023	19-Jul-2023	✓	09-Aug-2023	×
EP068: Pesticides by GCMS							
TP04_0.5	Soil Glass Jar - Unpreserved	28-Jul-2023	06-Sep-2023	19-Jul-2023	✓	09-Aug-2023	×
EP071: TRH - Semivolatile Fraction							
TP18_0.5	Soil Glass Jar - Unpreserved	28-Jul-2023	06-Sep-2023	19-Jul-2023	✓	09-Aug-2023	×
EP075(SIM): PAH/Phenols (SIM)							
TP20_0.5	Soil Glass Jar - Unpreserved	28-Jul-2023	06-Sep-2023	19-Jul-2023	✓	09-Aug-2023	×
EP080: TRH Volatiles/BTEX							
TP18_0.5	Soil Glass Jar - Unpreserved	28-Jul-2023	28-Jul-2023	19-Jul-2023	✓	09-Aug-2023	×

Requested Deliverables

ACCOUNTS ADDRESS		
- A4 - AU Tax Invoice (INV)	Email	accounts@westenv.com.au
ESDAT reports		
- *AU Certificate of Analysis - NATA (COA)	Email	westenv@esdat.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	westenv@esdat.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	westenv@esdat.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	westenv@esdat.com.au
- Chain of Custody (CoC) (COC)	Email	westenv@esdat.com.au
- EDI Format - ESDAT (ESDAT)	Email	westenv@esdat.com.au
JADE DENNIS		
- *AU Certificate of Analysis - NATA (COA)	Email	jade.d@westenv.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jade.d@westenv.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jade.d@westenv.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jade.d@westenv.com.au
- Chain of Custody (CoC) (COC)	Email	jade.d@westenv.com.au
- EDI Format - ESDAT (ESDAT)	Email	jade.d@westenv.com.au
Louis Grogan		
- *AU Certificate of Analysis - NATA (COA)	Email	louis.g@westenv.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	louis.g@westenv.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	louis.g@westenv.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	louis.g@westenv.com.au
- Chain of Custody (CoC) (COC)	Email	louis.g@westenv.com.au
- EDI Format - ESDAT (ESDAT)	Email	louis.g@westenv.com.au
ROBIN A		
- *AU Certificate of Analysis - NATA (COA)	Email	robin.a@westenv.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	robin.a@westenv.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	robin.a@westenv.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	robin.a@westenv.com.au
- Chain of Custody (CoC) (COC)	Email	robin.a@westenv.com.au
- EDI Format - ESDAT (ESDAT)	Email	robin.a@westenv.com.au

CERTIFICATE OF ANALYSIS

Work Order	: **EP2310835**	Page	: 1 of 7
Client	: **WESTERN ENVIRONMENTAL P/L**	Laboratory	: Environmental Division Perth
Contact	: Louis Grogan	Contact	: Customer Services EP
Address	: Unit 5, 162 Colin Street West Perth 6005	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: ----	Telephone	: +61-8-9406 1301
Project	: 22.142	Date Samples Received	: 19-Jul-2023 11:20
Order number	: ----	Date Analysis Commenced	: 11-Aug-2023
C-O-C number	: ----	Issue Date	: 16-Aug-2023 15:32
Sampler	: ----		
Site	: ----		
Quote number	: EN/110		
No. of samples received	: 4		
No. of samples analysed	: 4		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Thomas Donovan	Senior Organic Chemist	Perth Organics, Wangara, WA

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP068: Where reported, Total Chlordane (sum) is the sum of the reported concentrations of cis-Chlordane and trans-Chlordane at or above the LOR.
- EP068: Where reported, Total OCP is the sum of the reported concentrations of all Organochlorine Pesticides at or above LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- This workorder is a rebatch of EP2309599.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BG01	TP18_0.5	TP20_0.5	TP04_0.5	----
			Sampling date / time	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	----
Compound	CAS Number	LOR	Unit	EP2310835-001	EP2310835-002	EP2310835-003	EP2310835-004	--------
				Result	Result	Result	Result	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**----**	**15.0**	**4.8**	**6.4**	**----**
Moisture Content	----	1.0	%	**8.1**	**----**	**----**	**----**	**----**
ED093T: Total Major Cations								
Calcium	7440-70-2	50	mg/kg	**1000**	**----**	**----**	**----**	**----**
Magnesium	7439-95-4	50	mg/kg	**100**	**----**	**----**	**----**	**----**
EG005(ED093)T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	**680**	**----**	**----**	**----**	**----**
Antimony	7440-36-0	5	mg/kg	<5	**----**	**----**	**----**	**----**
Barium	7440-39-3	10	mg/kg	<10	**----**	**----**	**----**	**----**
Beryllium	7440-41-7	1	mg/kg	<1	**----**	**----**	**----**	**----**
Boron	7440-42-8	50	mg/kg	<50	**----**	**----**	**----**	**----**
Cobalt	7440-48-4	2	mg/kg	<2	**----**	**----**	**----**	**----**
Manganese	7439-96-5	5	mg/kg	<5	**----**	**----**	**----**	**----**
Molybdenum	7439-98-7	2	mg/kg	<2	**----**	**----**	**----**	**----**
Selenium	7782-49-2	5	mg/kg	<5	**----**	**----**	**----**	**----**
Tin	7440-31-5	5	mg/kg	<5	**----**	**----**	**----**	**----**
Arsenic	7440-38-2	5	mg/kg	<5	**----**	**----**	**----**	**----**
Cadmium	7440-43-9	1	mg/kg	<1	**----**	**----**	**----**	**----**
Chromium	7440-47-3	2	mg/kg	<2	**----**	**----**	**----**	**----**
Copper	7440-50-8	5	mg/kg	<5	**----**	**----**	**----**	**----**
Lead	7439-92-1	5	mg/kg	<5	**----**	**----**	**----**	**----**
Nickel	7440-02-0	2	mg/kg	<2	**----**	**----**	**----**	**----**
Zinc	7440-66-6	5	mg/kg	<5	**----**	**----**	**----**	**----**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	**----**	**----**	**----**	**----**
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	**----**	**----**	**----**	<0.05	**----**
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	**----**	**----**	**----**	<0.05	**----**
beta-BHC	319-85-7	0.05	mg/kg	**----**	**----**	**----**	<0.05	**----**
gamma-BHC	58-89-9	0.05	mg/kg	**----**	**----**	**----**	<0.05	**----**
delta-BHC	319-86-8	0.05	mg/kg	**----**	**----**	**----**	<0.05	**----**
Heptachlor	76-44-8	0.05	mg/kg	**----**	**----**	**----**	<0.05	**----**
Aldrin	309-00-2	0.05	mg/kg	**----**	**----**	**----**	<0.05	**----**
Heptachlor epoxide	1024-57-3	0.05	mg/kg	**----**	**----**	**----**	**0.09**	**----**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BG01	TP18_0.5	TP20_0.5	TP04_0.5	----
			Sampling date / time	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	----
Compound	CAS Number	LOR	Unit	EP2310835-001	EP2310835-002	EP2310835-003	EP2310835-004	--------
				Result	Result	Result	Result	----
EP068A: Organochlorine Pesticides (OC) - Continued								
^ Total Chlordane (sum)	----	0.05	mg/kg	----	----	----	**0.20**	----
trans-Chlordane	5103-74-2	0.05	mg/kg	----	----	----	**0.20**	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	----	----	----	<0.05	----
cis-Chlordane	5103-71-9	0.05	mg/kg	----	----	----	<0.05	----
Dieldrin	60-57-1	0.05	mg/kg	----	----	----	<0.05	----
4.4`-DDE	72-55-9	0.05	mg/kg	----	----	----	<0.05	----
Endrin	72-20-8	0.05	mg/kg	----	----	----	<0.05	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	----	----	----	<0.05	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	----	----	----	<0.05	----
4.4`-DDD	72-54-8	0.05	mg/kg	----	----	----	<0.05	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	----	----	----	<0.05	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	----	----	----	<0.05	----
4.4`-DDT	50-29-3	0.2	mg/kg	----	----	----	<0.2	----
Endrin ketone	53494-70-5	0.05	mg/kg	----	----	----	<0.05	----
Methoxychlor	72-43-5	0.2	mg/kg	----	----	----	<0.2	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	----	----	----	<0.05	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	----	----	----	<0.05	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	----	----	<0.5	----	----
Acenaphthylene	208-96-8	0.5	mg/kg	----	----	<0.5	----	----
Acenaphthene	83-32-9	0.5	mg/kg	----	----	<0.5	----	----
Fluorene	86-73-7	0.5	mg/kg	----	----	<0.5	----	----
Phenanthrene	85-01-8	0.5	mg/kg	----	----	<0.5	----	----
Anthracene	120-12-7	0.5	mg/kg	----	----	<0.5	----	----
Fluoranthene	206-44-0	0.5	mg/kg	----	----	<0.5	----	----
Pyrene	129-00-0	0.5	mg/kg	----	----	<0.5	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	----	----	<0.5	----	----
Chrysene	218-01-9	0.5	mg/kg	----	----	<0.5	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	----	----	<0.5	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	----	----	<0.5	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	----	----	<0.5	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	----	----	<0.5	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	----	----	<0.5	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	----	----	<0.5	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BG01	TP18_0.5	TP20_0.5	TP04_0.5	----
				Sampling date / time	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	----
Compound	CAS Number	LOR	Unit		EP2310835-001	EP2310835-002	EP2310835-003	EP2310835-004	--------
					Result	Result	Result	Result	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		----	----	<0.5	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		----	----	<0.5	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		----	----	**0.6**	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		----	----	**1.2**	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		----	<10	----	----	----
C10 - C14 Fraction	----	50	mg/kg		----	<50	----	----	----
C15 - C28 Fraction	----	100	mg/kg		----	<100	----	----	----
C29 - C36 Fraction	----	100	mg/kg		----	<100	----	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg		----	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		----	<10	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		----	<10	----	----	----
>C10 - C16 Fraction	----	50	mg/kg		----	<50	----	----	----
>C16 - C34 Fraction	----	100	mg/kg		----	<100	----	----	----
>C34 - C40 Fraction	----	100	mg/kg		----	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		----	<50	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		----	<50	----	----	----
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		----	<0.2	----	----	----
Toluene	108-88-3	0.5	mg/kg		----	<0.5	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg		----	<0.5	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		----	<0.5	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg		----	<0.5	----	----	----
^ Sum of BTEX	----	0.2	mg/kg		----	<0.2	----	----	----
^ Total Xylenes	----	0.5	mg/kg		----	<0.5	----	----	----
Naphthalene	91-20-3	1	mg/kg		----	<1	----	----	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		----	----	----	**121**	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		----	----	----	**111**	----
EP075(SIM)S: Phenolic Compound Surrogates									

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BG01	TP18_0.5	TP20_0.5	TP04_0.5	----
			Sampling date / time	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	14-Jul-2023 00:00	----
Compound	CAS Number	LOR	Unit	EP2310835-001	EP2310835-002	EP2310835-003	EP2310835-004	--------
				Result	Result	Result	Result	----
EP075(SIM)S: Phenolic Compound Surrogates - Continued								
Phenol-d6	13127-88-3	0.5	%	----	----	**105**	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%	----	----	**113**	----	----
2.4.6-Tribromophenol	118-79-6	0.5	%	----	----	**77.0**	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	----	----	**130**	----	----
Anthracene-d10	1719-06-8	0.5	%	----	----	**100**	----	----
4-Terphenyl-d14	1718-51-0	0.5	%	----	----	**108**	----	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	----	**98.0**	----	----	----
Toluene-D8	2037-26-5	0.2	%	----	**91.0**	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%	----	**82.8**	----	----	----

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	53	152
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	28	152
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	57	119
2-Chlorophenol-D4	93951-73-6	52	130
2.4.6-Tribromophenol	118-79-6	40	132
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	53	139
Anthracene-d10	1719-06-8	68	124
4-Terphenyl-d14	1718-51-0	66	132
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	63	132
Toluene-D8	2037-26-5	66	125
4-Bromofluorobenzene	460-00-4	60	124

QUALITY CONTROL REPORT

Work Order	: **EP2310835**	Page	: 1 of 8
Client	: **WESTERN ENVIRONMENTAL P/L**	Laboratory	: Environmental Division Perth
Contact	: Louis Grogan	Contact	: Customer Services EP
Address	: Unit 5, 162 Colin Street West Perth 6005	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: ----	Telephone	: +61-8-9406 1301
Project	: 22.142	Date Samples Received	: 19-Jul-2023
Order number	: ----	Date Analysis Commenced	: 11-Aug-2023
C-O-C number	: ----	Issue Date	: 16-Aug-2023
Sampler	: ----		
Site	: ----		
Quote number	: EN/110		
No. of samples received	: 4		
No. of samples analysed	: 4		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Thomas Donovan	Senior Organic Chemist	Perth Organics, Wangara, WA

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 5230253)									
EP2310835-001	BG01	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	<10	<10	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Antimony	7440-36-0	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Tin	7440-31-5	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Aluminium	7429-90-5	50	mg/kg	680	680	0.0	0% - 50%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.0	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 5230261)									
EP2310403-011	Anonymous	EA055: Moisture Content	----	0.1	%	5.0	4.9	2.4	0% - 20%
EP2310835-001	BG01	EA055: Moisture Content	----	0.1	%	8.1	8.2	0.0	No Limit
ED093T: Total Major Cations (QC Lot: 5230254)									
EP2310835-001	BG01	ED093T: Calcium	7440-70-2	50	mg/kg	1000	1100	9.6	0% - 20%
		ED093T: Magnesium	7439-95-4	50	mg/kg	100	110	10.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 5230252)									
EP2310835-001	BG01	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP068A: Organochlorine Pesticides (OC) (QC Lot: 5228957)									
EP2310835-004	TP04_0.5	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	0.09	0.08	11.3	No Limit
		EP068: Total Chlordane (sum)	----	0.05	mg/kg	0.20	0.17	16.2	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	0.20	0.17	12.2	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 5228956)									
EP2310835-003	TP20_0.5	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 5228956) - continued									
EP2310835-003	TP20_0.5	EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 5228953)									
EP2310822-005	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 5228955)									
EP2310822-001	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 5228953)									
EP2310822-005	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 5228955)									
EP2310822-001	Anonymous	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080: BTEXN (QC Lot: 5228953)									
EP2310822-005	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 5230253)								
EG005T: Aluminium	7429-90-5	50	mg/kg	<50	6134 mg/kg	105	76.8	112
EG005T: Antimony	7440-36-0	5	mg/kg	<5	----	----	----	----
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	98.2	87.2	114
EG005T: Barium	7440-39-3	10	mg/kg	<10	143 mg/kg	99.6	82.4	112
EG005T: Beryllium	7440-41-7	1	mg/kg	<1	5.63 mg/kg	106	91.3	121
EG005T: Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	93.8	80.9	105
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	86.9	70.0	100
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	16 mg/kg	100	79.6	112
EG005T: Copper	7440-50-8	5	mg/kg	<5	32 mg/kg	94.8	81.0	112
EG005T: Lead	7439-92-1	5	mg/kg	<5	40 mg/kg	97.8	77.2	104
EG005T: Manganese	7439-96-5	5	mg/kg	<5	130 mg/kg	109	70.5	128
EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	7.9 mg/kg	78.5	75.0	105
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55 mg/kg	98.5	78.7	106
EG005T: Selenium	7782-49-2	5	mg/kg	<5	5.37 mg/kg	104	75.0	115
EG005T: Tin	7440-31-5	5	mg/kg	<5	5.2 mg/kg	84.6	70.0	100
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	100	79.4	110
ED093T: Total Major Cations (QCLot: 5230254)								
ED093T: Calcium	7440-70-2	50	mg/kg	<50	2545 mg/kg	106	85.0	121
ED093T: Magnesium	7439-95-4	50	mg/kg	<50	2091 mg/kg	101	84.2	113
EG035T: Total Recoverable Mercury by FIMS (QCLot: 5230252)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.154 mg/kg	98.5	84.3	124
EP068A: Organochlorine Pesticides (OC) (QCLot: 5228957)								
EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	0.5 mg/kg	112	46.0	116
EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	0.5 mg/kg	124	53.0	133
EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	0.5 mg/kg	111	45.0	117
EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	0.5 mg/kg	109	46.0	122
EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	97.6	47.0	117
EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	0.5 mg/kg	116	40.0	118
EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	0.5 mg/kg	117	47.0	123

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP068A: Organochlorine Pesticides (OC) (QCLot: 5228957) - continued								
EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	0.5 mg/kg	117	41.0	119
EP068: Total Chlordane (sum)	----	0.05	mg/kg	<0.05	----	----	----	----
EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	0.5 mg/kg	86.9	43.0	119
EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	0.5 mg/kg	115	41.0	131
EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	0.5 mg/kg	67.6	41.0	119
EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	0.5 mg/kg	119	41.0	127
EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	0.5 mg/kg	63.3	44.0	122
EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	0.5 mg/kg	118	37.0	129
EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	0.5 mg/kg	113	41.0	127
EP068: Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	----	----	----	----
EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	0.5 mg/kg	122	42.0	122
EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	0.5 mg/kg	107	31.2	117
EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	0.5 mg/kg	63.6	38.0	120
EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	0.5 mg/kg	107	31.4	125
EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	0.5 mg/kg	122	31.2	123
EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	0.5 mg/kg	85.1	24.7	125
EP068: Sum of DDD + DDE + DDT	72-54-8/72-5 5-9/50-2	0.05	mg/kg	<0.05	----	----	----	----
EP068: Sum of Aldrin + Dieldrin	309-00-2/60- 57-1	0.05	mg/kg	<0.05	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 5228956)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	3 mg/kg	107	71.0	123
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	3 mg/kg	106	69.0	129
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	3 mg/kg	105	65.0	125
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	3 mg/kg	105	71.0	125
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	3 mg/kg	107	66.0	124
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	3 mg/kg	108	60.0	112
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	3 mg/kg	110	67.0	127
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	3 mg/kg	111	65.0	127
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	3 mg/kg	97.9	57.0	125
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	3 mg/kg	101	57.0	131
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	3 mg/kg	98.4	65.0	125
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	3 mg/kg	100	69.0	127
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	3 mg/kg	93.8	63.0	121

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 5228956) - continued								
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	3 mg/kg	74.2	61.0	121
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	3 mg/kg	72.1	52.0	128
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	3 mg/kg	75.4	65.0	125
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5228953)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	35 mg/kg	112	66.0	122
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5228955)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	1303 mg/kg	107	70.0	111
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	2379 mg/kg	101	71.9	109
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	336 mg/kg	96.8	63.8	118
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5228953)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	45 mg/kg	95.7	66.0	122
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5228955)								
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	1797 mg/kg	109	72.8	110
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	2060 mg/kg	99.5	67.8	114
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	100 mg/kg	71.9	50.3	123
EP080: BTEXN (QCLot: 5228953)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	2 mg/kg	91.0	72.0	122
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	2 mg/kg	101	75.0	119
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	2 mg/kg	98.0	73.0	121
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	4 mg/kg	100	74.0	122
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	2 mg/kg	99.4	75.0	121
EP080: Naphthalene	91-20-3	1	mg/kg	<1	0.5 mg/kg	91.4	64.0	126

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 5230253)							
EP2310822-005	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	98.0	70.0	130
		EG005T: Barium	7440-39-3	50 mg/kg	107	70.0	130
		EG005T: Beryllium	7440-41-7	50 mg/kg	110	70.0	130
		EG005T: Cadmium	7440-43-9	12.5 mg/kg	104	70.0	130

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 5230253) - continued							
EP2310822-005	Anonymous	EG005T: Chromium	7440-47-3	50 mg/kg	101	70.0	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	105	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	112	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	109	70.0	130
		EG005T: Manganese	7439-96-5	50 mg/kg	94.3	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	104	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 5230252)							
EP2310822-005	Anonymous	EG035T: Mercury	7439-97-6	1 mg/kg	92.5	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5228953)							
EP2310822-002	Anonymous	EP080: C6 - C9 Fraction	----	24 mg/kg	88.8	69.1	135
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5228955)							
EP2310822-002	Anonymous	EP071: C10 - C14 Fraction	----	1303 mg/kg	103	64.7	126
		EP071: C15 - C28 Fraction	----	2379 mg/kg	95.7	61.7	124
		EP071: C29 - C36 Fraction	----	336 mg/kg	94.0	64.6	131
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5228953)							
EP2310822-002	Anonymous	EP080: C6 - C10 Fraction	C6_C10	29 mg/kg	71.6	69.1	135
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5228955)							
EP2310822-002	Anonymous	EP071: >C10 - C16 Fraction	----	1797 mg/kg	105	64.7	126
		EP071: >C16 - C34 Fraction	----	2060 mg/kg	94.0	61.7	124
		EP071: >C34 - C40 Fraction	----	100 mg/kg	74.7	64.6	131
EP080: BTEXN (QCLot: 5228953)							
EP2310822-002	Anonymous	EP080: Benzene	71-43-2	2 mg/kg	89.2	76.4	118
		EP080: Toluene	108-88-3	2 mg/kg	97.3	67.4	112

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP2310835**	Page	: 1 of 5
Client	: **WESTERN ENVIRONMENTAL P/L**	Laboratory	: Environmental Division Perth
Contact	: Louis Grogan	Telephone	: +61-8-9406 1301
Project	: 22.142	Date Samples Received	: 19-Jul-2023
Site	: ----	Issue Date	: 16-Aug-2023
Sampler	: ----	No. of samples received	: 4
Order number	: ----	No. of samples analysed	: 4

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA055: Moisture Content (Dried @ 105-110°C)						
Soil Glass Jar - Unpreserved						
BG01, TP18_0.5, TP20_0.5, TP04_0.5	----	----	----	11-Aug-2023	28-Jul-2023	**14**
EG035T: Total Recoverable Mercury by FIMS						
Soil Glass Jar - Unpreserved						
BG01	----	----	----	14-Aug-2023	11-Aug-2023	**3**
EP068A: Organochlorine Pesticides (OC)						
Soil Glass Jar - Unpreserved						
TP04_0.5	14-Aug-2023	28-Jul-2023	**17**	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons						
Soil Glass Jar - Unpreserved						
TP20_0.5	14-Aug-2023	28-Jul-2023	**17**	----	----	----
EP080/071: Total Petroleum Hydrocarbons						
Soil Glass Jar - Unpreserved						
TP18_0.5	11-Aug-2023	28-Jul-2023	**14**	12-Aug-2023	28-Jul-2023	**15**
Soil Glass Jar - Unpreserved						
TP18_0.5	14-Aug-2023	28-Jul-2023	**17**	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions						
Soil Glass Jar - Unpreserved						
TP18_0.5	11-Aug-2023	28-Jul-2023	**14**	12-Aug-2023	28-Jul-2023	**15**
Soil Glass Jar - Unpreserved						
TP18_0.5	14-Aug-2023	28-Jul-2023	**17**	----	----	----
EP080: BTEXN						
Soil Glass Jar - Unpreserved						
TP18_0.5	11-Aug-2023	28-Jul-2023	**14**	12-Aug-2023	28-Jul-2023	**15**

Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type / Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
Matrix Spikes (MS)	0				
PAH/Phenols (SIM)	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055)							
BG01, TP18_0.5, TP20_0.5, TP04_0.5	**14-Jul-2023**	**----**	----	----	**11-Aug-2023**	28-Jul-2023	×
ED093T: Total Major Cations							
Soil Glass Jar - Unpreserved (ED093T)							
BG01	**14-Jul-2023**	**11-Aug-2023**	10-Jan-2024	✓	**16-Aug-2023**	10-Jan-2024	✓
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
BG01	**14-Jul-2023**	**11-Aug-2023**	10-Jan-2024	✓	**16-Aug-2023**	10-Jan-2024	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
BG01	**14-Jul-2023**	**11-Aug-2023**	11-Aug-2023	✓	**14-Aug-2023**	11-Aug-2023	×
EP068A: Organochlorine Pesticides (OC)							
Soil Glass Jar - Unpreserved (EP068)							
TP04_0.5	**14-Jul-2023**	**14-Aug-2023**	28-Jul-2023	×	**16-Aug-2023**	23-Sep-2023	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))							
TP20_0.5	**14-Jul-2023**	**14-Aug-2023**	28-Jul-2023	×	**16-Aug-2023**	23-Sep-2023	✓
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080)							
TP18_0.5	**14-Jul-2023**	**11-Aug-2023**	28-Jul-2023	×	**12-Aug-2023**	28-Jul-2023	×
Soil Glass Jar - Unpreserved (EP071)							
TP18_0.5	**14-Jul-2023**	**14-Aug-2023**	28-Jul-2023	×	**16-Aug-2023**	23-Sep-2023	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP080)							
TP18_0.5	**14-Jul-2023**	**11-Aug-2023**	28-Jul-2023	×	**12-Aug-2023**	28-Jul-2023	×
Soil Glass Jar - Unpreserved (EP071)							
TP18_0.5	**14-Jul-2023**	**14-Aug-2023**	28-Jul-2023	×	**16-Aug-2023**	23-Sep-2023	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080)							
TP18_0.5	**14-Jul-2023**	**11-Aug-2023**	28-Jul-2023	×	**12-Aug-2023**	28-Jul-2023	×

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Major Cations by ICPAES - Total	ED093T	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Major Cations by ICPAES - Total	ED093T	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Major Cations by ICPAES - Total	ED093T	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	0	1	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	0	1	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Major Cations by ICPAES - Total	ED093T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010 (ICPAES) Major cations are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
Pesticides by GCMS	EP068	SOIL	In house: Referenced to USEPA SW 846 - 8270 Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM Schedule B(3).
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015 Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM Schedule B(3).
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270. Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM Schedule B(3) amended.

Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.

CHAIN OF CUSTODY RECORD

WESTERN ENVIRONMENTAL

Company Name : WESTERN ENVIRONMENTAL PTY LTD	Contact Name : Louis Grogan	Purchase Order : 22.142	CoC Number :
Office Address : Unit 5 162 Colin Street, West Perth, WA 6005	Project Manager : Louis Grogan	Project Number : 22.142	Quote ID : 190301WES
Laboratory Address : Eurofins ARL, 46 - 48 Banksia Road, Welshpool WA 6106, Contact: Douglas Todd (Lab Manager), +61 (0)8 6253 4444, Email: douglastodd@arlwa.com.au	Email for results: louis.g@westenv.com.au	CC: jade.d@westenv.com.au robin.a@westenv.com.au	Courier Consignment # :

Special Directions & Comments :

#	Sample ID	Sample Date	Matrix	Analytes: Metals (Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, Zn)	S-24 (TRH (C6-C40) / BTEXN / PAH / Phenols)	S-12 (OC/ OP)	Methyl Tert-Butyl Ethyl (MTBE)	Please Hold							Container: ACM bag	0.5 L Blue plastic	Black MB plastic	100ml Green Plastic	100ml Purple Plastic	VIAL	Purple Amber (glass)	Glass Jar
1	TRIP01	13/07/2023	Soil	X	X	X	X															1
2	TRIP02	13/07/2023	Soil	X	X	X	X															1
3	TRIP03	14/07/2023						X														1
4																						
5																						
6																						
7																						
8																						
9																						
10																						
11																						
12																						
13																						
14																						
15																						

Relinquished By: Jade Dennis	Received By: Hayley	Turn around Time : 5 Days	Method Of Shipment :
Date & Time : 14/07/2023	Date & Time : 18/7/23 16:00		Courier
Signature: JD	Signature:	Comments : @17.9	Hand Delivered
	Report Number :		Postal

1009147

www.eurofins.com.au EnviroSales@eurofins.com

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NATA# 1261
Site# 25079 & 25289

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43 Detroit Drive
Rolleston,
Christchurch 7675
Tel: +64 3 343 5201
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Sample Receipt Advice

Company name:	Western Environmental Pty Ltd (WA)
Contact name:	Louis Grogan
Project name:	Not provided
Project ID:	22.142
Turnaround time:	5 Day
Date/Time received	Jul 18, 2023 4:00 PM
Eurofins reference	1009147

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	Sample Temperature of chilled sample on the batch as recorded by Eurofins Sample Receipt : 17.9 degrees Celsius.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
N/A	Sample containers for volatile analysis received with zero headspace.
X	Split sample sent to requested external lab.
X	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Andrew Harvey on phone : or by email: AndrewHarvey@eurofins.com

Results will be delivered electronically via email to Louis Grogan - louis.g@westenv.com.au.

Note: A copy of these results will also be delivered to the general Western Environmental Pty Ltd (WA) email address.

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Company Name: Western Environmental Pty Ltd (WA)
Address: Unit 5, 162 Colin St
West Perth
WA 6005

Project Name:
Project ID: 22.142

Order No.: 22.142
Report #: 1009147
Phone: 08 6162 8980
Fax:

Received: Jul 18, 2023 4:00 PM
Due: Jul 25, 2023
Priority: 5 Day
Contact Name: Louis Grogan

Eurofins Analytical Services Manager : Andrew Harvey

Sample Detail						Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	HOLD	Lead	Manganese	Methyl tert Butyl Ether	Molybdenum	Nickel	Selenium	Tin	Zinc	Moisture Set	Eurofins Suite B4A	OCOP in Soil
Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																										
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**																					
1	TRIP01	Jul 13, 2023		Soil	L23-JI0039645	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
2	TRIP02	Jul 13, 2023		Soil	L23-JI0039646	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
3	TRIP03	Jul 14, 2023		Soil	L23-JI0039647										X											
Test Counts						2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2

Western Environmental Pty Ltd
Unit 5, 162 Colin St
West Perth
WA 6005

NATA Accredited
Accreditation Number 2377
Site Number 2370

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Louis Grogan**

Report **1009147-S**
Project name
Project ID 22.142
Received Date Jul 18, 2023

Client Sample ID			**TRIP01**	**TRIP02**
Sample Matrix			**Soil**	**Soil**
Eurofins Sample No.			**L23-JI0039645**	**L23-JI0039646**
Date Sampled			**Jul 13, 2023**	**Jul 13, 2023**
Test/Reference	LOR	Unit		
Methyl tert Butyl Ether	0.1	mg/kg	< 0.1	< 0.1
Antimony	2	mg/kg	< 2	< 2
Arsenic	5	mg/kg	< 5	< 5
Barium	1	mg/kg	2.7	18
Beryllium	0.1	mg/kg	< 0.1	0.1
Boron	5	mg/kg	< 5	7.6
Cadmium	0.1	mg/kg	< 0.1	< 0.1
Chromium	1	mg/kg	< 1	< 1
Cobalt	1	mg/kg	< 1	< 1
Copper	1	mg/kg	< 1	< 1
Lead	1	mg/kg	< 1	< 1
Manganese	1	mg/kg	3.4	62
Molybdenum	2	mg/kg	< 2	< 2
Nickel	1	mg/kg	< 1	< 1
Selenium	2	mg/kg	< 2	< 2
Tin	1	mg/kg	< 1	< 1
Zinc	1	mg/kg	7.1	4.8
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				
TRH C6-C9	20	mg/kg	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20
TRH C15-C28	50	mg/kg	< 50	< 50
TRH C29-C36	50	mg/kg	< 50	< 50
TRH C10-C36 (Total)	50	mg/kg	< 50	< 50
BTEX				
Benzene	0.1	mg/kg	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1
Xylenes - Total*	0.3	mg/kg	< 0.3	< 0.3
BTEX				
4-Bromofluorobenzene (surr.)	1	%	137	104

Client Sample ID			TRIP01	TRIP02
Sample Matrix			Soil	Soil
Eurofins Sample No.			L23-JI0039645	L23-JI0039646
Date Sampled			Jul 13, 2023	Jul 13, 2023
Test/Reference	LOR	Unit		
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50
TRH C6-C10	20	mg/kg	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20
Polycyclic Aromatic Hydrocarbons				
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2	1.2
Acenaphthene	0.5	mg/kg	< 0.5	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5
Anthracene	0.5	mg/kg	< 0.5	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5	< 0.5
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 0.5	< 0.5
Benzo(g.h.i)perylene	0.5	mg/kg	< 0.5	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	< 0.5
Chrysene	0.5	mg/kg	< 0.5	< 0.5
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5	< 0.5
Fluoranthene	0.5	mg/kg	< 0.5	< 0.5
Fluorene	0.5	mg/kg	< 0.5	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5	< 0.5
Naphthalene	0.5	mg/kg	< 0.5	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5	< 0.5
Pyrene	0.5	mg/kg	< 0.5	< 0.5
Total PAH*	0.5	mg/kg	< 0.5	< 0.5
2-Fluorobiphenyl (surr.)	1	%	78	101
p-Terphenyl-d14 (surr.)	1	%	110	114
Phenols (Halogenated)				
2-Chlorophenol	0.5	mg/kg	< 0.5	< 0.5
2.4-Dichlorophenol	0.5	mg/kg	< 0.5	< 0.5
2.4.5-Trichlorophenol	1	mg/kg	< 1	< 1
2.4.6-Trichlorophenol	1	mg/kg	< 1	< 1
2.6-Dichlorophenol	0.5	mg/kg	< 0.5	< 0.5
4-Chloro-3-methylphenol	1	mg/kg	< 1	< 1
Pentachlorophenol	1	mg/kg	< 1	< 1
Tetrachlorophenols - Total	10	mg/kg	< 10	< 10
Total Halogenated Phenol*	1	mg/kg	< 1	< 1
Phenols (non-Halogenated)				
2-Cyclohexyl-4.6-dinitrophenol	20	mg/kg	< 20	< 20
2-Methyl-4.6-dinitrophenol	5	mg/kg	< 5	< 5
2-Nitrophenol	1	mg/kg	< 1	< 1
2.4-Dimethylphenol	0.5	mg/kg	< 0.5	< 0.5
2.4-Dinitrophenol	5	mg/kg	< 5	< 5
2-Methylphenol (o-Cresol)	0.2	mg/kg	< 0.2	< 0.2
3&4-Methylphenol (m&p-Cresol)	0.4	mg/kg	< 0.4	< 0.4
Total cresols*	0.5	mg/kg	< 0.5	< 0.5
4-Nitrophenol	5	mg/kg	< 5	< 5
Dinoseb	20	mg/kg	< 20	< 20
Phenol	0.5	mg/kg	< 0.5	< 0.5

Client Sample ID			TRIP01	TRIP02
Sample Matrix			Soil	Soil
Eurofins Sample No.			L23-JI0039645	L23-JI0039646
Date Sampled			Jul 13, 2023	Jul 13, 2023
Test/Reference	LOR	Unit		
Phenols (non-Halogenated)				
Phenol-d6 (surr.)	1	%	85	118
Total Non-Halogenated Phenol*	20	mg/kg	< 20	< 20
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				
TRH >C10-C16	50	mg/kg	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100	< 100
OCOP in Soil				
Aldrin	0.01	mg/kg	< 0.01	< 0.01
alpha-BHC (HCH)	0.01	mg/kg	< 0.01	< 0.01
beta-BHC (HCH)	0.01	mg/kg	< 0.01	< 0.01
delta-BHC (HCH)	0.01	mg/kg	< 0.01	< 0.01
Bifenthrin	0.2	mg/kg	< 0.2	< 0.2
Bromophos Ethyl	0.05	mg/kg	< 0.05	< 0.05
Chlordane	0.01	mg/kg	< 0.01	< 0.01
Chlorpyrifos	0.02	mg/kg	< 0.02	< 0.02
Dieldrin	0.01	mg/kg	< 0.01	< 0.01
p.p-DDD	0.01	mg/kg	< 0.01	< 0.01
p.p-DDE	0.01	mg/kg	< 0.01	< 0.01
p.p-DDT	0.01	mg/kg	< 0.01	< 0.01
o.p-DDT	0.01	mg/kg	< 0.01	< 0.01
Endosulfan I	0.01	mg/kg	< 0.01	< 0.01
Endosulfan II	0.01	mg/kg	< 0.01	< 0.01
Endosulfan Sulfate	0.01	mg/kg	< 0.01	< 0.01
Endrin	0.01	mg/kg	< 0.01	< 0.01
Heptachlor	0.01	mg/kg	< 0.01	< 0.01
Heptachlor Epoxide	0.01	mg/kg	< 0.01	< 0.01
Hexachlorobenzene (HCB)	0.01	mg/kg	< 0.01	< 0.01
Lindane	0.01	mg/kg	< 0.01	< 0.01
Methoxychlor	0.2	mg/kg	< 0.2	< 0.2
Oxychlordane	0.01	mg/kg	< 0.01	< 0.01
Diazinon	0.2	mg/kg	< 0.2	< 0.2
Ethion	0.05	mg/kg	< 0.05	< 0.05
Fenitrothion	0.1	mg/kg	< 0.1	< 0.1
Malathion	0.1	mg/kg	< 0.1	< 0.1
Trifluralin	0.2	mg/kg	< 0.2	< 0.2
Sample Properties				
% Moisture	1	%	5.4	11

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Methyl tert Butyl Ether	Welshpool	Jul 20, 2023	14 Days
- Method: ARL133 - Purgeable Volatile Organic Compounds in Soil by GCMS			
Antimony	Welshpool	Jul 20, 2023	180 Day
- Method: ARL401/403 - Metals in Soil and Sediment by ICPOES/MS			
Arsenic	Welshpool	Jul 20, 2023	180 Days
- Method: ARL401/403 - Metals in Soil and Sediment by ICPOES/MS			
Barium	Welshpool	Jul 20, 2023	180 Days
- Method: ARL401/403 - Metals in Soil and Sediment by ICPOES/MS			
Beryllium	Welshpool	Jul 20, 2023	180 Days
- Method: ARL401/403 - Metals in Soil and Sediment by ICPOES/MS			
Boron	Welshpool	Jul 20, 2023	180 Days
- Method: ARL401/403 - Metals in Soil and Sediment by ICPOES/MS			
Cadmium	Welshpool	Jul 20, 2023	180 Days
- Method: ARL401/403 - Metals in Soil and Sediment by ICPOES/MS			
Chromium	Welshpool	Jul 20, 2023	180 Days
- Method: ARL401/403 - Metals in Soil and Sediment by ICPOES/MS			
Cobalt	Welshpool	Jul 20, 2023	180 Days
- Method: ARL401/403 - Metals in Soil and Sediment by ICPOES/MS			
Copper	Welshpool	Jul 20, 2023	180 Days
- Method: ARL401/403 - Metals in Soil and Sediment by ICPOES/MS			
Lead	Welshpool	Jul 20, 2023	180 Days
- Method: ARL401/403 - Metals in Soil and Sediment by ICPOES/MS			
Manganese	Welshpool	Jul 20, 2023	180 Days
- Method: ARL401/403 - Metals in Soil and Sediment by ICPOES/MS			
Molybdenum	Welshpool	Jul 20, 2023	180 Days
- Method: ARL401/403 - Metals in Soil and Sediment by ICPOES/MS			
Nickel	Welshpool	Jul 20, 2023	180 Days
- Method: ARL401/403 - Metals in Soil and Sediment by ICPOES/MS			
Selenium	Welshpool	Jul 20, 2023	180 Days
- Method: ARL No. 065 - Selenium by Hydride Atomic Absorption			
Tin	Welshpool	Jul 20, 2023	180 Day
- Method: ARL401/403 - Metals in Soil and Sediment by ICPOES/MS			
Zinc	Welshpool	Jul 20, 2023	180 Days
- Method: ARL401/403 - Metals in Soil and Sediment by ICPOES/MS			
OCOP in Soil	Welshpool	Jul 20, 2023	14 Days
- Method: ARL003 - OCOP and PCB in Soil			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Welshpool	Jul 20, 2023	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Welshpool	Jul 20, 2023	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Welshpool	Jul 20, 2023	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Polycyclic Aromatic Hydrocarbons	Welshpool	Jul 20, 2023	14 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
Phenols (Halogenated)	Welshpool	Jul 20, 2023	14 Day
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water by GC MSMS			
Phenols (non-Halogenated)	Welshpool	Jul 20, 2023	14 Day
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water by GC MSMS			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Welshpool	Jul 20, 2023	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
% Moisture	Welshpool	Jul 19, 2023	14 Days
- Method: ARL135 Moisture in Solids			

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Project ID: 22.142

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Report #: 1009147
Phone: 08 6162 8980
Fax:

Received: Jul 18, 2023 4:00 PM
Due: Jul 25, 2023
Priority: 5 Day
Contact Name: Louis Grogan

Eurofins Analytical Services Manager : Andrew Harvey

Sample Detail						Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	HOLD	Lead	Manganese	Methyl tert Butyl Ether	Molybdenum	Nickel	Selenium	Tin	Zinc	Moisture Set	Eurofins Suite B4A	OCOP in Soil
Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																										
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**																					
1	TRIP01	Jul 13, 2023		Soil	L23-JI0039645	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
2	TRIP02	Jul 13, 2023		Soil	L23-JI0039646	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
3	TRIP03	Jul 14, 2023		Soil	L23-JI0039647										X											
Test Counts						2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/ g: milligrams per kilogram	**mg/L:** milligrams per litre	**g/L:** micrograms per litre
ppm: parts per million	**ppb:** parts per billion	**:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit		

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method lan	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPI E	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
T TO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Methyl tert Butyl Ether	mg/kg	< 0.1			0.1	Pass	
Antimony	mg/kg	< 2			2	Pass	
Arsenic	mg/kg	< 5			5	Pass	
Barium	mg/kg	< 1			1	Pass	
Beryllium	mg/kg	< 0.1			0.1	Pass	
Boron	mg/kg	< 5			5	Pass	
Cadmium	mg/kg	< 0.1			0.1	Pass	
Chromium	mg/kg	< 1			1	Pass	
Cobalt	mg/kg	< 1			1	Pass	
Copper	mg/kg	< 1			1	Pass	
Lead	mg/kg	< 1			1	Pass	
Manganese	mg/kg	< 1			1	Pass	
Molybdenum	mg/kg	< 2			2	Pass	
Nickel	mg/kg	< 1			1	Pass	
Selenium	mg/kg	< 2			2	Pass	
Tin	mg/kg	< 1			1	Pass	
Zinc	mg/kg	< 1			1	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
Method Blank							
BTEX							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total*	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g.h.i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a.h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1.2.3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Phenols (Halogenated)							
2-Chlorophenol	mg/kg	< 0.5			0.5	Pass	
2.4-Dichlorophenol	mg/kg	< 0.5			0.5	Pass	
2.4.5-Trichlorophenol	mg/kg	< 1			1	Pass	
2.4.6-Trichlorophenol	mg/kg	< 1			1	Pass	
2.6-Dichlorophenol	mg/kg	< 0.5			0.5	Pass	
4-Chloro-3-methylphenol	mg/kg	< 1			1	Pass	
Pentachlorophenol	mg/kg	< 1			1	Pass	
Tetrachlorophenols - Total	mg/kg	< 10			10	Pass	
Method Blank							
Phenols (non-Halogenated)							
2-Cyclohexyl-4.6-dinitrophenol	mg/kg	< 20			20	Pass	
2-Methyl-4.6-dinitrophenol	mg/kg	< 5			5	Pass	
2-Nitrophenol	mg/kg	< 1			1	Pass	
2.4-Dimethylphenol	mg/kg	< 0.5			0.5	Pass	
2.4-Dinitrophenol	mg/kg	< 5			5	Pass	
2-Methylphenol (o-Cresol)	mg/kg	< 0.2			0.2	Pass	
3&4-Methylphenol (m&p-Cresol)	mg/kg	< 0.4			0.4	Pass	
4-Nitrophenol	mg/kg	< 5			5	Pass	
Dinoseb	mg/kg	< 20			20	Pass	
Phenol	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
OCOP in Soil							
Aldrin	mg/kg	< 0.01			0.01	Pass	
alpha-BHC (HCH)	mg/kg	< 0.01			0.01	Pass	
beta-BHC (HCH)	mg/kg	< 0.01			0.01	Pass	
delta-BHC (HCH)	mg/kg	< 0.01			0.01	Pass	
Bifenthrin	mg/kg	< 0.2			0.2	Pass	
Bromophos Ethyl	mg/kg	< 0.05			0.05	Pass	
Chlordane	mg/kg	< 0.01			0.01	Pass	
Chlorpyrifos	mg/kg	< 0.02			0.02	Pass	
Dieldrin	mg/kg	< 0.01			0.01	Pass	
p.p-DDD	mg/kg	< 0.01			0.01	Pass	
p.p-DDE	mg/kg	< 0.01			0.01	Pass	
p.p-DDT	mg/kg	< 0.01			0.01	Pass	
o.p-DDT	mg/kg	< 0.01			0.01	Pass	
Endosulfan I	mg/kg	< 0.01			0.01	Pass	
Endosulfan II	mg/kg	< 0.01			0.01	Pass	
Endosulfan Sulfate	mg/kg	< 0.01			0.01	Pass	
Endrin	mg/kg	< 0.01			0.01	Pass	
Heptachlor	mg/kg	< 0.01			0.01	Pass	
Heptachlor Epoxide	mg/kg	< 0.01			0.01	Pass	
Hexachlorobenzene (HCB)	mg/kg	< 0.01			0.01	Pass	
Lindane	mg/kg	< 0.01			0.01	Pass	
Methoxychlor	mg/kg	< 0.2			0.2	Pass	
Oxychlordane	mg/kg	< 0.01			0.01	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Diazinon	mg/kg	< 0.2			0.2	Pass	
Ethion	mg/kg	< 0.05			0.05	Pass	
Fenitrothion	mg/kg	< 0.1			0.1	Pass	
Malathion	mg/kg	< 0.1			0.1	Pass	
Trifluralin	mg/kg	< 0.2			0.2	Pass	
LCS - % Recovery							
Methyl tert Butyl Ether	%	99			60-120	Pass	
Antimony	%	107			80-120	Pass	
Arsenic	%	92			80-120	Pass	
Barium	%	83			80-120	Pass	
Beryllium	%	109			80-120	Pass	
Boron	%	114			80-120	Pass	
Cadmium	%	92			80-120	Pass	
Chromium	%	92			80-120	Pass	
Cobalt	%	103			80-120	Pass	
Copper	%	111			80-120	Pass	
Lead	%	86			80-120	Pass	
Manganese	%	82			80-120	Pass	
Molybdenum	%	91			80-120	Pass	
Nickel	%	120			80-120	Pass	
Selenium	%	105			80-120	Pass	
Zinc	%	109			80-120	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	118			70-130	Pass	
TRH C10-C14	%	110			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	101			70-130	Pass	
Toluene	%	103			70-130	Pass	
Ethylbenzene	%	101			70-130	Pass	
m&p-Xylenes	%	101			70-130	Pass	
o-Xylene	%	100			70-130	Pass	
Xylenes - Total*	%	101			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	102			70-130	Pass	
TRH C6-C10	%	94			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	95			70-130	Pass	
Acenaphthylene	%	96			70-130	Pass	
Anthracene	%	111			70-130	Pass	
Benz(a)anthracene	%	106			70-130	Pass	
Benzo(a)pyrene	%	106			70-130	Pass	
Benzo(b&j)fluoranthene	%	107			70-130	Pass	
Benzo(g.h.i)perylene	%	92			70-130	Pass	
Benzo(k)fluoranthene	%	107			70-130	Pass	
Chrysene	%	107			70-130	Pass	
Dibenz(a.h)anthracene	%	92			70-130	Pass	
Fluoranthene	%	99			70-130	Pass	
Fluorene	%	107			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	112			70-130	Pass	
Naphthalene	%	95			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Phenanthrene	%	114			70-130	Pass	
Pyrene	%	116			70-130	Pass	
LCS - % Recovery							
Phenols (Halogenated)							
2-Chlorophenol	%	98			25-140	Pass	
2.4-Dichlorophenol	%	94			25-140	Pass	
2.4.5-Trichlorophenol	%	101			25-140	Pass	
2.4.6-Trichlorophenol	%	89			25-140	Pass	
2.6-Dichlorophenol	%	108			25-140	Pass	
4-Chloro-3-methylphenol	%	92			25-140	Pass	
Tetrachlorophenols - Total	%	88			25-140	Pass	
LCS - % Recovery							
Phenols (non-Halogenated)							
2-Nitrophenol	%	111			25-140	Pass	
2.4-Dimethylphenol	%	100			25-140	Pass	
2.4-Dinitrophenol	%	108			25-140	Pass	
2-Methylphenol (o-Cresol)	%	114			25-140	Pass	
3&4-Methylphenol (m&p-Cresol)	%	109			25-140	Pass	
Phenol	%	96			25-140	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	%	122			70-130	Pass	
LCS - % Recovery							
OCOP in Soil							
Aldrin	%	102			60-120	Pass	
Dieldrin	%	86			60-120	Pass	
p.p-DDT	%	63			60-120	Pass	
Endrin	%	70			60-120	Pass	
Heptachlor	%	100			60-120	Pass	
Lindane	%	88			60-120	Pass	
CRM - % Recovery							
Antimony	%	80			80-120	Pass	
Arsenic	%	87			80-120	Pass	
Barium	%	88			80-120	Pass	
Beryllium	%	92			80-120	Pass	
Boron	%	103			80-120	Pass	
Cadmium	%	90			80-120	Pass	
Chromium	%	93			80-120	Pass	
Cobalt	%	100			80-120	Pass	
Copper	%	88			80-120	Pass	
Lead	%	99			80-120	Pass	
Manganese	%	89			80-120	Pass	
Molybdenum	%	89			80-120	Pass	
Nickel	%	92			80-120	Pass	
Selenium	%	82			80-120	Pass	
Tin	%	89			80-120	Pass	
Zinc	%	102			80-120	Pass	
CRM - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	103			70-130	Pass	
CRM - % Recovery							
BTEX							
Benzene	%	97			70-130	Pass	
Toluene	%	98			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Ethylbenzene	%	99			70-130	Pass	
m&p-Xylenes	%	93			70-130	Pass	
o-Xylene	%	98			70-130	Pass	
Xylenes - Total*	%	94			70-130	Pass	
CRM - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	97			70-130	Pass	
TRH C6-C10	%	94			70-130	Pass	
CRM - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	100			80-120	Pass	
Acenaphthylene	%	93			80-120	Pass	
Anthracene	%	103			80-120	Pass	
Benz(a)anthracene	%	96			70-130	Pass	
Benzo(a)pyrene	%	88			80-120	Pass	
Benzo(b&j)fluoranthene	%	99			80-120	Pass	
Benzo(k)fluoranthene	%	117			80-120	Pass	
Chrysene	%	103			80-120	Pass	
Fluoranthene	%	104			80-120	Pass	
Fluorene	%	96			80-120	Pass	
Naphthalene	%	104			70-130	Pass	
Phenanthrene	%	103			80-120	Pass	
Pyrene	%	101			80-120	Pass	
CRM - % Recovery							
Phenols (Halogenated)							
2-Chlorophenol	%	103			30-130	Pass	
2.4-Dichlorophenol	%	90			30-130	Pass	
2.4.5-Trichlorophenol	%	89			30-130	Pass	
2.4.6-Trichlorophenol	%	95			30-130	Pass	
2.6-Dichlorophenol	%	82			30-130	Pass	
4-Chloro-3-methylphenol	%	91			30-130	Pass	
Tetrachlorophenols - Total	%	103			30-130	Pass	
CRM - % Recovery							
Phenols (non-Halogenated)							
2-Nitrophenol	%	103			30-130	Pass	
2.4-Dimethylphenol	%	80			30-130	Pass	
2.4-Dinitrophenol	%	82			70-130	Pass	
2-Methylphenol (o-Cresol)	%	87			30-130	Pass	
3&4-Methylphenol (m&p-Cresol)	%	89			30-130	Pass	
4-Nitrophenol	%	95			30-130	Pass	
Phenol	%	108			30-130	Pass	
CRM - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	%	97			70-130	Pass	
TRH >C34-C40	%	98			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Antimony	L23-JI0042661	NCP	%	64			80-120	Fail	Q08
Arsenic	L23-JI0042661	NCP	%	68			80-120	Fail	Q08
Barium	L23-JI0042661	NCP	%	67			80-120	Fail	Q08
Beryllium	L23-JI0042661	NCP	%	75			80-120	Fail	Q08
Boron	L23-JI0042661	NCP	%	94			80-120	Pass	
Cadmium	L23-JI0042661	NCP	%	67			80-120	Fail	Q08

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Chromium	L23-JI0042661	NCP	%	70			80-120	Fail	Q08
Cobalt	L23-JI0042661	NCP	%	83			80-120	Pass	
Copper	L23-JI0042661	NCP	%	86			80-120	Pass	
Lead	L23-JI0042661	NCP	%	88			80-120	Pass	
Manganese	L23-JI0042661	NCP	%	68			80-120	Fail	Q08
Molybdenum	L23-JI0042661	NCP	%	80			80-120	Pass	
Nickel	L23-JI0042661	NCP	%	61			80-120	Fail	Q08
Selenium	L23-JI0042661	NCP	%	64			80-120	Fail	Q08
Tin	L23-JI0042661	NCP	%	72			80-120	Fail	Q08
Zinc	L23-JI0042661	NCP	%	82			80-120	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C10-C14	L23-JI0040317	NCP	%	99			70-130	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	L23-JI0035574	NCP	%	82			70-130	Pass	
Acenaphthylene	L23-JI0035574	NCP	%	86			70-130	Pass	
Anthracene	L23-JI0035574	NCP	%	89			70-130	Pass	
Benz(a)anthracene	L23-JI0035574	NCP	%	94			70-130	Pass	
Benzo(a)pyrene	L23-JI0035574	NCP	%	95			70-130	Pass	
Benzo(b&j)fluoranthene	L23-JI0035574	NCP	%	88			70-130	Pass	
Benzo(g.h.i)perylene	L23-JI0035574	NCP	%	92			70-130	Pass	
Benzo(k)fluoranthene	L23-JI0035574	NCP	%	88			70-130	Pass	
Chrysene	L23-JI0035574	NCP	%	89			70-130	Pass	
Dibenz(a.h)anthracene	L23-JI0035574	NCP	%	83			70-130	Pass	
Fluoranthene	L23-JI0035574	NCP	%	105			70-130	Pass	
Fluorene	L23-JI0035574	NCP	%	95			70-130	Pass	
Indeno(1.2.3-cd)pyrene	L23-JI0035574	NCP	%	103			70-130	Pass	
Naphthalene	L23-JI0035574	NCP	%	87			70-130	Pass	
Phenanthrene	L23-JI0035574	NCP	%	110			70-130	Pass	
Pyrene	L23-JI0035574	NCP	%	109			70-130	Pass	
Spike - % Recovery									
Phenols (Halogenated)				Result 1					
2-Chlorophenol	L23-JI0035574	NCP	%	84			30-130	Pass	
2.4-Dichlorophenol	L23-JI0035574	NCP	%	84			30-130	Pass	
2.6-Dichlorophenol	L23-JI0035574	NCP	%	89			30-130	Pass	
4-Chloro-3-methylphenol	L23-JI0035574	NCP	%	77			30-130	Pass	
Pentachlorophenol	L23-JI0035574	NCP	%	106			30-130	Pass	
Spike - % Recovery									
Phenols (non-Halogenated)				Result 1					
2-Nitrophenol	L23-JI0035574	NCP	%	91			30-130	Pass	
2.4-Dimethylphenol	L23-JI0040339	NCP	%	77			30-130	Pass	
2.4-Dinitrophenol	L23-JI0035574	NCP	%	89			30-130	Pass	
2-Methylphenol (o-Cresol)	L23-JI0035574	NCP	%	78			30-130	Pass	
3&4-Methylphenol (m&p-Cresol)	L23-JI0040339	NCP	%	85			30-130	Pass	
Phenol	L23-JI0035574	NCP	%	77			30-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	L23-JI0040317	NCP	%	95			70-130	Pass	
Spike - % Recovery									
OCOP in Soil				Result 1					
Aldrin	L23-JI0035573	NCP	%	98			60-120	Pass	
Dieldrin	L23-JI0035573	NCP	%	84			60-120	Pass	
p.p-DDT	L23-JI0035573	NCP	%	107			60-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Endrin	L23-JI0035573	NCP	%	73			60-120	Pass	
Heptachlor	L23-JI0035573	NCP	%	107			60-120	Pass	
Lindane	L23-JI0035573	NCP	%	101			60-120	Pass	
Spike - % Recovery									
				Result 1					
Methyl tert Butyl Ether	L23-JI0039646	CP	%	81			60-120	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	L23-JI0039646	CP	%	75			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	L23-JI0039646	CP	%	79			70-130	Pass	
Toluene	L23-JI0039646	CP	%	75			70-130	Pass	
Ethylbenzene	L23-JI0039646	CP	%	78			70-130	Pass	
m&p-Xylenes	L23-JI0039646	CP	%	72			70-130	Pass	
o-Xylene	L23-JI0039646	CP	%	78			70-130	Pass	
Xylenes - Total*	L23-JI0039646	CP	%	74			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	L23-JI0039646	CP	%	78			70-130	Pass	
TRH C6-C10	L23-JI0039646	CP	%	76			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Methyl tert Butyl Ether	L23-JI0039645	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Antimony	L23-JI0042660	NCP	mg/kg	< 2	< 2	<1	20%	Pass	
Arsenic	L23-JI0042660	NCP	mg/kg	< 5	< 5	<1	20%	Pass	
Barium	L23-JI0042660	NCP	mg/kg	5.7	6.5	12	20%	Pass	
Beryllium	L23-JI0042660	NCP	mg/kg	< 0.1	< 0.1	<1	20%	Pass	
Boron	L23-JI0042660	NCP	mg/kg	< 5	< 5	<1	20%	Pass	
Cadmium	L23-JI0042660	NCP	mg/kg	< 0.1	< 0.1	<1	20%	Pass	
Chromium	L23-JI0042660	NCP	mg/kg	2.0	2.1	5.0	20%	Pass	
Cobalt	L23-JI0042660	NCP	mg/kg	< 1	< 1	<1	20%	Pass	
Copper	L23-JI0042660	NCP	mg/kg	2.4	2.9	16	20%	Pass	
Lead	L23-JI0042660	NCP	mg/kg	12	14	16	20%	Pass	
Manganese	L23-JI0042660	NCP	mg/kg	1.2	1.5	23	20%	Fail	Q15
Molybdenum	L23-JI0042660	NCP	mg/kg	< 2	< 2	<1	20%	Pass	
Nickel	L23-JI0042660	NCP	mg/kg	< 1	< 1	<1	20%	Pass	
Selenium	L23-JI0042660	NCP	mg/kg	< 2	< 2	<1	20%	Pass	
Tin	L23-JI0042660	NCP	mg/kg	< 1	< 1	<1	20%	Pass	
Zinc	L23-JI0042660	NCP	mg/kg	8.3	9.6	15	20%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	L23-JI0039645	CP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C10-C14	L23-JI0018695	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	L23-JI0018695	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	L23-JI0018695	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	L23-JI0039645	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	L23-JI0039645	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	L23-JI0039645	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	L23-JI0039645	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	L23-JI0039645	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total*	L23-JI0039645	CP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	

Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	L23-JI0039645	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	L23-JI0039645	CP	mg/kg	< 20	< 20	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(a)pyrene	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(b&j)fluoranthene	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(g.h.i)perylene	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(k)fluoranthene	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chrysene	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dibenz(a.h)anthracene	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluorene	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Naphthalene	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenanthrene	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Pyrene	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Phenols (Halogenated)				Result 1	Result 2	RPD			
2-Chlorophenol	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
2.4-Dichlorophenol	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
2.4.5-Trichlorophenol	L23-JI0035573	NCP	mg/kg	< 1	< 1	<1	30%	Pass	
2.4.6-Trichlorophenol	L23-JI0035573	NCP	mg/kg	< 1	< 1	<1	30%	Pass	
2.6-Dichlorophenol	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
4-Chloro-3-methylphenol	L23-JI0035573	NCP	mg/kg	< 1	< 1	<1	30%	Pass	
Pentachlorophenol	L23-JI0035573	NCP	mg/kg	< 1	< 1	<1	30%	Pass	
Tetrachlorophenols - Total	L23-JI0035573	NCP	mg/kg	< 10	< 10	<1	30%	Pass	
Duplicate									
Phenols (non-Halogenated)				Result 1	Result 2	RPD			
2-Cyclohexyl-4.6-dinitrophenol	L23-JI0035573	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
2-Methyl-4.6-dinitrophenol	L23-JI0035573	NCP	mg/kg	< 5	< 5	<1	30%	Pass	
2-Nitrophenol	L23-JI0035573	NCP	mg/kg	< 1	< 1	<1	30%	Pass	
2.4-Dimethylphenol	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
2.4-Dinitrophenol	L23-JI0035573	NCP	mg/kg	< 5	< 5	<1	30%	Pass	
2-Methylphenol (o-Cresol)	L23-JI0035573	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
3&4-Methylphenol (m&p-Cresol)	L23-JI0035573	NCP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
4-Nitrophenol	L23-JI0035573	NCP	mg/kg	< 5	< 5	<1	30%	Pass	
Dinoseb	L23-JI0035573	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
Phenol	L23-JI0035573	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH >C10-C16	L23-JI0018695	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34	L23-JI0018695	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
TRH >C34-C40	L23-JI0018695	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
Duplicate									
OCOP in Soil				Result 1	Result 2	RPD			
Aldrin	L23-JI0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
alpha-BHC (HCH)	L23-JI0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
beta-BHC (HCH)	L23-JI0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
delta-BHC (HCH)	L23-JI0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Bifenthrin	L23-JI0035569	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	

Duplicate									
OCOP in Soil				Result 1	Result 2	RPD			
Bromophos Ethyl	L23-Jl0035569	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Chlordane	L23-Jl0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Chlorpyrifos	L23-Jl0035569	NCP	mg/kg	< 0.02	< 0.02	<1	30%	Pass	
Dieldrin	L23-Jl0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
p.p-DDD	L23-Jl0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
p.p-DDE	L23-Jl0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
p.p-DDT	L23-Jl0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
o.p-DDT	L23-Jl0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Endosulfan I	L23-Jl0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Endosulfan II	L23-Jl0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Endosulfan Sulfate	L23-Jl0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Endrin	L23-Jl0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Heptachlor	L23-Jl0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Heptachlor Epoxide	L23-Jl0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Hexachlorobenzene (HCB)	L23-Jl0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Lindane	L23-Jl0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Methoxychlor	L23-Jl0035569	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Oxychlordane	L23-Jl0035569	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Diazinon	L23-Jl0035569	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Ethion	L23-Jl0035569	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Fenitrothion	L23-Jl0035569	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Malathion	L23-Jl0035569	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Trifluralin	L23-Jl0035569	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Duplicate									
Sample Properties				Result 1	Result 2	RPD			
% Moisture	L23-Jl0039646	CP	%	11	10	4.7	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	N/A
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference.
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised by:

Andrew Harvey	Analytical Services Manager
Sean Sangster	Senior Analyst-Metal
Douglas Todd	Senior Analyst-Sample Properties
Paul Nottle	Senior Analyst-Organic
Patrick Patfield	Senior Analyst-Volatile
Patrick Patfield	Senior Analyst-Organic

Kim Rodgers
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

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CHAIN OF CUSTODY RECORD

WESTERN ENVIRONMENTAL

Company Name : WESTERN ENVIRONMENTAL PTY LTD	Contact Name : Napolean Kwa	Purchase Order : 22.142	CoC Number : 2734
Office Address : Unit 5 162 Colin Street, West Perth, WA 6005	Project Manager : Robin Anderson	Project Number : 22.142	Quote ID : EN-110-18

Laboratory Address :
ALS Perth
26 Rigali Way
Wangara WA 6065
Contact: Brandon Ovens, +61 (0)8 9406 1301, +61 (0)4 2793 4085
Email: Brandon.Ovens@alsglobal.com

Email for results: napolean.k@westenv.com.au CC: robin.a@westenv.com.au ESdat_AU+WestEnvWA@ESdatLabSync.net

Courier Consignment # :

Special Directions & Comments :

#	Sample ID	Sample Date	Matrix	W-2 Filtered Metals	W-23 (VOC/SVOC)	EP074L (Fuel oxygenates)	NT-8A (TN, TKN, NO_x, NO_2, NO_3, NH_3, TP, FRP)	EK060 (Organic Nitrogen)	M5 (Total, Faecal Coliforms & E. coli)	NT-1 & NT-2 (Anions/ cations)	EP030 (Biochemical Oxygen Demand	pH	Conductivity	C6-C40 (TRH)	Container: ASS Bag	250ml Green	Black MB Plastic	100ml Red Plastic	100ml Purple Plastic	VIAL	Purple Amber (Glass)	Glass Jar
1	GW01	19/07/2023	Water	X	X	X	X	X	X	X	X	X	X	X								
2	GW02	19/07/2023	Water	X	X	X	X	X	X	X	X	X	X	X								
3	GW03	19/07/2023	Water	X	X	X	X	X	X	X	X	X	X	X								
4	GW04	19/07/2023	Water	X	X	X	X	X	X	X	X	X	X	X								
5	DUP_01	19/07/2023	Water	X	X	X	X	X	X	X	X	X	X	X								
6	RINSATE	19/07/2023	Water	X	X	X	X	X	X	X	X	X	X	X								
7	FB_TB	19/07/2023	Water	X	X	X																
8																						
9																						
10																						
11																						
12																						
13																						
14																						
15																						

Environmental Division Perth
Work Order Reference
EP2309684

Telephone : +61-8-9406 1301

Relinquished By: Napolean Kwa
Date & Time : 19/07/2023
Signature: N.K

Received By: EG
Date & Time : 19/7 @ 1735.
Signature:
Report Number :

Turn around Time : 5 Days

Comments :

Method Of Shipment :
Courier
Hand Delivered
Postal

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EP2309684**

Client	: **WESTERN ENVIRONMENTAL P/L**	Laboratory	: Environmental Division Perth
Contact	: ROBIN A	Contact	: Customer Services EP
Address	: Unit 5, 162 Colin Street West Perth 6005	Address	: 26 Rigali Way Wangara WA Australia 6065
E-mail	: robin.a@westenv.com.au	E-mail	: ALSEnviro.Perth@alsglobal.com
Telephone	: ----	Telephone	: +61-8-9406 1301
Facsimile	: ----	Facsimile	: +61-8-9406 1399
Project	: 22.142	Page	: 1 of 3
Order number	: 22.142	Quote number	: EP2020WESENV0004 (EN/110)
C-O-C number	: 2734	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	:		

Dates

Date Samples Received	: 19-Jul-2023 17:35	Issue Date	: 19-Jul-2023
Client Requested Due Date	: 28-Jul-2023	Scheduled Reporting Date	: **28-Jul-2023**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: 2	Temperature	: 3.6 - Ice present
Receipt Detail	:	No. of samples received / analysed	: 8 / 7

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- Please see scanned COC for sample discrepencies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA005P pH (Auto Titrator)	WATER - EK060G Organic Nitrogen as N (TKN - NH3) By Discrete	WATER - M5 - ES/EB/FM FC, E.coli & TC by MF	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity	WATER - NT-08A Total Nitrogen + NO2 + NO3 + NH3 + Total P +	WATER - W-05 TRH/BTEXN/8 Metals	WATER - W-23 minus BTEX SVOC/VOC without BTEX
EP2309684-001	19-Jul-2023 00:00	GW01	✓	✓	✓	✓	✓	✓	✓
EP2309684-002	19-Jul-2023 00:00	GW02	✓	✓	✓	✓	✓	✓	✓
EP2309684-003	19-Jul-2023 00:00	GW03	✓	✓	✓	✓	✓	✓	✓
EP2309684-004	19-Jul-2023 00:00	GW04	✓	✓	✓	✓	✓	✓	✓
EP2309684-005	19-Jul-2023 00:00	DUP_01	✓	✓	✓	✓	✓	✓	✓
EP2309684-006	19-Jul-2023 00:00	RINSATE	✓	✓	✓	✓	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	(On Hold) WATER No analysis requested	WATER - EA010P Electrical Conductivity (Auto Titrator)	WATER - EP030 BOD	WATER - EP074L Fuel Oxygenates	WATER - W-02 8 Metals	WATER - W-23 SVOC/VOC
EP2309684-001	19-Jul-2023 00:00	GW01		✓	✓	✓		
EP2309684-002	19-Jul-2023 00:00	GW02		✓	✓	✓		
EP2309684-003	19-Jul-2023 00:00	GW03		✓	✓	✓		
EP2309684-004	19-Jul-2023 00:00	GW04		✓	✓	✓		
EP2309684-005	19-Jul-2023 00:00	DUP_01		✓	✓	✓		
EP2309684-006	19-Jul-2023 00:00	RINSATE		✓	✓	✓		
EP2309684-007	19-Jul-2023 00:00	FB_TB				✓	✓	✓
EP2309684-008	19-Jul-2023 00:00	TBW 922	✓					

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ACCOUNTS ADDRESS		
- A4 - AU Tax Invoice (INV)	Email	accounts@westenv.com.au
ESDAT_AU + WESTENVWA		
- *AU Certificate of Analysis - NATA (COA)	Email	esdat_au+westenvwa@esdatlabsync.net
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	esdat_au+westenvwa@esdatlabsync.net
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	esdat_au+westenvwa@esdatlabsync.net
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	esdat_au+westenvwa@esdatlabsync.net
- Chain of Custody (CoC) (COC)	Email	esdat_au+westenvwa@esdatlabsync.net
- EDI Format - ESDAT (ESDAT)	Email	esdat_au+westenvwa@esdatlabsync.net
- EDI Format - XTab (XTAB)	Email	esdat_au+westenvwa@esdatlabsync.net
Napolean Kwa		
- *AU Certificate of Analysis - NATA (COA)	Email	napolean.k@westenv.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	napolean.k@westenv.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	napolean.k@westenv.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	napolean.k@westenv.com.au
- Chain of Custody (CoC) (COC)	Email	napolean.k@westenv.com.au
- EDI Format - ESDAT (ESDAT)	Email	napolean.k@westenv.com.au
- EDI Format - XTab (XTAB)	Email	napolean.k@westenv.com.au
ROBIN A		
- *AU Certificate of Analysis - NATA (COA)	Email	robin.a@westenv.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	robin.a@westenv.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	robin.a@westenv.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	robin.a@westenv.com.au
- Chain of Custody (CoC) (COC)	Email	robin.a@westenv.com.au
- EDI Format - ESDAT (ESDAT)	Email	robin.a@westenv.com.au
- EDI Format - XTab (XTAB)	Email	robin.a@westenv.com.au

Inter-Laboratory Testing

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(WATER) EP074A: Monocyclic Aromatic Hydrocarbons
(WATER) EP074B: Oxygenated Compounds
(WATER) EP074C: Sulfonated Compounds
(WATER) EP074D: Fumigants
(WATER) EP074E: Halogenated Aliphatic Compounds
(WATER) EP074F: Halogenated Aromatic Compounds
(WATER) EP074G: Trihalomethanes
(WATER) EP075A: Phenolic Compounds
(WATER) EP075B: Polynuclear Aromatic Hydrocarbons
(WATER) EP075I: Organochlorine Pesticides
(WATER) EP075J: Organophosphorus Pesticides
(WATER) EP075C: Phthalate Esters
(WATER) EP075D: Nitrosamines
(WATER) EP075E: Nitroaromatics and Ketones
(WATER) EP075F: Haloethers
(WATER) EP075G: Chlorinated Hydrocarbons
(WATER) EP075H: Anilines and Benzidines
(WATER) EP080/071: Total Petroleum Hydrocarbons
(WATER) EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions
(WATER) EP080: BTEXN
(WATER) EP074L: Fuel Oxygenates

CERTIFICATE OF ANALYSIS

Work Order	: **EP2309684**	Page	: 1 of 22
Client	: **WESTERN ENVIRONMENTAL P/L**	Laboratory	: Environmental Division Perth
Contact	: ROBIN A	Contact	: Customer Services EP
Address	: Unit 5, 162 Colin Street West Perth 6005	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: ----	Telephone	: +61-8-9406 1301
Project	: 22.142	Date Samples Received	: 19-Jul-2023 17:35
Order number	: 22.142	Date Analysis Commenced	: 19-Jul-2023
C-O-C number	: 2734	Issue Date	: 31-Jul-2023 09:47
Sampler	: ----		
Site	: ----		
Quote number	: EN/110		
No. of samples received	: 8		
No. of samples analysed	: 8		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Jasmine Myintaye	Lab Technician	Perth Microbiology, Wangara, WA
Vinitha Kesavan	Analyst	Perth Microbiology, Wangara, WA

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- MF = membrane filtration
- CFU = colony forming unit
- EP075: Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP074: Where reported, Total Trihalomethanes is the sum of the reported concentrations of all Trihalomethanes at or above the LOR.
- EP074: Where reported, Total Trimethylbenzenes is the sum of the reported concentrations of 1.2.3-Trimethylbenzene, 1.2.4-Trimethylbenzene and 1.3.5-Trimethylbenzene at or above the LOR.
- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- MW006 is ALS's internal code and is equivalent to AS4276.5.
- MW006 and MW007: Analysis Commenced:Date:19/07/2023.Time:07:00pm
- Microbiological Comment: In accordance with ALS work instruction QWI-MIC/04, membrane filtration result is reported an approximate (~) when the count of colonies on the filtered membrane is outside the range of 10 - 100cfu.
- Ionic balances were calculated using: major anions - nitrate as N, chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium for sample #2 and 3.
- EP075: Where reported, 'Sum of PAH' is the sum of the USEPA 16 priority PAHs
- MW007 is ALS's internal code and is equivalent to AS4276.5.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GW01	GW02	GW03	GW04	DUP_01
			Sampling date / time	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309684-001	EP2309684-002	EP2309684-003	EP2309684-004	EP2309684-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**6.55**	**6.32**	**6.62**	**7.15**	**6.60**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**752**	**628**	**192**	**514**	**768**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**47**	**30**	**17**	**145**	**47**
Total Alkalinity as CaCO3	----	1	mg/L	**47**	**30**	**17**	**145**	**47**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**66**	**60**	**8**	**60**	**65**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**162**	**87**	**27**	**35**	**158**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**18**	**37**	**8**	**46**	**17**
Magnesium	7439-95-4	1	mg/L	**11**	**16**	**5**	**18**	**11**
Sodium	7440-23-5	1	mg/L	**111**	**49**	**18**	**25**	**109**
Potassium	7440-09-7	1	mg/L	**6**	**10**	**4**	**4**	**6**
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	**0.004**	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	**0.001**	**0.002**	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	<0.001	**0.002**	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	**0.002**	<0.001	**0.005**	<0.001	**0.002**
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	**0.016**	<0.005	<0.005	<0.005	**0.016**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.09**	<0.01	**0.12**	**0.18**	**0.01**
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	**0.02**	**0.01**	**0.02**	**0.01**	**0.02**
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**7.33**	**21.9**	**4.86**	**0.02**	**7.54**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GW01	GW02	GW03	GW04	DUP_01
			Sampling date / time	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309684-001	EP2309684-002	EP2309684-003	EP2309684-004	EP2309684-005
				Result	Result	Result	Result	Result
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	7.35	21.9	4.88	0.03	7.56
EK060G:Organic Nitrogen as N (TKN-NH3) By Discrete Analyser								
Organic Nitrogen as N	----	0.1	mg/L	0.9	1.3	0.6	0.4	1.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.0	1.3	0.7	0.6	1.1
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	8.4	23.2	5.6	0.6	8.7
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.05	0.04	0.04	0.15	0.04
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	----	5.87	1.62	----	----
ø Total Anions	----	0.01	meq/L	6.88	----	----	5.13	6.75
ø Total Cations	----	0.01	meq/L	6.78	5.55	1.70	4.97	6.65
ø Ionic Balance	----	0.01	%	----	2.78	2.39	----	----
ø Ionic Balance	----	0.01	%	0.72	----	----	1.65	0.75
EP030: Biochemical Oxygen Demand (BOD)								
Biochemical Oxygen Demand	----	2	mg/L	<2	<2	<2	<2	<2
EP074A: Monocyclic Aromatic Hydrocarbons								
Styrene	100-42-5	5	µg/L	<5	<5	<5	<5	<5
Isopropylbenzene	98-82-8	5	µg/L	<5	<5	<5	<5	<5
n-Propylbenzene	103-65-1	5	µg/L	<5	<5	<5	<5	<5
1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	<5	<5	<5	<5
sec-Butylbenzene	135-98-8	5	µg/L	<5	<5	<5	<5	<5
1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	<5	<5	<5	<5
tert-Butylbenzene	98-06-6	5	µg/L	<5	<5	<5	<5	<5
p-Isopropyltoluene	99-87-6	5	µg/L	<5	<5	<5	<5	<5
n-Butylbenzene	104-51-8	5	µg/L	<5	<5	<5	<5	<5
EP074B: Oxygenated Compounds								
Vinyl Acetate	108-05-4	50	µg/L	<50	<50	<50	<50	<50
2-Butanone (MEK)	78-93-3	50	µg/L	<50	<50	<50	<50	<50
4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	<50	<50	<50	<50

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GW01	GW02	GW03	GW04	DUP_01
			Sampling date / time	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309684-001	EP2309684-002	EP2309684-003	EP2309684-004	EP2309684-005
				Result	Result	Result	Result	Result
EP074B: Oxygenated Compounds - Continued								
2-Hexanone (MBK)	591-78-6	50	µg/L	<50	<50	<50	<50	<50
EP074C: Sulfonated Compounds								
Carbon disulfide	75-15-0	5	µg/L	<5	<5	<5	<5	<5
EP074D: Fumigants								
2.2-Dichloropropane	594-20-7	5	µg/L	<5	<5	<5	<5	<5
1.2-Dichloropropane	78-87-5	5	µg/L	<5	<5	<5	<5	<5
cis-1.3-Dichloropropylene	10061-01-5	5	µg/L	<5	<5	<5	<5	<5
trans-1.3-Dichloropropylene	10061-02-6	5	µg/L	<5	<5	<5	<5	<5
1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	<5	<5	<5	<5
EP074E: Halogenated Aliphatic Compounds								
Dichlorodifluoromethane	75-71-8	50	µg/L	<50	<50	<50	<50	<50
Chloromethane	74-87-3	50	µg/L	<50	<50	<50	<50	<50
Vinyl chloride	75-01-4	50	µg/L	<50	<50	<50	<50	<50
Bromomethane	74-83-9	50	µg/L	<50	<50	<50	<50	<50
Chloroethane	75-00-3	50	µg/L	<50	<50	<50	<50	<50
Trichlorofluoromethane	75-69-4	50	µg/L	<50	<50	<50	<50	<50
1.1-Dichloroethene	75-35-4	5	µg/L	<5	<5	<5	<5	<5
Iodomethane	74-88-4	5	µg/L	<5	<5	<5	<5	<5
trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	<5	<5	<5	<5
1.1-Dichloroethane	75-34-3	5	µg/L	<5	<5	<5	<5	<5
cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	<5	<5	<5	<5
1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	<5	<5	<5	<5
1.1-Dichloropropylene	563-58-6	5	µg/L	<5	<5	<5	<5	<5
Carbon Tetrachloride	56-23-5	5	µg/L	<5	<5	<5	<5	<5
1.2-Dichloroethane	107-06-2	5	µg/L	<5	<5	<5	<5	<5
Trichloroethene	79-01-6	5	µg/L	<5	<5	<5	<5	<5
Dibromomethane	74-95-3	5	µg/L	<5	<5	<5	<5	<5
1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	<5	<5	<5	<5
1.3-Dichloropropane	142-28-9	5	µg/L	<5	<5	<5	<5	<5
Tetrachloroethene	127-18-4	5	µg/L	<5	<5	<5	<5	<5
1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	<5	<5	<5	<5
trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	<5	<5	<5	<5
cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	<5	<5	<5	<5
1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	<5	<5	<5	<5

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GW01	GW02	GW03	GW04	DUP_01
			Sampling date / time	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309684-001	EP2309684-002	EP2309684-003	EP2309684-004	EP2309684-005
				Result	Result	Result	Result	Result
EP074E: Halogenated Aliphatic Compounds - Continued								
1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	<5	<5	<5	<5
Pentachloroethane	76-01-7	5	µg/L	<5	<5	<5	<5	<5
1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	<5	<5	<5	<5
EP074F: Halogenated Aromatic Compounds								
Chlorobenzene	108-90-7	5	µg/L	<5	<5	<5	<5	<5
Bromobenzene	108-86-1	5	µg/L	<5	<5	<5	<5	<5
2-Chlorotoluene	95-49-8	5	µg/L	<5	<5	<5	<5	<5
4-Chlorotoluene	106-43-4	5	µg/L	<5	<5	<5	<5	<5
1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	<5	<5	<5	<5
EP074G: Trihalomethanes								
Chloroform	67-66-3	5	µg/L	<5	<5	<5	<5	<5
Bromodichloromethane	75-27-4	5	µg/L	<5	<5	<5	<5	<5
Dibromochloromethane	124-48-1	5	µg/L	<5	<5	<5	<5	<5
Bromoform	75-25-2	5	µg/L	<5	<5	<5	<5	<5
EP074L: Fuel Oxygenates								
tert-Butyl alcohol (TBA)	75-65-0	5	µg/L	<5	<5	<5	<5	<5
Methyl tert-butyl ether (MTBE)	1634-04-4	1	µg/L	<1	<1	<1	<1	<1
Diisopropyl ether (DIPE)	108-20-3	1	µg/L	<1	<1	<1	<1	<1
Ethyl tert-butyl ether (ETBE)	637-92-3	1	µg/L	<1	<1	<1	<1	<1
tert-Amyl ethyl ether (TAEE)	919-94-8	1	µg/L	<1	<1	<1	<1	<1
tert-amyl methyl ether (TAME)	994-05-8	1	µg/L	<1	<1	<1	<1	<1
EP075A: Phenolic Compounds								
Phenol	108-95-2	2	µg/L	<2	<2	<2	<2	<2
2-Chlorophenol	95-57-8	2	µg/L	<2	<2	<2	<2	<2
2-Methylphenol	95-48-7	2	µg/L	<2	<2	<2	<2	<2
3- & 4-Methylphenol	1319-77-3	4	µg/L	<4	<4	<4	<4	<4
2-Nitrophenol	88-75-5	2	µg/L	<2	<2	<2	<2	<2
2.4-Dimethylphenol	105-67-9	2	µg/L	<2	<2	<2	<2	<2
2.4-Dichlorophenol	120-83-2	2	µg/L	<2	<2	<2	<2	<2
2.6-Dichlorophenol	87-65-0	2	µg/L	<2	<2	<2	<2	<2
4-Chloro-3-methylphenol	59-50-7	2	µg/L	<2	<2	<2	<2	<2
2.4.6-Trichlorophenol	88-06-2	2	µg/L	<2	<2	<2	<2	<2
2.4.5-Trichlorophenol	95-95-4	2	µg/L	<2	<2	<2	<2	<2
Pentachlorophenol	87-86-5	4	µg/L	<4	<4	<4	<4	<4

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GW01	GW02	GW03	GW04	DUP_01
			Sampling date / time	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309684-001	EP2309684-002	EP2309684-003	EP2309684-004	EP2309684-005
				Result	Result	Result	Result	Result
EP075B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	2	µg/L	<2	<2	<2	<2	<2
2-Methylnaphthalene	91-57-6	2	µg/L	<2	<2	<2	<2	<2
2-Chloronaphthalene	91-58-7	2	µg/L	<2	<2	<2	<2	<2
Acenaphthylene	208-96-8	2	µg/L	<2	<2	<2	<2	<2
Acenaphthene	83-32-9	2	µg/L	<2	<2	<2	<2	<2
Fluorene	86-73-7	2	µg/L	<2	<2	<2	<2	<2
Phenanthrene	85-01-8	2	µg/L	<2	<2	<2	<2	<2
Anthracene	120-12-7	2	µg/L	<2	<2	<2	<2	<2
Fluoranthene	206-44-0	2	µg/L	<2	<2	<2	<2	<2
Pyrene	129-00-0	2	µg/L	<2	<2	<2	<2	<2
N-2-Fluorenyl Acetamide	53-96-3	2	µg/L	<2	<2	<2	<2	<2
Benz(a)anthracene	56-55-3	2	µg/L	<2	<2	<2	<2	<2
Chrysene	218-01-9	2	µg/L	<2	<2	<2	<2	<2
Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L	<4	<4	<4	<4	<4
7.12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L	<2	<2	<2	<2	<2
Benzo(a)pyrene	50-32-8	2	µg/L	<2	<2	<2	<2	<2
3-Methylcholanthrene	56-49-5	2	µg/L	<2	<2	<2	<2	<2
Indeno(1.2.3.cd)pyrene	193-39-5	2	µg/L	<2	<2	<2	<2	<2
Dibenz(a.h)anthracene	53-70-3	2	µg/L	<2	<2	<2	<2	<2
Benzo(g.h.i)perylene	191-24-2	2	µg/L	<2	<2	<2	<2	<2
^ Sum of PAHs	----	2	µg/L	<2	<2	<2	<2	<2
^ Benzo(a)pyrene TEQ (zero)	----	2	µg/L	<2	<2	<2	<2	<2
EP075C: Phthalate Esters								
Dimethyl phthalate	131-11-3	2	µg/L	<2	<2	<2	<2	<2
Diethyl phthalate	84-66-2	2	µg/L	<2	<2	<2	<2	<2
Di-n-butyl phthalate	84-74-2	2	µg/L	<2	<2	<2	<2	<2
Butyl benzyl phthalate	85-68-7	2	µg/L	<2	<2	<2	<2	<2
bis(2-ethylhexyl) phthalate	117-81-7	10	µg/L	<10	<10	<10	<10	<10
Di-n-octylphthalate	117-84-0	2	µg/L	<2	<2	<2	<2	<2
EP075D: Nitrosamines								
N-Nitrosomethylethylamine	10595-95-6	2	µg/L	<2	<2	<2	<2	<2
N-Nitrosodiethylamine	55-18-5	2	µg/L	<2	<2	<2	<2	<2
N-Nitrosopyrrolidine	930-55-2	4	µg/L	<4	<4	<4	<4	<4

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GW01	GW02	GW03	GW04	DUP_01
			Sampling date / time	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309684-001	EP2309684-002	EP2309684-003	EP2309684-004	EP2309684-005
				Result	Result	Result	Result	Result
EP075D: Nitrosamines - Continued								
N-Nitrosomorpholine	59-89-2	2	µg/L	<2	<2	<2	<2	<2
N-Nitrosodi-n-propylamine	621-64-7	2	µg/L	<2	<2	<2	<2	<2
N-Nitrosopiperidine	100-75-4	2	µg/L	<2	<2	<2	<2	<2
N-Nitrosodibutylamine	924-16-3	2	µg/L	<2	<2	<2	<2	<2
N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	4	µg/L	<4	<4	<4	<4	<4
Methapyrilene	91-80-5	2	µg/L	<2	<2	<2	<2	<2
EP075E: Nitroaromatics and Ketones								
2-Picoline	109-06-8	2	µg/L	<2	<2	<2	<2	<2
Acetophenone	98-86-2	2	µg/L	<2	<2	<2	<2	<2
Nitrobenzene	98-95-3	2	µg/L	<2	<2	<2	<2	<2
Isophorone	78-59-1	2	µg/L	<2	<2	<2	<2	<2
2.6-Dinitrotoluene	606-20-2	4	µg/L	<4	<4	<4	<4	<4
2.4-Dinitrotoluene	121-14-2	4	µg/L	<4	<4	<4	<4	<4
1-Naphthylamine	134-32-7	2	µg/L	<2	<2	<2	<2	<2
4-Nitroquinoline-N-oxide	56-57-5	2	µg/L	<2	<2	<2	<2	<2
5-Nitro-o-toluidine	99-55-8	2	µg/L	<2	<2	<2	<2	<2
Azobenzene	103-33-3	2	µg/L	<2	<2	<2	<2	<2
1.3.5-Trinitrobenzene	99-35-4	2	µg/L	<2	<2	<2	<2	<2
Phenacetin	62-44-2	2	µg/L	<2	<2	<2	<2	<2
4-Aminobiphenyl	92-67-1	2	µg/L	<2	<2	<2	<2	<2
Pentachloronitrobenzene	82-68-8	2	µg/L	<2	<2	<2	<2	<2
Pronamide	23950-58-5	2	µg/L	<2	<2	<2	<2	<2
Dimethylaminoazobenzene	60-11-7	2	µg/L	<2	<2	<2	<2	<2
Chlorobenzilate	510-15-6	2	µg/L	<2	<2	<2	<2	<2
EP075F: Haloethers								
Bis(2-chloroethyl) ether	111-44-4	2	µg/L	<2	<2	<2	<2	<2
Bis(2-chloroethoxy) methane	111-91-1	2	µg/L	<2	<2	<2	<2	<2
4-Chlorophenyl phenyl ether	7005-72-3	2	µg/L	<2	<2	<2	<2	<2
4-Bromophenyl phenyl ether	101-55-3	2	µg/L	<2	<2	<2	<2	<2
EP075G: Chlorinated Hydrocarbons								
1.3-Dichlorobenzene	541-73-1	2	µg/L	<2	<2	<2	<2	<2
1.4-Dichlorobenzene	106-46-7	2	µg/L	<2	<2	<2	<2	<2
1.2-Dichlorobenzene	95-50-1	2	µg/L	<2	<2	<2	<2	<2

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GW01	GW02	GW03	GW04	DUP_01
				Sampling date / time	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00
Compound	CAS Number	LOR	Unit		EP2309684-001	EP2309684-002	EP2309684-003	EP2309684-004	EP2309684-005
					Result	Result	Result	Result	Result
EP075G: Chlorinated Hydrocarbons - Continued									
Hexachloroethane	67-72-1	2	µg/L		<2	<2	<2	<2	<2
1.2.4-Trichlorobenzene	120-82-1	2	µg/L		<2	<2	<2	<2	<2
Hexachloropropylene	1888-71-7	2	µg/L		<2	<2	<2	<2	<2
Hexachlorobutadiene	87-68-3	2	µg/L		<2	<2	<2	<2	<2
Hexachlorocyclopentadiene	77-47-4	10	µg/L		<10	<10	<10	<10	<10
Pentachlorobenzene	608-93-5	2	µg/L		<2	<2	<2	<2	<2
Hexachlorobenzene (HCB)	118-74-1	4	µg/L		<4	<4	<4	<4	<4
EP075H: Anilines and Benzidines									
Aniline	62-53-3	2	µg/L		<2	<2	<2	<2	<2
4-Chloroaniline	106-47-8	2	µg/L		<2	<2	<2	<2	<2
2-Nitroaniline	88-74-4	4	µg/L		<4	<4	<4	<4	<4
3-Nitroaniline	99-09-2	4	µg/L		<4	<4	<4	<4	<4
Dibenzofuran	132-64-9	2	µg/L		<2	<2	<2	<2	<2
4-Nitroaniline	100-01-6	2	µg/L		<2	<2	<2	<2	<2
Carbazole	86-74-8	2	µg/L		<2	<2	<2	<2	<2
3.3`-Dichlorobenzidine	91-94-1	2	µg/L		<2	<2	<2	<2	<2
EP075I: Organochlorine Pesticides									
alpha-BHC	319-84-6	2	µg/L		<2	<2	<2	<2	<2
beta-BHC	319-85-7	2	µg/L		<2	<2	<2	<2	<2
gamma-BHC	58-89-9	2	µg/L		<2	<2	<2	<2	<2
delta-BHC	319-86-8	2	µg/L		<2	<2	<2	<2	<2
Heptachlor	76-44-8	2	µg/L		<2	<2	<2	<2	<2
Aldrin	309-00-2	2	µg/L		<2	<2	<2	<2	<2
Heptachlor epoxide	1024-57-3	2	µg/L		<2	<2	<2	<2	<2
alpha-Endosulfan	959-98-8	2	µg/L		<2	<2	<2	<2	<2
4.4`-DDE	72-55-9	2	µg/L		<2	<2	<2	<2	<2
Dieldrin	60-57-1	2	µg/L		<2	<2	<2	<2	<2
Endrin	72-20-8	2	µg/L		<2	<2	<2	<2	<2
beta-Endosulfan	33213-65-9	2	µg/L		<2	<2	<2	<2	<2
4.4`-DDD	72-54-8	2	µg/L		<2	<2	<2	<2	<2
Endosulfan sulfate	1031-07-8	2	µg/L		<2	<2	<2	<2	<2
4.4`-DDT	50-29-3	4	µg/L		<4	<4	<4	<4	<4
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	4	µg/L		<4	<4	<4	<4	<4

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GW01	GW02	GW03	GW04	DUP_01
				Sampling date / time	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00
Compound	CAS Number	LOR	Unit		EP2309684-001	EP2309684-002	EP2309684-003	EP2309684-004	EP2309684-005
					Result	Result	Result	Result	Result
EP075I: Organochlorine Pesticides - Continued									
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/50-2	4	µg/L		<4	<4	<4	<4	<4
EP075J: Organophosphorus Pesticides									
Dichlorvos	62-73-7	2	µg/L		<2	<2	<2	<2	<2
Dimethoate	60-51-5	2	µg/L		<2	<2	<2	<2	<2
Diazinon	333-41-5	2	µg/L		<2	<2	<2	<2	<2
Chlorpyrifos-methyl	5598-13-0	2	µg/L		<2	<2	<2	<2	<2
Malathion	121-75-5	2	µg/L		<2	<2	<2	<2	<2
Fenthion	55-38-9	2	µg/L		<2	<2	<2	<2	<2
Chlorpyrifos	2921-88-2	2	µg/L		<2	<2	<2	<2	<2
Pirimphos-ethyl	23505-41-1	2	µg/L		<2	<2	<2	<2	<2
Chlorfenvinphos	470-90-6	2	µg/L		<2	<2	<2	<2	<2
Prothiofos	34643-46-4	2	µg/L		<2	<2	<2	<2	<2
Ethion	563-12-2	2	µg/L		<2	<2	<2	<2	<2
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
^ **C10 - C36 Fraction (sum)**	----	50	µg/L		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	<20	<20
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		<100	<100	<100	<100	<100
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GW01	GW02	GW03	GW04	DUP_01
			Sampling date / time	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00
Compound	CAS Number	LOR	Unit	EP2309684-001	EP2309684-002	EP2309684-003	EP2309684-004	EP2309684-005
				Result	Result	Result	Result	Result
EP080: BTEXN - Continued								
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	<2
^ Total Xylenes	----	2	µg/L	<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	<5
MW006: Faecal Coliforms & E.coli by MF								
Faecal Coliforms	----	1	CFU/100mL	~2	23	37	15	~1
Escherichia coli	----	1	CFU/100mL	<1	<1	~3	~1	<1
MW007: Coliforms by MF								
Coliforms	----	1	CFU/100mL	15	26	260	120	16
EP074L-S: Fuel Oxygenate Surrogate								
Methyl tert-butyl ether-d12 (MTBE-d12)	----	1	%	92.0	97.2	94.2	93.8	94.6
EP074S: VOC Surrogates								
1.2-Dichloroethane-D4	17060-07-0	5	%	101	89.4	102	98.1	99.7
Toluene-D8	2037-26-5	5	%	98.0	86.0	99.7	94.2	95.8
4-Bromofluorobenzene	460-00-4	5	%	99.4	84.8	99.2	96.4	97.2
EP075S: Acid Extractable Surrogates								
2-Fluorophenol	367-12-4	2	%	46.8	41.3	42.6	43.7	46.4
Phenol-d6	13127-88-3	2	%	40.3	35.2	37.1	35.4	38.3
2-Chlorophenol-D4	93951-73-6	2	%	77.1	70.2	73.8	68.8	75.1
2.4.6-Tribromophenol	118-79-6	2	%	61.4	53.0	58.8	51.5	62.3
EP075T: Base/Neutral Extractable Surrogates								
Nitrobenzene-D5	4165-60-0	2	%	78.9	72.3	76.0	71.6	78.6
1.2-Dichlorobenzene-D4	2199-69-1	2	%	63.6	61.6	64.2	61.3	68.3
2-Fluorobiphenyl	321-60-8	2	%	71.3	64.3	68.8	67.4	73.6
Anthracene-d10	1719-06-8	2	%	90.0	79.7	81.5	79.8	86.3
4-Terphenyl-d14	1718-51-0	2	%	87.4	78.5	79.2	77.1	86.2
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	2	%	95.7	85.2	97.5	92.4	94.0
Toluene-D8	2037-26-5	2	%	97.0	84.5	97.8	92.6	94.2
4-Bromofluorobenzene	460-00-4	2	%	113	99.0	113	108	113

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	RINSATE	FB_TB	TBW 922	----	----
			Sampling date / time	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	----	----
Compound	CAS Number	LOR	Unit	EP2309684-006	EP2309684-007	EP2309684-008	--------	--------
				Result	Result	Result	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**5.38**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	<1	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	<1	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	<1	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	<0.01	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	RINSATE	FB_TB	TBW 922	----	----
			Sampling date / time	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	----	----
Compound	CAS Number	LOR	Unit	EP2309684-006	EP2309684-007	EP2309684-008	--------	--------
				Result	Result	Result	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	----	----	----	----
EK060G:Organic Nitrogen as N (TKN-NH3) By Discrete Analyser								
Organic Nitrogen as N	----	0.1	mg/L	<0.1	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	<0.1	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	<0.01	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	----	----	----	----
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	<0.01	----	----	----	----
ø Total Cations	----	0.01	meq/L	<0.01	----	----	----	----
ø Ionic Balance	----	0.01	%	<0.01	----	----	----	----
EP030: Biochemical Oxygen Demand (BOD)								
Biochemical Oxygen Demand	----	2	mg/L	<2	----	----	----	----
EP074A: Monocyclic Aromatic Hydrocarbons								
Benzene	71-43-2	1	µg/L	----	<1	----	----	----
Toluene	108-88-3	2	µg/L	----	<2	----	----	----
Ethylbenzene	100-41-4	2	µg/L	----	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	----	<2	----	----	----
Styrene	100-42-5	5	µg/L	<5	<5	----	----	----
ortho-Xylene	95-47-6	2	µg/L	----	<2	----	----	----
Isopropylbenzene	98-82-8	5	µg/L	<5	<5	----	----	----
n-Propylbenzene	103-65-1	5	µg/L	<5	<5	----	----	----
1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	<5	----	----	----
sec-Butylbenzene	135-98-8	5	µg/L	<5	<5	----	----	----
1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	<5	----	----	----
tert-Butylbenzene	98-06-6	5	µg/L	<5	<5	----	----	----
p-Isopropyltoluene	99-87-6	5	µg/L	<5	<5	----	----	----
n-Butylbenzene	104-51-8	5	µg/L	<5	<5	----	----	----
EP074B: Oxygenated Compounds								

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	RINSATE	FB_TB	TBW 922	----	----
				Sampling date / time	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	----	----
Compound	CAS Number	LOR	Unit		EP2309684-006	EP2309684-007	EP2309684-008	--------	--------
					Result	Result	Result	----	----
EP074B: Oxygenated Compounds - Continued									
Vinyl Acetate	108-05-4	50	µg/L		<50	<50	----	----	----
2-Butanone (MEK)	78-93-3	50	µg/L		<50	<50	----	----	----
4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L		<50	<50	----	----	----
2-Hexanone (MBK)	591-78-6	50	µg/L		<50	<50	----	----	----
EP074C: Sulfonated Compounds									
Carbon disulfide	75-15-0	5	µg/L		<5	<5	----	----	----
EP074D: Fumigants									
2.2-Dichloropropane	594-20-7	5	µg/L		<5	<5	----	----	----
1.2-Dichloropropane	78-87-5	5	µg/L		<5	<5	----	----	----
cis-1.3-Dichloropropylene	10061-01-5	5	µg/L		<5	<5	----	----	----
trans-1.3-Dichloropropylene	10061-02-6	5	µg/L		<5	<5	----	----	----
1.2-Dibromoethane (EDB)	106-93-4	5	µg/L		<5	<5	----	----	----
EP074E: Halogenated Aliphatic Compounds									
Dichlorodifluoromethane	75-71-8	50	µg/L		<50	<50	----	----	----
Chloromethane	74-87-3	50	µg/L		<50	<50	----	----	----
Vinyl chloride	75-01-4	50	µg/L		<50	<50	----	----	----
Bromomethane	74-83-9	50	µg/L		<50	<50	----	----	----
Chloroethane	75-00-3	50	µg/L		<50	<50	----	----	----
Trichlorofluoromethane	75-69-4	50	µg/L		<50	<50	----	----	----
1.1-Dichloroethene	75-35-4	5	µg/L		<5	<5	----	----	----
Iodomethane	74-88-4	5	µg/L		<5	<5	----	----	----
trans-1.2-Dichloroethene	156-60-5	5	µg/L		<5	<5	----	----	----
1.1-Dichloroethane	75-34-3	5	µg/L		<5	<5	----	----	----
cis-1.2-Dichloroethene	156-59-2	5	µg/L		<5	<5	----	----	----
1.1.1-Trichloroethane	71-55-6	5	µg/L		<5	<5	----	----	----
1.1-Dichloropropylene	563-58-6	5	µg/L		<5	<5	----	----	----
Carbon Tetrachloride	56-23-5	5	µg/L		<5	<5	----	----	----
1.2-Dichloroethane	107-06-2	5	µg/L		<5	<5	----	----	----
Trichloroethene	79-01-6	5	µg/L		<5	<5	----	----	----
Dibromomethane	74-95-3	5	µg/L		<5	<5	----	----	----
1.1.2-Trichloroethane	79-00-5	5	µg/L		<5	<5	----	----	----
1.3-Dichloropropane	142-28-9	5	µg/L		<5	<5	----	----	----
Tetrachloroethene	127-18-4	5	µg/L		<5	<5	----	----	----
1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L		<5	<5	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	RINSATE	FB_TB	TBW 922	----	----
				Sampling date / time	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	----	----
Compound	CAS Number	LOR	Unit		EP2309684-006	EP2309684-007	EP2309684-008	--------	--------
					Result	Result	Result	----	----
EP074E: Halogenated Aliphatic Compounds - Continued									
trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L		<5	<5	----	----	----
cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L		<5	<5	----	----	----
1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L		<5	<5	----	----	----
1.2.3-Trichloropropane	96-18-4	5	µg/L		<5	<5	----	----	----
Pentachloroethane	76-01-7	5	µg/L		<5	<5	----	----	----
1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L		<5	<5	----	----	----
EP074F: Halogenated Aromatic Compounds									
Chlorobenzene	108-90-7	5	µg/L		<5	<5	----	----	----
Bromobenzene	108-86-1	5	µg/L		<5	<5	----	----	----
2-Chlorotoluene	95-49-8	5	µg/L		<5	<5	----	----	----
4-Chlorotoluene	106-43-4	5	µg/L		<5	<5	----	----	----
1.2.3-Trichlorobenzene	87-61-6	5	µg/L		<5	<5	----	----	----
EP074G: Trihalomethanes									
Chloroform	67-66-3	5	µg/L		<5	<5	----	----	----
Bromodichloromethane	75-27-4	5	µg/L		<5	<5	----	----	----
Dibromochloromethane	124-48-1	5	µg/L		<5	<5	----	----	----
Bromoform	75-25-2	5	µg/L		<5	<5	----	----	----
EP074L: Fuel Oxygenates									
tert-Butyl alcohol (TBA)	75-65-0	5	µg/L		<5	<5	----	----	----
Methyl tert-butyl ether (MTBE)	1634-04-4	1	µg/L		<1	<1	----	----	----
Diisopropyl ether (DIPE)	108-20-3	1	µg/L		<1	<1	----	----	----
Ethyl tert-butyl ether (ETBE)	637-92-3	1	µg/L		<1	<1	----	----	----
tert-Amyl ethyl ether (TAEE)	919-94-8	1	µg/L		<1	<1	----	----	----
tert-amyl methyl ether (TAME)	994-05-8	1	µg/L		<1	<1	----	----	----
EP075A: Phenolic Compounds									
Phenol	108-95-2	2	µg/L		<2	<2	----	----	----
2-Chlorophenol	95-57-8	2	µg/L		<2	<2	----	----	----
2-Methylphenol	95-48-7	2	µg/L		<2	<2	----	----	----
3- & 4-Methylphenol	1319-77-3	4	µg/L		<4	<4	----	----	----
2-Nitrophenol	88-75-5	2	µg/L		<2	<2	----	----	----
2.4-Dimethylphenol	105-67-9	2	µg/L		<2	<2	----	----	----
2.4-Dichlorophenol	120-83-2	2	µg/L		<2	<2	----	----	----
2.6-Dichlorophenol	87-65-0	2	µg/L		<2	<2	----	----	----
4-Chloro-3-methylphenol	59-50-7	2	µg/L		<2	<2	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	RINSATE	FB_TB	TBW 922	----	----
				Sampling date / time	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	----	----
Compound	CAS Number	LOR	Unit		EP2309684-006	EP2309684-007	EP2309684-008	--------	--------
					Result	Result	Result	----	----
EP075A: Phenolic Compounds - Continued									
2.4.6-Trichlorophenol	88-06-2	2	µg/L		<2	<2	----	----	----
2.4.5-Trichlorophenol	95-95-4	2	µg/L		<2	<2	----	----	----
Pentachlorophenol	87-86-5	4	µg/L		<4	<4	----	----	----
EP075B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	2	µg/L		<2	<2	----	----	----
2-Methylnaphthalene	91-57-6	2	µg/L		<2	<2	----	----	----
2-Chloronaphthalene	91-58-7	2	µg/L		<2	<2	----	----	----
Acenaphthylene	208-96-8	2	µg/L		<2	<2	----	----	----
Acenaphthene	83-32-9	2	µg/L		<2	<2	----	----	----
Fluorene	86-73-7	2	µg/L		<2	<2	----	----	----
Phenanthrene	85-01-8	2	µg/L		<2	<2	----	----	----
Anthracene	120-12-7	2	µg/L		<2	<2	----	----	----
Fluoranthene	206-44-0	2	µg/L		<2	<2	----	----	----
Pyrene	129-00-0	2	µg/L		<2	<2	----	----	----
N-2-Fluorenyl Acetamide	53-96-3	2	µg/L		<2	<2	----	----	----
Benz(a)anthracene	56-55-3	2	µg/L		<2	<2	----	----	----
Chrysene	218-01-9	2	µg/L		<2	<2	----	----	----
Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L		<4	<4	----	----	----
7.12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L		<2	<2	----	----	----
Benzo(a)pyrene	50-32-8	2	µg/L		<2	<2	----	----	----
3-Methylcholanthrene	56-49-5	2	µg/L		<2	<2	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	2	µg/L		<2	<2	----	----	----
Dibenz(a.h)anthracene	53-70-3	2	µg/L		<2	<2	----	----	----
Benzo(g.h.i)perylene	191-24-2	2	µg/L		<2	<2	----	----	----
^ Sum of PAHs	----	2	µg/L		<2	<2	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	2	µg/L		<2	<2	----	----	----
EP075C: Phthalate Esters									
Dimethyl phthalate	131-11-3	2	µg/L		<2	<2	----	----	----
Diethyl phthalate	84-66-2	2	µg/L		<2	<2	----	----	----
Di-n-butyl phthalate	84-74-2	2	µg/L		<2	<2	----	----	----
Butyl benzyl phthalate	85-68-7	2	µg/L		<2	<2	----	----	----
bis(2-ethylhexyl) phthalate	117-81-7	10	µg/L		<10	<10	----	----	----
Di-n-octylphthalate	117-84-0	2	µg/L		<2	<2	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	RINSATE	FB_TB	TBW 922	----	----
				Sampling date / time	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	----	----
Compound	CAS Number	LOR	Unit		EP2309684-006	EP2309684-007	EP2309684-008	--------	--------
					Result	Result	Result	----	----
EP075D: Nitrosamines									
N-Nitrosomethylethylamine	10595-95-6	2	µg/L		<2	<2	----	----	----
N-Nitrosodiethylamine	55-18-5	2	µg/L		<2	<2	----	----	----
N-Nitrosopyrrolidine	930-55-2	4	µg/L		<4	<4	----	----	----
N-Nitrosomorpholine	59-89-2	2	µg/L		<2	<2	----	----	----
N-Nitrosodi-n-propylamine	621-64-7	2	µg/L		<2	<2	----	----	----
N-Nitrosopiperidine	100-75-4	2	µg/L		<2	<2	----	----	----
N-Nitrosodibutylamine	924-16-3	2	µg/L		<2	<2	----	----	----
N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	4	µg/L		<4	<4	----	----	----
Methapyrilene	91-80-5	2	µg/L		<2	<2	----	----	----
EP075E: Nitroaromatics and Ketones									
2-Picoline	109-06-8	2	µg/L		<2	<2	----	----	----
Acetophenone	98-86-2	2	µg/L		<2	<2	----	----	----
Nitrobenzene	98-95-3	2	µg/L		<2	<2	----	----	----
Isophorone	78-59-1	2	µg/L		<2	<2	----	----	----
2.6-Dinitrotoluene	606-20-2	4	µg/L		<4	<4	----	----	----
2.4-Dinitrotoluene	121-14-2	4	µg/L		<4	<4	----	----	----
1-Naphthylamine	134-32-7	2	µg/L		<2	<2	----	----	----
4-Nitroquinoline-N-oxide	56-57-5	2	µg/L		<2	<2	----	----	----
5-Nitro-o-toluidine	99-55-8	2	µg/L		<2	<2	----	----	----
Azobenzene	103-33-3	2	µg/L		<2	<2	----	----	----
1.3.5-Trinitrobenzene	99-35-4	2	µg/L		<2	<2	----	----	----
Phenacetin	62-44-2	2	µg/L		<2	<2	----	----	----
4-Aminobiphenyl	92-67-1	2	µg/L		<2	<2	----	----	----
Pentachloronitrobenzene	82-68-8	2	µg/L		<2	<2	----	----	----
Pronamide	23950-58-5	2	µg/L		<2	<2	----	----	----
Dimethylaminoazobenzene	60-11-7	2	µg/L		<2	<2	----	----	----
Chlorobenzilate	510-15-6	2	µg/L		<2	<2	----	----	----
EP075F: Haloethers									
Bis(2-chloroethyl) ether	111-44-4	2	µg/L		<2	<2	----	----	----
Bis(2-chloroethoxy) methane	111-91-1	2	µg/L		<2	<2	----	----	----
4-Chlorophenyl phenyl ether	7005-72-3	2	µg/L		<2	<2	----	----	----
4-Bromophenyl phenyl ether	101-55-3	2	µg/L		<2	<2	----	----	----
EP075G: Chlorinated Hydrocarbons									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	RINSATE	FB_TB	TBW 922	----	----
				Sampling date / time	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	----	----
Compound	CAS Number	LOR	Unit		EP2309684-006	EP2309684-007	EP2309684-008	--------	--------
					Result	Result	Result	----	----
EP075G: Chlorinated Hydrocarbons - Continued									
1.3-Dichlorobenzene	541-73-1	2	µg/L		<2	<2	----	----	----
1.4-Dichlorobenzene	106-46-7	2	µg/L		<2	<2	----	----	----
1.2-Dichlorobenzene	95-50-1	2	µg/L		<2	<2	----	----	----
Hexachloroethane	67-72-1	2	µg/L		<2	<2	----	----	----
1.2.4-Trichlorobenzene	120-82-1	2	µg/L		<2	<2	----	----	----
Hexachloropropylene	1888-71-7	2	µg/L		<2	<2	----	----	----
Hexachlorobutadiene	87-68-3	2	µg/L		<2	<2	----	----	----
Hexachlorocyclopentadiene	77-47-4	10	µg/L		<10	<10	----	----	----
Pentachlorobenzene	608-93-5	2	µg/L		<2	<2	----	----	----
Hexachlorobenzene (HCB)	118-74-1	4	µg/L		<4	<4	----	----	----
EP075H: Anilines and Benzidines									
Aniline	62-53-3	2	µg/L		<2	<2	----	----	----
4-Chloroaniline	106-47-8	2	µg/L		<2	<2	----	----	----
2-Nitroaniline	88-74-4	4	µg/L		<4	<4	----	----	----
3-Nitroaniline	99-09-2	4	µg/L		<4	<4	----	----	----
Dibenzofuran	132-64-9	2	µg/L		<2	<2	----	----	----
4-Nitroaniline	100-01-6	2	µg/L		<2	<2	----	----	----
Carbazole	86-74-8	2	µg/L		<2	<2	----	----	----
3.3`-Dichlorobenzidine	91-94-1	2	µg/L		<2	<2	----	----	----
EP075I: Organochlorine Pesticides									
alpha-BHC	319-84-6	2	µg/L		<2	<2	----	----	----
beta-BHC	319-85-7	2	µg/L		<2	<2	----	----	----
gamma-BHC	58-89-9	2	µg/L		<2	<2	----	----	----
delta-BHC	319-86-8	2	µg/L		<2	<2	----	----	----
Heptachlor	76-44-8	2	µg/L		<2	<2	----	----	----
Aldrin	309-00-2	2	µg/L		<2	<2	----	----	----
Heptachlor epoxide	1024-57-3	2	µg/L		<2	<2	----	----	----
alpha-Endosulfan	959-98-8	2	µg/L		<2	<2	----	----	----
4.4`-DDE	72-55-9	2	µg/L		<2	<2	----	----	----
Dieldrin	60-57-1	2	µg/L		<2	<2	----	----	----
Endrin	72-20-8	2	µg/L		<2	<2	----	----	----
beta-Endosulfan	33213-65-9	2	µg/L		<2	<2	----	----	----
4.4`-DDD	72-54-8	2	µg/L		<2	<2	----	----	----
Endosulfan sulfate	1031-07-8	2	µg/L		<2	<2	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	RINSATE	FB_TB	TBW 922	----	----
				Sampling date / time	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	----	----
Compound	CAS Number	LOR	Unit		EP2309684-006	EP2309684-007	EP2309684-008	--------	--------
					Result	Result	Result	----	----
EP075I: Organochlorine Pesticides - Continued									
4.4`-DDT	50-29-3	4	µg/L		<4	<4	----	----	----
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	4	µg/L		<4	<4	----	----	----
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/50-2	4	µg/L		<4	<4	----	----	----
EP075J: Organophosphorus Pesticides									
Dichlorvos	62-73-7	2	µg/L		<2	<2	----	----	----
Dimethoate	60-51-5	2	µg/L		<2	<2	----	----	----
Diazinon	333-41-5	2	µg/L		<2	<2	----	----	----
Chlorpyrifos-methyl	5598-13-0	2	µg/L		<2	<2	----	----	----
Malathion	121-75-5	2	µg/L		<2	<2	----	----	----
Fenthion	55-38-9	2	µg/L		<2	<2	----	----	----
Chlorpyrifos	2921-88-2	2	µg/L		<2	<2	----	----	----
Pirimphos-ethyl	23505-41-1	2	µg/L		<2	<2	----	----	----
Chlorfenvinphos	470-90-6	2	µg/L		<2	<2	----	----	----
Prothiofos	34643-46-4	2	µg/L		<2	<2	----	----	----
Ethion	563-12-2	2	µg/L		<2	<2	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	----	<20	----	----
C10 - C14 Fraction	----	50	µg/L		<50	----	----	----	----
C15 - C28 Fraction	----	100	µg/L		<100	----	----	----	----
C29 - C36 Fraction	----	50	µg/L		<50	----	----	----	----
^ **C10 - C36 Fraction (sum)**	----	50	µg/L		<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	----	<20	----	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		<20	----	<20	----	----
>C10 - C16 Fraction	----	100	µg/L		<100	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L		<100	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	----	----	----	----
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		<100	----	----	----	----
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	----	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	----	<1	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	RINSATE	FB_TB	TBW 922	----	----
				Sampling date / time	19-Jul-2023 00:00	19-Jul-2023 00:00	19-Jul-2023 00:00	----	----
Compound	CAS Number	LOR	Unit		EP2309684-006	EP2309684-007	EP2309684-008	--------	--------
					Result	Result	Result	----	----
EP080: BTEXN - Continued									
Toluene	108-88-3	2	µg/L		<2	----	<2	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	----	<2	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	----	<2	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	----	<2	----	----
^ Total Xylenes	----	2	µg/L		<2	----	<2	----	----
^ Sum of BTEX	----	1	µg/L		<1	----	<1	----	----
Naphthalene	91-20-3	5	µg/L		<5	----	<5	----	----
MW006: Faecal Coliforms & E.coli by MF									
Faecal Coliforms	----	1	CFU/100mL		<1	----	----	----	----
Escherichia coli	----	1	CFU/100mL		<1	----	----	----	----
MW007: Coliforms by MF									
Coliforms	----	1	CFU/100mL		<1	----	----	----	----
EP074L-S: Fuel Oxygenate Surrogate									
Methyl tert-butyl ether-d12 (MTBE-d12)	----	1	%		**94.4**	**92.6**	----	----	----
EP074S: VOC Surrogates									
1.2-Dichloroethane-D4	17060-07-0	5	%		**87.5**	**105**	----	----	----
Toluene-D8	2037-26-5	5	%		**84.5**	**100**	----	----	----
4-Bromofluorobenzene	460-00-4	5	%		**80.5**	**98.5**	----	----	----
EP075S: Acid Extractable Surrogates									
2-Fluorophenol	367-12-4	2	%		**44.8**	**32.0**	----	----	----
Phenol-d6	13127-88-3	2	%		**40.4**	**34.3**	----	----	----
2-Chlorophenol-D4	93951-73-6	2	%		**76.6**	**61.1**	----	----	----
2.4.6-Tribromophenol	118-79-6	2	%		**61.9**	**37.5**	----	----	----
EP075T: Base/Neutral Extractable Surrogates									
Nitrobenzene-D5	4165-60-0	2	%		**80.2**	**73.1**	----	----	----
1.2-Dichlorobenzene-D4	2199-69-1	2	%		**69.7**	**60.3**	----	----	----
2-Fluorobiphenyl	321-60-8	2	%		**78.1**	**64.0**	----	----	----
Anthracene-d10	1719-06-8	2	%		**96.7**	**81.1**	----	----	----
4-Terphenyl-d14	1718-51-0	2	%		**92.4**	**75.6**	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**80.4**	----	**90.8**	----	----
Toluene-D8	2037-26-5	2	%		**77.7**	----	**89.1**	----	----
4-Bromofluorobenzene	460-00-4	2	%		**89.0**	----	**102**	----	----

Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP074L-S: Fuel Oxygenate Surrogate			
Methyl tert-butyl ether-d12 (MTBE-d12)	----	70	130
EP074S: VOC Surrogates			
1.2-Dichloroethane-D4	17060-07-0	78	133
Toluene-D8	2037-26-5	79	129
4-Bromofluorobenzene	460-00-4	81	124
EP075S: Acid Extractable Surrogates			
2-Fluorophenol	367-12-4	10	117
Phenol-d6	13127-88-3	10	69
2-Chlorophenol-D4	93951-73-6	21	130
2.4.6-Tribromophenol	118-79-6	10	151
EP075T: Base/Neutral Extractable Surrogates			
Nitrobenzene-D5	4165-60-0	29	142
1.2-Dichlorobenzene-D4	2199-69-1	24	121
2-Fluorobiphenyl	321-60-8	27	135
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	21	123
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	72	143
Toluene-D8	2037-26-5	75	131
4-Bromofluorobenzene	460-00-4	73	137

Inter-Laboratory Testing

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(WATER) EP074G: Trihalomethanes
(WATER) EP074A: Monocyclic Aromatic Hydrocarbons
(WATER) EP074S: VOC Surrogates
(WATER) EP075A: Phenolic Compounds
(WATER) EP075B: Polynuclear Aromatic Hydrocarbons
(WATER) EP075I: Organochlorine Pesticides
(WATER) EP075J: Organophosphorus Pesticides
(WATER) EP075C: Phthalate Esters
(WATER) EP075D: Nitrosamines
(WATER) EP075E: Nitroaromatics and Ketones
(WATER) EP075F: Haloethers
(WATER) EP075G: Chlorinated Hydrocarbons
(WATER) EP075H: Anilines and Benzidines
(WATER) EP075S: Acid Extractable Surrogates
(WATER) EP075T: Base/Neutral Extractable Surrogates
(WATER) EP074L: Fuel Oxygenates
(WATER) EP074L-S: Fuel Oxygenate Surrogate
(WATER) EP080/071: Total Petroleum Hydrocarbons
(WATER) EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions
(WATER) EP080: BTEXN
(WATER) EP080S: TPH(V)/BTEX Surrogates
(WATER) EP074B: Oxygenated Compounds
(WATER) EP074C: Sulfonated Compounds
(WATER) EP074D: Fumigants
(WATER) EP074E: Halogenated Aliphatic Compounds
(WATER) EP074F: Halogenated Aromatic Compounds

QUALITY CONTROL REPORT

Work Order	: **EP2309684**	Page	: 1 of 20
Client	: **WESTERN ENVIRONMENTAL P/L**	Laboratory	: Environmental Division Perth
Contact	: ROBIN A	Contact	: Customer Services EP
Address	: Unit 5, 162 Colin Street West Perth 6005	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: ----	Telephone	: +61-8-9406 1301
Project	: 22.142	Date Samples Received	: 19-Jul-2023
Order number	: 22.142	Date Analysis Commenced	: 19-Jul-2023
C-O-C number	: 2734	Issue Date	: 31-Jul-2023
Sampler	: ----		
Site	: ----		
Quote number	: EN/110		
No. of samples received	: 8		
No. of samples analysed	: 8		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Jasmine Myintaye	Lab Technician	Perth Microbiology, Wangara, WA
Vinitha Kesavan	Analyst	Perth Microbiology, Wangara, WA

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA005P: pH by PC Titrator (QC Lot: 5187436)									
EP2309684-003	GW03	EA005-P: pH Value	----	0.01	pH Unit	6.62	6.69	1.1	0% - 20%
EP2309670-015	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.88	7.86	0.3	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 5187435)									
EP2309655-010	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	3990	3970	0.5	0% - 20%
EP2309670-005	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	473	468	1.1	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 5187438)									
EP2309684-003	GW03	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	192	194	0.9	0% - 20%
EP2309687-004	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	88	88	0.0	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 5187437)									
EP2309670-015	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	76	76	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	76	76	0.0	0% - 20%
EP2309687-004	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	9	9	0.0	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	9	9	0.0	No Limit
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 5182912)									
EP2309631-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	853	872	2.1	0% - 20%
EP2309684-006	RINSATE	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.0	No Limit
ED045G: Chloride by Discrete Analyser (QC Lot: 5182913)									
EP2309631-002	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	1260	1240	1.5	0% - 20%
EP2309684-006	RINSATE	ED045G: Chloride	16887-00-6	1	mg/L	<1	<1	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
ED093F: Dissolved Major Cations (QC Lot: 5196747)									
EP2309684-001	GW01	ED093F: Calcium	7440-70-2	1	mg/L	18	18	0.0	0% - 50%
		ED093F: Magnesium	7439-95-4	1	mg/L	11	11	0.0	0% - 50%
		ED093F: Sodium	7440-23-5	1	mg/L	111	108	1.9	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	6	6	0.0	No Limit
EP2309750-005	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	15	16	0.0	0% - 50%
		ED093F: Magnesium	7439-95-4	1	mg/L	13	13	0.0	0% - 50%
		ED093F: Sodium	7440-23-5	1	mg/L	90	91	1.1	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	3	3	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 5196745)									
EP2309684-001	GW01	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.016	0.016	0.0	No Limit
EP2309750-005	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.003	0.003	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 5196746)									
EP2309618-004	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EP2309750-002	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	0.0002	0.0002	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 5182957)									
EP2309695-002	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.05	0.04	0.0	No Limit
EP2309695-007	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	9.74	9.72	0.2	0% - 20%
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 5182911)									
EP2309631-002	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2309684-006	RINSATE	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 5182958)									
EP2309695-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	9.51	9.33	1.9	0% - 20%
EP2309695-007	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	1.83	1.98	7.6	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 5195326)									
EP2309673-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	2.6	2.5	5.0	0% - 20%
EP2309686-003	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	13.2	13.7	3.7	0% - 50%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 5195327)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 5195327) - continued									
EP2309673-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.12	0.12	0.0	0% - 50%
EP2309686-003	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.14	0.15	0.0	0% - 50%
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 5182915)									
EP2309684-006	RINSATE	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP030: Biochemical Oxygen Demand (BOD) (QC Lot: 5187983)									
EP2309621-001	Anonymous	EP030: Biochemical Oxygen Demand	----	2	mg/L	10	12	20.3	No Limit
EP2309684-006	RINSATE	EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	<2	0.0	No Limit
EP074A: Monocyclic Aromatic Hydrocarbons (QC Lot: 5193293)									
EP2309684-001	GW01	EP074: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP074: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP074: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP074: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP074: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP074: Styrene	100-42-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: Isopropylbenzene	98-82-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: n-Propylbenzene	103-65-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: sec-Butylbenzene	135-98-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: tert-Butylbenzene	98-06-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: p-Isopropyltoluene	99-87-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: n-Butylbenzene	104-51-8	5	µg/L	<5	<5	0.0	No Limit
EP074B: Oxygenated Compounds (QC Lot: 5193293)									
EP2309684-001	GW01	EP074: Vinyl Acetate	108-05-4	50	µg/L	<50	<50	0.0	No Limit
		EP074: 2-Butanone (MEK)	78-93-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	<50	0.0	No Limit
		EP074: 2-Hexanone (MBK)	591-78-6	50	µg/L	<50	<50	0.0	No Limit
EP074C: Sulfonated Compounds (QC Lot: 5193293)									
EP2309684-001	GW01	EP074: Carbon disulfide	75-15-0	5	µg/L	<5	<5	0.0	No Limit
EP074D: Fumigants (QC Lot: 5193293)									
EP2309684-001	GW01	EP074: 2.2-Dichloropropane	594-20-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichloropropane	78-87-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.3-Dichloropropylene	10061-01-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.3-Dichloropropylene	10061-02-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	<5	0.0	No Limit
EP074E: Halogenated Aliphatic Compounds (QC Lot: 5193293)									
EP2309684-001	GW01	EP074: 1.1-Dichloroethene	75-35-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Iodomethane	74-88-4	5	µg/L	<5	<5	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP074E: Halogenated Aliphatic Compounds (QC Lot: 5193293) - continued									
EP2309684-001	GW01	EP074: trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1-Dichloroethane	75-34-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1-Dichloropropylene	563-58-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: Carbon Tetrachloride	56-23-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichloroethane	107-06-2	5	µg/L	<5	<5	0.0	No Limit
		EP074: Trichloroethene	79-01-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dibromomethane	74-95-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3-Dichloropropane	142-28-9	5	µg/L	<5	<5	0.0	No Limit
		EP074: Tetrachloroethene	127-18-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Pentachloroethane	76-01-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dichlorodifluoromethane	75-71-8	50	µg/L	<50	<50	0.0	No Limit
		EP074: Chloromethane	74-87-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: Vinyl chloride	75-01-4	50	µg/L	<50	<50	0.0	No Limit
		EP074: Bromomethane	74-83-9	50	µg/L	<50	<50	0.0	No Limit
		EP074: Chloroethane	75-00-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: Trichlorofluoromethane	75-69-4	50	µg/L	<50	<50	0.0	No Limit
EP074F: Halogenated Aromatic Compounds (QC Lot: 5193293)									
EP2309684-001	GW01	EP074: Chlorobenzene	108-90-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromobenzene	108-86-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 2-Chlorotoluene	95-49-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: 4-Chlorotoluene	106-43-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	<5	0.0	No Limit
EP074G: Trihalomethanes (QC Lot: 5193293)									
EP2309684-001	GW01	EP074: Chloroform	67-66-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromodichloromethane	75-27-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dibromochloromethane	124-48-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromoform	75-25-2	5	µg/L	<5	<5	0.0	No Limit
EP074L: Fuel Oxygenates (QC Lot: 5193291)									
EP2309684-001	GW01	EP074L: Methyl tert-butyl ether (MTBE)	1634-04-4	1	µg/L	<1	<1	0.0	No Limit
		EP074L: Diisopropyl ether (DIPE)	108-20-3	1	µg/L	<1	<1	0.0	No Limit
		EP074L: Ethyl tert-butyl ether (ETBE)	637-92-3	1	µg/L	<1	<1	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP074L: Fuel Oxygenates (QC Lot: 5193291) - continued									
EP2309684-001	GW01	EP074L: tert-Amyl ethyl ether (TAEE)	919-94-8	1	µg/L	<1	<1	0.0	No Limit
		EP074L: tert-amyl methyl ether (TAME)	994-05-8	1	µg/L	<1	<1	0.0	No Limit
		EP074L: tert-Butyl alcohol (TBA)	75-65-0	5	µg/L	<5	<5	0.0	No Limit
EP075A: Phenolic Compounds (QC Lot: 5187968)									
EP2309684-001	GW01	EP075: Phenol	108-95-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2-Chlorophenol	95-57-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2-Methylphenol	95-48-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: 3- & 4-Methylphenol	1319-77-3	2	µg/L	<4	<4	0.0	No Limit
		EP075: 2-Nitrophenol	88-75-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2.4-Dimethylphenol	105-67-9	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2.4-Dichlorophenol	120-83-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2.6-Dichlorophenol	87-65-0	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4-Chloro-3-methylphenol	59-50-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2.4.6-Trichlorophenol	88-06-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2.4.5-Trichlorophenol	95-95-4	2	µg/L	<2	<2	0.0	No Limit
		EP075: Pentachlorophenol	87-86-5	4	µg/L	<4	<4	0.0	No Limit
EP075B: Polynuclear Aromatic Hydrocarbons (QC Lot: 5187968)									
EP2309684-001	GW01	EP075: Naphthalene	91-20-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2-Methylnaphthalene	91-57-6	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2-Chloronaphthalene	91-58-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: Acenaphthylene	208-96-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: Acenaphthene	83-32-9	2	µg/L	<2	<2	0.0	No Limit
		EP075: Fluorene	86-73-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: Phenanthrene	85-01-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: Anthracene	120-12-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: Fluoranthene	206-44-0	2	µg/L	<2	<2	0.0	No Limit
		EP075: Pyrene	129-00-0	2	µg/L	<2	<2	0.0	No Limit
		EP075: N-2-Fluorenyl Acetamide	53-96-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: Benz(a)anthracene	56-55-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: Chrysene	218-01-9	2	µg/L	<2	<2	0.0	No Limit
		EP075: 7.12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L	<2	<2	0.0	No Limit
		EP075: Benzo(a)pyrene	50-32-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: 3-Methylcholanthrene	56-49-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: Indeno(1.2.3.cd)pyrene	193-39-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: Dibenz(a.h)anthracene	53-70-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: Benzo(g.h.i)perylene	191-24-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: Benzo(a)pyrene TEQ (zero)	----	2	µg/L	<2	<2	0.0	No Limit
		EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L	<4	<4	0.0	No Limit
EP075C: Phthalate Esters (QC Lot: 5187968)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075C: Phthalate Esters (QC Lot: 5187968) - continued									
EP2309684-001	GW01	EP075: bis(2-ethylhexyl) phthalate	117-81-7	10	µg/L	<10	<10	0.0	No Limit
		EP075: Dimethyl phthalate	131-11-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: Diethyl phthalate	84-66-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: Di-n-butyl phthalate	84-74-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: Butyl benzyl phthalate	85-68-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: Di-n-octylphthalate	117-84-0	2	µg/L	<2	<2	0.0	No Limit
EP075D: Nitrosamines (QC Lot: 5187968)									
EP2309684-001	GW01	EP075: N-Nitrosomethylethylamine	10595-95-6	2	µg/L	<2	<2	0.0	No Limit
		EP075: N-Nitrosodiethylamine	55-18-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: N-Nitrosomorpholine	59-89-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: N-Nitrosodi-n-propylamine	621-64-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: N-Nitrosopiperidine	100-75-4	2	µg/L	<2	<2	0.0	No Limit
		EP075: N-Nitrosodibutylamine	924-16-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: Methapyrilene	91-80-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: N-Nitrosopyrrolidine	930-55-2	4	µg/L	<4	<4	0.0	No Limit
		EP075: N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	4	µg/L	<4	<4	0.0	No Limit
EP075E: Nitroaromatics and Ketones (QC Lot: 5187968)									
EP2309684-001	GW01	EP075: 2-Picoline	109-06-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: Acetophenone	98-86-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: Nitrobenzene	98-95-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: Isophorone	78-59-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: 1-Naphthylamine	134-32-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4-Nitroquinoline-N-oxide	56-57-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: 5-Nitro-o-toluidine	99-55-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: Azobenzene	103-33-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: 1.3.5-Trinitrobenzene	99-35-4	2	µg/L	<2	<2	0.0	No Limit
		EP075: Phenacetin	62-44-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4-Aminobiphenyl	92-67-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: Pentachloronitrobenzene	82-68-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: Pronamide	23950-58-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: Dimethylaminoazobenzene	60-11-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: Chlorobenzilate	510-15-6	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2.6-Dinitrotoluene	606-20-2	4	µg/L	<4	<4	0.0	No Limit
		EP075: 2.4-Dinitrotoluene	121-14-2	4	µg/L	<4	<4	0.0	No Limit
EP075F: Haloethers (QC Lot: 5187968)									
EP2309684-001	GW01	EP075: Bis(2-chloroethyl) ether	111-44-4	2	µg/L	<2	<2	0.0	No Limit
		EP075: Bis(2-chloroethoxy) methane	111-91-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4-Chlorophenyl phenyl ether	7005-72-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4-Bromophenyl phenyl ether	101-55-3	2	µg/L	<2	<2	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075G: Chlorinated Hydrocarbons (QC Lot: 5187968)									
EP2309684-001	GW01	EP075: Hexachlorocyclopentadiene	77-47-4	10	µg/L	<10	<10	0.0	No Limit
		EP075: 1.4-Dichlorobenzene	106-46-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: 1.3-Dichlorobenzene	541-73-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: 1.2-Dichlorobenzene	95-50-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: Hexachloroethane	67-72-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: 1.2.4-Trichlorobenzene	120-82-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: Hexachloropropylene	1888-71-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: Hexachlorobutadiene	87-68-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: Pentachlorobenzene	608-93-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: Hexachlorobenzene (HCB)	118-74-1	4	µg/L	<4	<4	0.0	No Limit
EP075H: Anilines and Benzidines (QC Lot: 5187968)									
EP2309684-001	GW01	EP075: Aniline	62-53-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4-Chloroaniline	106-47-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: Dibenzofuran	132-64-9	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4-Nitroaniline	100-01-6	2	µg/L	<2	<2	0.0	No Limit
		EP075: Carbazole	86-74-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: 3.3`-Dichlorobenzidine	91-94-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: 2-Nitroaniline	88-74-4	4	µg/L	<4	<4	0.0	No Limit
		EP075: 3-Nitroaniline	99-09-2	4	µg/L	<4	<4	0.0	No Limit
EP075I: Organochlorine Pesticides (QC Lot: 5187968)									
EP2309684-001	GW01	EP075: alpha-BHC	319-84-6	2	µg/L	<2	<2	0.0	No Limit
		EP075: beta-BHC	319-85-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: gamma-BHC	58-89-9	2	µg/L	<2	<2	0.0	No Limit
		EP075: delta-BHC	319-86-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: Heptachlor	76-44-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: Aldrin	309-00-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: Heptachlor epoxide	1024-57-3	2	µg/L	<2	<2	0.0	No Limit
		EP075: alpha-Endosulfan	959-98-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4.4`-DDE	72-55-9	2	µg/L	<2	<2	0.0	No Limit
		EP075: Dieldrin	60-57-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: Endrin	72-20-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: beta-Endosulfan	33213-65-9	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4.4`-DDD	72-54-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: Endosulfan sulfate	1031-07-8	2	µg/L	<2	<2	0.0	No Limit
		EP075: 4.4`-DDT	50-29-3	4	µg/L	<4	<4	0.0	No Limit
		EP075: Sum of Aldrin + Dieldrin	309-00-2/60-57-1	4	µg/L	<4	<4	0.0	No Limit
		EP075: Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	4	µg/L	<4	<4	0.0	No Limit
EP075J: Organophosphorus Pesticides (QC Lot: 5187968)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075J: Organophosphorus Pesticides (QC Lot: 5187968) - continued									
EP2309684-001	GW01	EP075: Dichlorvos	62-73-7	2	µg/L	<2	<2	0.0	No Limit
		EP075: Dimethoate	60-51-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: Diazinon	333-41-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: Chlorpyrifos-methyl	5598-13-0	2	µg/L	<2	<2	0.0	No Limit
		EP075: Malathion	121-75-5	2	µg/L	<2	<2	0.0	No Limit
		EP075: Fenthion	55-38-9	2	µg/L	<2	<2	0.0	No Limit
		EP075: Chlorpyrifos	2921-88-2	2	µg/L	<2	<2	0.0	No Limit
		EP075: Pirimphos-ethyl	23505-41-1	2	µg/L	<2	<2	0.0	No Limit
		EP075: Chlorfenvinphos	470-90-6	2	µg/L	<2	<2	0.0	No Limit
		EP075: Prothiofos	34643-46-4	2	µg/L	<2	<2	0.0	No Limit
		EP075: Ethion	563-12-2	2	µg/L	<2	<2	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 5187969)									
EP2309684-001	GW01	EP071: C15 - C28 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	µg/L	<50	<50	0.0	No Limit
		EP071: C29 - C36 Fraction	----	50	µg/L	<50	<50	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 5193292)									
EP2309684-001	GW01	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 5187969)									
EP2309684-001	GW01	EP071: >C10 - C16 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
		EP071: >C16 - C34 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 5193292)									
EP2309684-001	GW01	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
EP080: BTEXN (QC Lot: 5193292)									
EP2309684-001	GW01	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA005P: pH by PC Titrator (QCLot: 5187436)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	100	98.5	102
				----	7 pH Unit	100	98.5	102
EA010P: Conductivity by PC Titrator (QCLot: 5187435)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	24800 µS/cm	96.5	92.1	105
EA010P: Conductivity by PC Titrator (QCLot: 5187438)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	24800 µS/cm	97.7	92.1	105
ED037P: Alkalinity by PC Titrator (QCLot: 5187437)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	109	87.8	118
				<1	200 mg/L	103	87.8	118
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 5182912)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	104	89.9	112
				<1	500 mg/L	106	89.9	112
ED045G: Chloride by Discrete Analyser (QCLot: 5182913)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	93.7	88.6	113
				<1	1000 mg/L	97.2	88.6	113
ED093F: Dissolved Major Cations (QCLot: 5196747)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	105	86.5	117
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	103	88.4	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	107	91.4	113
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	107	84.6	108
EG020F: Dissolved Metals by ICP-MS (QCLot: 5196745)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	103	90.3	113
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	103	89.7	108
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	104	87.3	107
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	98.1	88.9	108
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	99.9	89.4	106
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	99.2	87.2	108

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 5196745) - continued								
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	103	89.5	112
EG035F: Dissolved Mercury by FIMS (QCLot: 5196746)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.005 mg/L	95.6	85.6	120
EK055G: Ammonia as N by Discrete Analyser (QCLot: 5182957)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	100	86.2	111
EK057G: Nitrite as N by Discrete Analyser (QCLot: 5182911)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	100	88.7	113
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 5182958)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	98.4	90.5	110
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 5195326)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	91.2	75.8	100
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 5195327)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	91.5	70.0	110
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 5182915)								
EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	0.5 mg/L	100	89.4	109
EP030: Biochemical Oxygen Demand (BOD) (QCLot: 5187983)								
EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	198 mg/L	87.8	75.4	101
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 5193293)								
EP074: Benzene	71-43-2	1	µg/L	<1	10 µg/L	97.7	77.0	119
EP074: Toluene	108-88-3	2	µg/L	<2	10 µg/L	104	69.0	129
EP074: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	98.7	76.0	118
EP074: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	20 µg/L	100	77.0	119
EP074: Styrene	100-42-5	5	µg/L	<5	10 µg/L	98.1	73.0	119
EP074: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	105	79.0	117
EP074: Isopropylbenzene	98-82-8	5	µg/L	<5	10 µg/L	101	76.0	118
EP074: n-Propylbenzene	103-65-1	5	µg/L	<5	10 µg/L	92.2	69.0	119
EP074: 1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	10 µg/L	91.8	74.0	116
EP074: sec-Butylbenzene	135-98-8	5	µg/L	<5	10 µg/L	92.7	73.0	119
EP074: 1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	10 µg/L	93.8	74.0	116
EP074: tert-Butylbenzene	98-06-6	5	µg/L	<5	10 µg/L	92.8	72.0	116
EP074: p-Isopropyltoluene	99-87-6	5	µg/L	<5	10 µg/L	92.6	71.0	119
EP074: n-Butylbenzene	104-51-8	5	µg/L	<5	10 µg/L	92.3	65.0	123
EP074B: Oxygenated Compounds (QCLot: 5193293)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP074B: Oxygenated Compounds (QCLot: 5193293) - continued								
EP074: Vinyl Acetate	108-05-4	50	µg/L	<50	100 µg/L	107	61.4	134
EP074: 2-Butanone (MEK)	78-93-3	50	µg/L	<50	100 µg/L	115	73.6	130
EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	100 µg/L	110	66.0	132
EP074: 2-Hexanone (MBK)	591-78-6	50	µg/L	<50	100 µg/L	111	65.0	137
EP074C: Sulfonated Compounds (QCLot: 5193293)								
EP074: Carbon disulfide	75-15-0	5	µg/L	<5	10 µg/L	91.6	72.8	127
EP074D: Fumigants (QCLot: 5193293)								
EP074: 2.2-Dichloropropane	594-20-7	5	µg/L	<5	10 µg/L	99.7	68.0	122
EP074: 1.2-Dichloropropane	78-87-5	5	µg/L	<5	10 µg/L	106	76.0	118
EP074: cis-1.3-Dichloropropylene	10061-01-5	5	µg/L	<5	10 µg/L	101	62.0	120
EP074: trans-1.3-Dichloropropylene	10061-02-6	5	µg/L	<5	10 µg/L	106	60.0	114
EP074: 1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	10 µg/L	# 118	69.0	117
EP074E: Halogenated Aliphatic Compounds (QCLot: 5193293)								
EP074: Dichlorodifluoromethane	75-71-8	50	µg/L	<50	100 µg/L	76.0	60.6	138
EP074: Chloromethane	74-87-3	50	µg/L	<50	100 µg/L	88.2	67.4	130
EP074: Vinyl chloride	75-01-4	50	µg/L	<50	100 µg/L	88.6	69.4	129
EP074: Bromomethane	74-83-9	50	µg/L	<50	100 µg/L	89.7	56.0	140
EP074: Chloroethane	75-00-3	50	µg/L	<50	100 µg/L	90.4	61.0	139
EP074: Trichlorofluoromethane	75-69-4	50	µg/L	<50	100 µg/L	92.8	69.0	131
EP074: 1.1-Dichloroethene	75-35-4	5	µg/L	<5	10 µg/L	92.4	70.0	124
EP074: Iodomethane	74-88-4	5	µg/L	<5	10 µg/L	95.0	70.2	128
EP074: trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	10 µg/L	96.0	74.0	118
EP074: 1.1-Dichloroethane	75-34-3	5	µg/L	<5	10 µg/L	99.8	74.0	120
EP074: cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	10 µg/L	99.4	77.0	119
EP074: 1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	10 µg/L	95.6	67.0	119
EP074: 1.1-Dichloropropylene	563-58-6	5	µg/L	<5	10 µg/L	97.5	73.0	119
EP074: Carbon Tetrachloride	56-23-5	5	µg/L	<5	10 µg/L	98.1	62.0	120
EP074: 1.2-Dichloroethane	107-06-2	5	µg/L	<5	10 µg/L	106	73.0	123
EP074: Trichloroethene	79-01-6	5	µg/L	<5	10 µg/L	98.7	76.0	118
EP074: Dibromomethane	74-95-3	5	µg/L	<5	10 µg/L	105	73.0	119
EP074: 1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	10 µg/L	111	72.0	126
EP074: 1.3-Dichloropropane	142-28-9	5	µg/L	<5	10 µg/L	113	71.0	129
EP074: Tetrachloroethene	127-18-4	5	µg/L	<5	10 µg/L	100	72.0	124
EP074: 1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	10 µg/L	102	66.0	114

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP074E: Halogenated Aliphatic Compounds (QCLot: 5193293) - continued								
EP074: trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	10 µg/L	111	60.0	120
EP074: cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	10 µg/L	118	70.6	128
EP074: 1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	10 µg/L	124	70.0	124
EP074: 1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	10 µg/L	116	74.0	126
EP074: Pentachloroethane	76-01-7	5	µg/L	<5	10 µg/L	102	71.8	126
EP074: 1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	10 µg/L	107	66.4	136
EP074F: Halogenated Aromatic Compounds (QCLot: 5193293)								
EP074: Chlorobenzene	108-90-7	5	µg/L	<5	10 µg/L	107	79.0	117
EP074: Bromobenzene	108-86-1	5	µg/L	<5	10 µg/L	102	76.0	116
EP074: 2-Chlorotoluene	95-49-8	5	µg/L	<5	10 µg/L	95.2	73.0	119
EP074: 4-Chlorotoluene	106-43-4	5	µg/L	<5	10 µg/L	92.7	73.0	119
EP074: 1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	10 µg/L	120	67.0	123
EP074G: Trihalomethanes (QCLot: 5193293)								
EP074: Chloroform	67-66-3	5	µg/L	<5	10 µg/L	101	72.0	120
EP074: Bromodichloromethane	75-27-4	5	µg/L	<5	10 µg/L	100	64.0	118
EP074: Dibromochloromethane	124-48-1	5	µg/L	<5	10 µg/L	114	65.0	115
EP074: Bromoform	75-25-2	5	µg/L	<5	10 µg/L	117	73.5	126
EP074L: Fuel Oxygenates (QCLot: 5193291)								
EP074L: tert-Butyl alcohol (TBA)	75-65-0	5	µg/L	<5	50 µg/L	101	70.0	130
EP074L: Methyl tert-butyl ether (MTBE)	1634-04-4	1	µg/L	<1	10 µg/L	94.6	70.0	130
EP074L: Diisopropyl ether (DIPE)	108-20-3	1	µg/L	<1	10 µg/L	100	70.0	130
EP074L: Ethyl tert-butyl ether (ETBE)	637-92-3	1	µg/L	<1	10 µg/L	99.1	70.0	130
EP074L: tert-Amyl ethyl ether (TAEE)	919-94-8	1	µg/L	<1	10 µg/L	107	70.0	130
EP074L: tert-amyl methyl ether (TAME)	994-05-8	1	µg/L	<1	10 µg/L	100	70.0	130
EP075A: Phenolic Compounds (QCLot: 5187968)								
EP075: Phenol	108-95-2	2	µg/L	<2	10 µg/L	39.0	25.5	64.1
EP075: 2-Chlorophenol	95-57-8	2	µg/L	<2	10 µg/L	65.2	52.0	88.0
EP075: 2-Methylphenol	95-48-7	2	µg/L	<2	10 µg/L	61.6	50.0	94.0
EP075: 3- & 4-Methylphenol	1319-77-3	2	µg/L	<2	10 µg/L	57.2	45.0	96.2
EP075: 2-Nitrophenol	88-75-5	2	µg/L	<2	10 µg/L	70.7	48.0	98.0
EP075: 2.4-Dimethylphenol	105-67-9	2	µg/L	<2	10 µg/L	66.1	50.0	94.0
EP075: 2.4-Dichlorophenol	120-83-2	2	µg/L	<2	10 µg/L	69.0	61.9	109
EP075: 2.6-Dichlorophenol	87-65-0	2	µg/L	<2	10 µg/L	73.4	61.5	108
EP075: 4-Chloro-3-methylphenol	59-50-7	2	µg/L	<2	10 µg/L	74.7	61.4	107

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP075A: Phenolic Compounds (QCLot: 5187968) - continued								
EP075: 2.4.6-Trichlorophenol	88-06-2	2	µg/L	<2	10 µg/L	74.4	57.6	112
EP075: 2.4.5-Trichlorophenol	95-95-4	2	µg/L	<2	10 µg/L	77.3	58.0	110
EP075: Pentachlorophenol	87-86-5	4	µg/L	<4	20 µg/L	75.3	12.8	95.0
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 5187968)								
EP075: Naphthalene	91-20-3	2	µg/L	<2	10 µg/L	73.1	51.0	95.0
EP075: 2-Methylnaphthalene	91-57-6	2	µg/L	<2	10 µg/L	74.6	59.0	108
EP075: 2-Chloronaphthalene	91-58-7	2	µg/L	<2	10 µg/L	71.9	60.6	106
EP075: Acenaphthylene	208-96-8	2	µg/L	<2	10 µg/L	74.9	64.0	108
EP075: Acenaphthene	83-32-9	2	µg/L	<2	10 µg/L	79.7	65.0	108
EP075: Fluorene	86-73-7	2	µg/L	<2	10 µg/L	84.9	65.2	107
EP075: Phenanthrene	85-01-8	2	µg/L	<2	10 µg/L	88.4	66.7	108
EP075: Anthracene	120-12-7	2	µg/L	<2	10 µg/L	88.0	65.8	108
EP075: Fluoranthene	206-44-0	2	µg/L	<2	10 µg/L	86.5	64.9	109
EP075: Pyrene	129-00-0	2	µg/L	<2	10 µg/L	85.2	60.1	111
EP075: N-2-Fluorenyl Acetamide	53-96-3	2	µg/L	<2	10 µg/L	90.9	59.7	110
EP075: Benz(a)anthracene	56-55-3	2	µg/L	<2	10 µg/L	90.2	62.2	112
EP075: Chrysene	218-01-9	2	µg/L	<2	10 µg/L	87.3	59.3	114
EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L	<4	20 µg/L	90.8	60.1	111
EP075: 7.12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L	<2	10 µg/L	103	50.0	108
EP075: Benzo(a)pyrene	50-32-8	2	µg/L	<2	10 µg/L	93.5	59.2	112
EP075: 3-Methylcholanthrene	56-49-5	2	µg/L	<2	10 µg/L	86.5	60.1	110
EP075: Indeno(1.2.3.cd)pyrene	193-39-5	2	µg/L	<2	10 µg/L	85.5	59.6	110
EP075: Dibenz(a.h)anthracene	53-70-3	2	µg/L	<2	10 µg/L	83.6	57.2	109
EP075: Benzo(g.h.i)perylene	191-24-2	2	µg/L	<2	10 µg/L	84.3	60.6	110
EP075: Benzo(a)pyrene TEQ (zero)	----	2	µg/L	<2	----	----	----	----
EP075C: Phthalate Esters (QCLot: 5187968)								
EP075: Dimethyl phthalate	131-11-3	2	µg/L	<2	10 µg/L	80.4	64.3	112
EP075: Diethyl phthalate	84-66-2	2	µg/L	<2	10 µg/L	91.4	67.3	111
EP075: Di-n-butyl phthalate	84-74-2	2	µg/L	<2	10 µg/L	88.1	68.4	122
EP075: Butyl benzyl phthalate	85-68-7	2	µg/L	<2	10 µg/L	91.2	61.2	114
EP075: bis(2-ethylhexyl) phthalate	117-81-7	----	µg/L	----	10 µg/L	96.5	60.0	132
EP075: Di-n-octylphthalate	117-84-0	2	µg/L	<2	10 µg/L	93.4	62.1	115
EP075D: Nitrosamines (QCLot: 5187968)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP075D: Nitrosamines (QCLot: 5187968) - continued								
EP075: N-Nitrosomethylethylamine	10595-95-6	2	µg/L	<2	10 µg/L	64.5	46.0	110
EP075: N-Nitrosodiethylamine	55-18-5	2	µg/L	<2	10 µg/L	68.1	60.6	113
EP075: N-Nitrosopyrrolidine	930-55-2	4	µg/L	<4	10 µg/L	59.4	45.0	91.0
EP075: N-Nitrosomorpholine	59-89-2	2	µg/L	<2	10 µg/L	58.8	42.0	100
EP075: N-Nitrosodi-n-propylamine	621-64-7	2	µg/L	<2	10 µg/L	76.0	63.5	108
EP075: N-Nitrosopiperidine	100-75-4	2	µg/L	<2	10 µg/L	70.5	61.7	107
EP075: N-Nitrosodibutylamine	924-16-3	2	µg/L	<2	10 µg/L	70.5	62.5	108
EP075: N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	4	µg/L	<4	20 µg/L	85.8	64.6	112
EP075: Methapyrilene	91-80-5	2	µg/L	<2	10 µg/L	77.2	23.3	125
EP075E: Nitroaromatics and Ketones (QCLot: 5187968)								
EP075: 2-Picoline	109-06-8	2	µg/L	<2	10 µg/L	42.5	41.0	109
EP075: Acetophenone	98-86-2	2	µg/L	<2	10 µg/L	71.6	68.3	112
EP075: Nitrobenzene	98-95-3	2	µg/L	<2	10 µg/L	69.1	68.3	112
EP075: Isophorone	78-59-1	2	µg/L	<2	10 µg/L	74.2	67.6	111
EP075: 2.6-Dinitrotoluene	606-20-2	4	µg/L	<4	10 µg/L	78.1	64.4	113
EP075: 2.4-Dinitrotoluene	121-14-2	4	µg/L	<4	10 µg/L	86.6	59.5	109
EP075: 1-Naphthylamine	134-32-7	2	µg/L	<2	10 µg/L	76.7	46.8	102
EP075: 4-Nitroquinoline-N-oxide	56-57-5	2	µg/L	<2	10 µg/L	73.9	40.0	96.0
EP075: 5-Nitro-o-toluidine	99-55-8	2	µg/L	<2	10 µg/L	80.3	58.3	106
EP075: Azobenzene	103-33-3	2	µg/L	<2	10 µg/L	85.4	66.0	112
EP075: 1.3.5-Trinitrobenzene	99-35-4	2	µg/L	<2	10 µg/L	82.9	46.0	108
EP075: Phenacetin	62-44-2	2	µg/L	<2	10 µg/L	77.8	57.8	101
EP075: 4-Aminobiphenyl	92-67-1	2	µg/L	<2	10 µg/L	84.4	60.1	112
EP075: Pentachloronitrobenzene	82-68-8	2	µg/L	<2	10 µg/L	82.8	59.0	109
EP075: Pronamide	23950-58-5	2	µg/L	<2	10 µg/L	87.5	62.7	109
EP075: Dimethylaminoazobenzene	60-11-7	2	µg/L	<2	10 µg/L	85.0	59.4	108
EP075: Chlorobenzilate	510-15-6	2	µg/L	<2	10 µg/L	88.8	57.7	110
EP075F: Haloethers (QCLot: 5187968)								
EP075: Bis(2-chloroethyl) ether	111-44-4	2	µg/L	<2	10 µg/L	73.2	69.1	112
EP075: Bis(2-chloroethoxy) methane	111-91-1	2	µg/L	<2	10 µg/L	70.6	66.2	111
EP075: 4-Chlorophenyl phenyl ether	7005-72-3	2	µg/L	<2	10 µg/L	84.0	64.7	109
EP075: 4-Bromophenyl phenyl ether	101-55-3	2	µg/L	<2	10 µg/L	82.6	61.6	108
EP075G: Chlorinated Hydrocarbons (QCLot: 5187968)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP075G: Chlorinated Hydrocarbons (QCLot: 5187968) - continued								
EP075: 1.4-Dichlorobenzene	106-46-7	2	µg/L	<2	10 µg/L	67.8	41.0	97.0
EP075: 1.3-Dichlorobenzene	541-73-1	2	µg/L	<2	10 µg/L	66.5	40.0	96.0
EP075: 1.2-Dichlorobenzene	95-50-1	2	µg/L	<2	10 µg/L	65.7	41.0	95.0
EP075: Hexachloroethane	67-72-1	2	µg/L	<2	10 µg/L	63.6	46.0	88.0
EP075: 1.2.4-Trichlorobenzene	120-82-1	2	µg/L	<2	10 µg/L	66.0	46.0	96.0
EP075: Hexachloropropylene	1888-71-7	2	µg/L	<2	10 µg/L	68.1	34.0	96.0
EP075: Hexachlorobutadiene	87-68-3	2	µg/L	<2	10 µg/L	70.1	37.4	100
EP075: Hexachlorocyclopentadiene	77-47-4	10	µg/L	<10	10 µg/L	59.2	23.5	107
EP075: Pentachlorobenzene	608-93-5	2	µg/L	<2	10 µg/L	84.7	64.5	107
EP075: Hexachlorobenzene (HCB)	118-74-1	4	µg/L	<4	10 µg/L	83.6	65.7	110
EP075H: Anilines and Benzidines (QCLot: 5187968)								
EP075: Aniline	62-53-3	2	µg/L	<2	10 µg/L	59.0	50.0	104
EP075: 4-Chloroaniline	106-47-8	2	µg/L	<2	10 µg/L	63.5	42.0	106
EP075: 2-Nitroaniline	88-74-4	4	µg/L	<4	10 µg/L	79.0	60.9	110
EP075: 3-Nitroaniline	99-09-2	4	µg/L	<4	10 µg/L	81.4	51.5	96.9
EP075: Dibenzofuran	132-64-9	2	µg/L	<2	10 µg/L	82.4	65.3	108
EP075: 4-Nitroaniline	100-01-6	2	µg/L	<2	10 µg/L	89.4	48.9	99.5
EP075: Carbazole	86-74-8	2	µg/L	<2	10 µg/L	87.0	64.3	107
EP075: 3.3`-Dichlorobenzidine	91-94-1	2	µg/L	<2	10 µg/L	90.3	60.3	119
EP075I: Organochlorine Pesticides (QCLot: 5187968)								
EP075: alpha-BHC	319-84-6	2	µg/L	<2	10 µg/L	84.4	64.3	110
EP075: beta-BHC	319-85-7	2	µg/L	<2	10 µg/L	74.3	53.0	107
EP075: gamma-BHC	58-89-9	2	µg/L	<2	10 µg/L	82.6	51.0	111
EP075: delta-BHC	319-86-8	2	µg/L	<2	10 µg/L	88.0	57.0	111
EP075: Heptachlor	76-44-8	2	µg/L	<2	10 µg/L	86.3	57.9	108
EP075: Aldrin	309-00-2	2	µg/L	<2	10 µg/L	83.2	56.0	112
EP075: Heptachlor epoxide	1024-57-3	2	µg/L	<2	10 µg/L	92.4	50.0	118
EP075: alpha-Endosulfan	959-98-8	2	µg/L	<2	10 µg/L	87.9	59.0	111
EP075: 4.4`-DDE	72-55-9	2	µg/L	<2	10 µg/L	86.6	53.0	115
EP075: Dieldrin	60-57-1	2	µg/L	<2	10 µg/L	89.7	59.0	115
EP075: Endrin	72-20-8	2	µg/L	<2	10 µg/L	87.7	58.0	114
EP075: beta-Endosulfan	33213-65-9	2	µg/L	<2	10 µg/L	90.7	54.0	116
EP075: 4.4`-DDD	72-54-8	2	µg/L	<2	10 µg/L	87.8	55.0	115
EP075: Endosulfan sulfate	1031-07-8	2	µg/L	<2	10 µg/L	109	52.8	114

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP075I: Organochlorine Pesticides (QCLot: 5187968) - continued								
EP075: 4.4`-DDT	50-29-3	4	µg/L	<4	10 µg/L	85.3	56.0	114
EP075: Sum of Aldrin + Dieldrin	309-00-2/60-57-1	4	µg/L	<4	----	----	----	----
EP075: Sum of DDD + DDE + DDT	72-54-8/72-5 5-9/50-2	4	µg/L	<4	----	----	----	----
EP075J: Organophosphorus Pesticides (QCLot: 5187968)								
EP075: Dichlorvos	62-73-7	2	µg/L	<2	10 µg/L	84.2	51.0	113
EP075: Dimethoate	60-51-5	2	µg/L	<2	10 µg/L	79.2	43.0	109
EP075: Diazinon	333-41-5	2	µg/L	<2	10 µg/L	91.4	49.0	113
EP075: Chlorpyrifos-methyl	5598-13-0	2	µg/L	<2	10 µg/L	89.7	54.1	116
EP075: Malathion	121-75-5	2	µg/L	<2	10 µg/L	93.6	54.0	124
EP075: Fenthion	55-38-9	2	µg/L	<2	10 µg/L	86.6	57.0	115
EP075: Chlorpyrifos	2921-88-2	2	µg/L	<2	10 µg/L	87.6	53.0	109
EP075: Pirimphos-ethyl	23505-41-1	2	µg/L	<2	10 µg/L	90.2	55.0	111
EP075: Chlorfenvinphos	470-90-6	2	µg/L	<2	10 µg/L	81.0	50.0	116
EP075: Prothiofos	34643-46-4	2	µg/L	<2	10 µg/L	89.8	54.0	118
EP075: Ethion	563-12-2	2	µg/L	<2	10 µg/L	89.6	51.0	117
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5187969)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	400 µg/L	81.6	53.7	97.0
EP071: C15 - C28 Fraction	----	100	µg/L	<100	600 µg/L	82.4	63.3	107
EP071: C29 - C36 Fraction	----	50	µg/L	<50	400 µg/L	92.7	58.3	120
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5193292)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	86.7	75.0	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5187969)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	500 µg/L	69.6	53.9	95.5
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	700 µg/L	65.4	57.8	110
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	300 µg/L	99.9	50.5	115
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5193292)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	86.0	75.0	127
EP080: BTEXN (QCLot: 5193292)								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	91.8	68.3	119
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	96.7	73.5	120
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	93.8	73.8	122
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	94.4	73.0	122

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP080: BTEXN (QCLot: 5193292) - continued								
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	104	76.4	123
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	95.5	75.5	124

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 5182912)							
EP2309631-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	108	70.4	130
ED045G: Chloride by Discrete Analyser (QCLot: 5182913)							
EP2309631-001	Anonymous	ED045G: Chloride	16887-00-6	1000 mg/L	90.8	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 5196745)							
EP2309618-006	Anonymous	EG020A-F: Arsenic	7440-38-2	0.2 mg/L	93.2	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	96.1	70.0	130
		EG020A-F: Chromium	7440-47-3	0.2 mg/L	93.7	70.0	130
		EG020A-F: Copper	7440-50-8	0.2 mg/L	91.2	70.0	130
		EG020A-F: Lead	7439-92-1	0.2 mg/L	86.8	70.0	130
		EG020A-F: Nickel	7440-02-0	0.2 mg/L	90.3	70.0	130
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	95.0	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 5196746)							
EP2309684-002	GW02	EG035F: Mercury	7439-97-6	0.005 mg/L	88.3	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 5182957)							
EP2309695-001	Anonymous	EK055G: Ammonia as N	7664-41-7	1 mg/L	# Not Determined	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 5182911)							
EP2309684-001	GW01	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	91.2	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 5182958)							
EP2309695-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	# Not Determined	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 5195326)							
EP2309673-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	87.7	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 5195327)							
EP2309673-002	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	98.1	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 5182915)							
EP2309684-001	GW01	EK071G: Reactive Phosphorus as P	14265-44-2	0.5 mg/L	96.0	70.0	130
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 5193293)							
EP2309684-001	GW01	EP074: Benzene	71-43-2	25 µg/L	98.0	70.0	130
		EP074: Toluene	108-88-3	25 µg/L	97.6	70.0	130
EP074E: Halogenated Aliphatic Compounds (QCLot: 5193293)							
EP2309684-001	GW01	EP074: 1.1-Dichloroethene	75-35-4	25 µg/L	105	70.0	130
		EP074: Trichloroethene	79-01-6	25 µg/L	91.5	70.0	130
EP074F: Halogenated Aromatic Compounds (QCLot: 5193293)							
EP2309684-001	GW01	EP074: Chlorobenzene	108-90-7	25 µg/L	98.9	70.0	130
EP074L: Fuel Oxygenates (QCLot: 5193291)							
EP2309684-001	GW01	EP074L: tert-Butyl alcohol (TBA)	75-65-0	125 µg/L	101	70.0	130
		EP074L: Methyl tert-butyl ether (MTBE)	1634-04-4	25 µg/L	97.0	70.0	130
		EP074L: Diisopropyl ether (DIPE)	108-20-3	25 µg/L	99.5	70.0	130
		EP074L: Ethyl tert-butyl ether (ETBE)	637-92-3	25 µg/L	98.0	70.0	130
		EP074L: tert-Amyl ethyl ether (TAEE)	919-94-8	25 µg/L	103	70.0	130
		EP074L: tert-amyl methyl ether (TAME)	994-05-8	25 µg/L	105	70.0	130
EP075A: Phenolic Compounds (QCLot: 5187968)							
EP2309684-001	GW01	EP075: Phenol	108-95-2	20 µg/L	32.2	20.0	130
		EP075: 2-Chlorophenol	95-57-8	20 µg/L	62.0	60.0	130
		EP075: 2-Nitrophenol	88-75-5	20 µg/L	77.9	60.0	130
		EP075: 4-Chloro-3-methylphenol	59-50-7	20 µg/L	70.8	50.0	130
		EP075: Pentachlorophenol	87-86-5	20 µg/L	54.5	10.0	130
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 5187968)							
EP2309684-001	GW01	EP075: Acenaphthene	83-32-9	20 µg/L	74.9	60.0	130
		EP075: Pyrene	129-00-0	20 µg/L	80.4	60.0	130
EP075D: Nitrosamines (QCLot: 5187968)							
EP2309684-001	GW01	EP075: N-Nitrosodi-n-propylamine	621-64-7	20 µg/L	75.1	60.0	130
EP075E: Nitroaromatics and Ketones (QCLot: 5187968)							
EP2309684-001	GW01	EP075: 2.4-Dinitrotoluene	121-14-2	20 µg/L	76.3	60.0	130
EP075G: Chlorinated Hydrocarbons (QCLot: 5187968)							
EP2309684-001	GW01	EP075: 1.4-Dichlorobenzene	106-46-7	20 µg/L	67.0	40.0	130
		EP075: 1.2.4-Trichlorobenzene	120-82-1	20 µg/L	60.6	40.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5187969)							
EP2309684-001	GW01	EP071: C10 - C14 Fraction	----	200 µg/L	85.9	70.0	130
		EP071: C15 - C28 Fraction	----	250 µg/L	106	71.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5187969) - continued							
EP2309684-001	GW01	EP071: C29 - C36 Fraction	----	200 µg/L	85.2	67.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 5193292)							
EP2309684-001	GW01	EP080: C6 - C9 Fraction	----	325 µg/L	79.5	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5187969)							
EP2309684-001	GW01	EP071: >C10 - C16 Fraction	----	250 µg/L	76.8	70.0	130
		EP071: >C16 - C34 Fraction	----	350 µg/L	89.9	75.0	130
		EP071: >C34 - C40 Fraction	----	150 µg/L	91.0	67.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 5193292)							
EP2309684-001	GW01	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	79.2	70.0	130
EP080: BTEXN (QCLot: 5193292)							
EP2309684-001	GW01	EP080: Benzene	71-43-2	25 µg/L	79.3	70.0	130
		EP080: Toluene	108-88-3	25 µg/L	88.9	70.0	130
		EP080: Ethylbenzene	100-41-4	25 µg/L	97.7	70.0	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	25 µg/L	107	70.0	130
		EP080: ortho-Xylene	95-47-6	25 µg/L	106	70.0	130
		EP080: Naphthalene	91-20-3	25 µg/L	107	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP2309684**	Page	: 1 of 14
Client	: **WESTERN ENVIRONMENTAL P/L**	Laboratory	: Environmental Division Perth
Contact	: ROBIN A	Telephone	: +61-8-9406 1301
Project	: 22.142	Date Samples Received	: 19-Jul-2023
Site	: ----	Issue Date	: 31-Jul-2023
Sampler	: ----	No. of samples received	: 8
Order number	: 22.142	No. of samples analysed	: 8

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **Laboratory Control outliers exist - please see following pages for full details.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **Surrogate recovery outliers exist for all regular sample matrices - please see following pages for full details.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Laboratory Control Spike (LCS) Recoveries							
EP074D: Fumigants	QC-5193293-002	----	**1.2-Dibromoethane (EDB)**	106-93-4	118 %	69.0-117%	**Recovery greater than upper control limit**
Matrix Spike (MS) Recoveries							
EK055G: Ammonia as N by Discrete Analyser	EP2309695--001	Anonymous	**Ammonia as N**	7664-41-7	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Ar	EP2309695--001	Anonymous	**Nitrite + Nitrate as N**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Regular Sample Surrogates

Sub-Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP074S: VOC Surrogates	EP2309684-006	RINSATE	**4-Bromofluorobenzene**	460-00-4	80.5 %	80.8-124 %	**Recovery less than lower data quality objective**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)		Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural							
GW01,	GW02,	----	----	----	22-Jul-2023	19-Jul-2023	**3**
GW03,	GW04,						
DUP_01,	RINSATE						

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural (EA005-P)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE	**19-Jul-2023**	**----**	----	----	**22-Jul-2023**	19-Jul-2023	×
EA010P: Conductivity by PC Titrator							
Clear Plastic Bottle - Natural (EA010-P)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE	**19-Jul-2023**	**----**	----	----	**22-Jul-2023**	16-Aug-2023	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE	**19-Jul-2023**	**----**	----	----	**22-Jul-2023**	02-Aug-2023	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE	**19-Jul-2023**	**----**	----	----	**19-Jul-2023**	16-Aug-2023	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE	**19-Jul-2023**	**----**	----	----	**19-Jul-2023**	16-Aug-2023	✓
ED093F: Dissolved Major Cations							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE	**19-Jul-2023**	**----**	----	----	**27-Jul-2023**	16-Aug-2023	✓
EG020F: Dissolved Metals by ICP-MS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG020A-F)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**----**	----	----	**27-Jul-2023**	15-Jan-2024	✓
EG035F: Dissolved Mercury by FIMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**----**	----	----	**27-Jul-2023**	16-Aug-2023	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE	**19-Jul-2023**	**----**	----	----	**19-Jul-2023**	16-Aug-2023	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE	**19-Jul-2023**	**----**	----	----	**19-Jul-2023**	21-Jul-2023	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE	**19-Jul-2023**	**----**	----	----	**19-Jul-2023**	16-Aug-2023	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE	**19-Jul-2023**	**27-Jul-2023**	16-Aug-2023	✓	**27-Jul-2023**	16-Aug-2023	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE	**19-Jul-2023**	**27-Jul-2023**	16-Aug-2023	✓	**27-Jul-2023**	16-Aug-2023	✓
EK071G: Reactive Phosphorus as P by discrete analyser							
Clear Plastic Bottle - Natural (EK071G)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE	**19-Jul-2023**	**----**	----	----	**19-Jul-2023**	21-Jul-2023	✓
EP030: Biochemical Oxygen Demand (BOD)							
Clear Plastic Bottle - Natural (EP030)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE	**19-Jul-2023**	**----**	----	----	**21-Jul-2023**	21-Jul-2023	✓
EP074A: Monocyclic Aromatic Hydrocarbons							
Amber VOC Vial - Sulfuric Acid (EP074)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**26-Jul-2023**	02-Aug-2023	✓	**26-Jul-2023**	02-Aug-2023	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP074B: Oxygenated Compounds							
Amber VOC Vial - Sulfuric Acid (EP074)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**26-Jul-2023**	02-Aug-2023	✓	**26-Jul-2023**	02-Aug-2023	✓
EP074C: Sulfonated Compounds							
Amber VOC Vial - Sulfuric Acid (EP074)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**26-Jul-2023**	02-Aug-2023	✓	**26-Jul-2023**	02-Aug-2023	✓
EP074D: Fumigants							
Amber VOC Vial - Sulfuric Acid (EP074)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**26-Jul-2023**	02-Aug-2023	✓	**26-Jul-2023**	02-Aug-2023	✓
EP074E: Halogenated Aliphatic Compounds							
Amber VOC Vial - Sulfuric Acid (EP074)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**26-Jul-2023**	02-Aug-2023	✓	**26-Jul-2023**	02-Aug-2023	✓
EP074F: Halogenated Aromatic Compounds							
Amber VOC Vial - Sulfuric Acid (EP074)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**26-Jul-2023**	02-Aug-2023	✓	**26-Jul-2023**	02-Aug-2023	✓
EP074G: Trihalomethanes							
Amber VOC Vial - Sulfuric Acid (EP074)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**26-Jul-2023**	02-Aug-2023	✓	**26-Jul-2023**	02-Aug-2023	✓
EP074L: Fuel Oxygenates							
Amber VOC Vial - Sulfuric Acid (EP074L)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**26-Jul-2023**	02-Aug-2023	✓	**26-Jul-2023**	02-Aug-2023	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075A: Phenolic Compounds							
Amber Glass Bottle - Unpreserved (EP075) GW01, GW03	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**28-Jul-2023**	03-Sep-2023	✓
Amber Glass Bottle - Unpreserved (EP075) GW02, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**29-Jul-2023**	03-Sep-2023	✓
EP075B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075) GW01, GW03	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**28-Jul-2023**	03-Sep-2023	✓
Amber Glass Bottle - Unpreserved (EP075) GW02, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**29-Jul-2023**	03-Sep-2023	✓
EP075C: Phthalate Esters							
Amber Glass Bottle - Unpreserved (EP075) GW01, GW03	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**28-Jul-2023**	03-Sep-2023	✓
Amber Glass Bottle - Unpreserved (EP075) GW02, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**29-Jul-2023**	03-Sep-2023	✓
EP075D: Nitrosamines							
Amber Glass Bottle - Unpreserved (EP075) GW01, GW03	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**28-Jul-2023**	03-Sep-2023	✓
Amber Glass Bottle - Unpreserved (EP075) GW02, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**29-Jul-2023**	03-Sep-2023	✓
EP075E: Nitroaromatics and Ketones							
Amber Glass Bottle - Unpreserved (EP075) GW01, GW03	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**28-Jul-2023**	03-Sep-2023	✓
Amber Glass Bottle - Unpreserved (EP075) GW02, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**29-Jul-2023**	03-Sep-2023	✓
EP075F: Haloethers							
Amber Glass Bottle - Unpreserved (EP075) GW01, GW03	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**28-Jul-2023**	03-Sep-2023	✓
Amber Glass Bottle - Unpreserved (EP075) GW02, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**29-Jul-2023**	03-Sep-2023	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075G: Chlorinated Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075) GW01, GW03	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**28-Jul-2023**	03-Sep-2023	✓
Amber Glass Bottle - Unpreserved (EP075) GW02, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**29-Jul-2023**	03-Sep-2023	✓
EP075H: Anilines and Benzidines							
Amber Glass Bottle - Unpreserved (EP075) GW01, GW03	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**28-Jul-2023**	03-Sep-2023	✓
Amber Glass Bottle - Unpreserved (EP075) GW02, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**29-Jul-2023**	03-Sep-2023	✓
EP075I: Organochlorine Pesticides							
Amber Glass Bottle - Unpreserved (EP075) GW01, GW03	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**28-Jul-2023**	03-Sep-2023	✓
Amber Glass Bottle - Unpreserved (EP075) GW02, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**29-Jul-2023**	03-Sep-2023	✓
EP075J: Organophosphorus Pesticides							
Amber Glass Bottle - Unpreserved (EP075) GW01, GW03	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**28-Jul-2023**	03-Sep-2023	✓
Amber Glass Bottle - Unpreserved (EP075) GW02, GW04, DUP_01, RINSATE, FB_TB	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**29-Jul-2023**	03-Sep-2023	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP071) GW01, GW02, GW03, GW04, DUP_01, RINSATE	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**28-Jul-2023**	03-Sep-2023	✓
Amber VOC Vial - Sulfuric Acid (EP080) GW01, GW02, GW03, GW04, DUP_01, RINSATE, TBW 922	**19-Jul-2023**	**26-Jul-2023**	02-Aug-2023	✓	**26-Jul-2023**	02-Aug-2023	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Amber Glass Bottle - Unpreserved (EP071)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE	**19-Jul-2023**	**25-Jul-2023**	26-Jul-2023	✓	**28-Jul-2023**	03-Sep-2023	✓
Amber VOC Vial - Sulfuric Acid (EP080)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE, TBW 922	**19-Jul-2023**	**26-Jul-2023**	02-Aug-2023	✓	**26-Jul-2023**	02-Aug-2023	✓
EP080: BTEXN							
Amber VOC Vial - Sulfuric Acid (EP080)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE, TBW 922	**19-Jul-2023**	**26-Jul-2023**	02-Aug-2023	✓	**26-Jul-2023**	02-Aug-2023	✓
MW006: Faecal Coliforms & E.coli by MF							
Sterile Plastic Bottle - Sodium Thiosulfate (MW006)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE	**19-Jul-2023**	**----**	----	----	**19-Jul-2023**	20-Jul-2023	✓
MW007: Coliforms by MF							
Sterile Plastic Bottle - Sodium Thiosulfate (MW007)							
GW01, GW02, GW03, GW04, DUP_01, RINSATE	**19-Jul-2023**	**----**	----	----	**19-Jul-2023**	20-Jul-2023	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by Auto Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	11	**18.18**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fuel Oxygenates	EP074L	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by Auto Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by Auto Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fuel Oxygenates	EP074L	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by Auto Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Control Samples (LCS) - Continued							
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Alkalinity by Auto Titrator	ED037-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fuel Oxygenates	EP074L	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fuel Oxygenates	EP074L	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Matrix Spikes (MS) - Continued							
Volatile Organic Compounds	EP074	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH by Auto Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM Schedule B(3)
Conductivity by Auto Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)
Alkalinity by Auto Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm.
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Organic Nitrogen as N (TKN - NH3) (discrete analyser)	EK060G	WATER	In house: Referenced to APHA 4500-Norg/4500-NH3. This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Reactive Phosphorus as P-By Discrete Analyser	EK071G	WATER	In house: Referenced to APHA 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)
Biochemical Oxygen Demand (BOD)	EP030	WATER	In house: Referenced to APHA 5210 B. The 5-Day BOD test provides an empirical measure of the oxygen consumption capacity of a given water. A portion of the sample is diluted into oxygenated, nutrient rich water, and a seed added to begin biological decay. The initial dissolved oxygen content is measured, then the bottle is sealed and incubated for five days. The remaining dissolved oxygen is measured, and from the difference, the demand for oxygen, by biological decay, is determined. This method is compliant with NEPM Schedule B(3).
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM Schedule B(3)
Volatile Organic Compounds	EP074	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
Fuel Oxygenates	EP074L	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
Semivolatile Organic Compounds	EP075	WATER	In house: Referenced to USEPA SW 846 - 8270 Sample extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Thermotolerant Coliforms & E.coli by Membrane Filtration	MW006	WATER	AS 4276.7
Coliforms by Membrane Filtration	MW007	WATER	AS 4276.5

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.

CHAIN OF CUSTODY RECORD

WESTERN ENVIRONMENTAL

Company Name : WESTERN ENVIRONMENTAL PTY LTD	Contact Name : Napolean Kwa	Purchase Order : 22.142	CoC Number : 2733
Office Address : Unit 5 162 Colin Street, West Perth, WA 6005	Project Manager : Robin Anderson	Project Number : 22.142	Quote ID : 190301WES
Laboratory Address : Eurofins ARL, 46 - 48 Banksia Road, Welshpool WA 6106, Contact: Douglas Todd (Lab Manager), +61 (0)8 6253 4444, Email: douglastodd@arlwa.com.au	Email for results: napolean.k@westenv.com.au	CC: robin.a@westenv.com.au ESdat_AU+WestEnvWA@ESdatLabSync.net	Courier Consignment # :

Special Directions & Comments :

#	Sample ID	Sample Date	Matrix	M8 : Metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg)	SVV : SVOC, VOC	B19E : Nutrients : Total N, TKN, NOX, NO2, NO3, NH3, Total P, Reactive P	MTBE	B11D : Cation Suite : Na, K, Ca, Mg + Hardness	B11E : Anion Suite : Cl, SO4, Alkalinity (CO3, HCO3, OH-, Total Alkalinity)	pH	Conductivity	Organic nitrogen	MIC1 : Coliforms, E.Coli, TPC	TRH C6-C40	Container: ACM bag	0.5 L Blue plastic	Black MB plastic	100ml Green Plastic	100ml Purple Plastic	VIAL	Purple Amber (glass)	Glass Jar
1	TRIP01	19/07/2023	Water	X	X	X	X	X	X	X	X	X	X	X								
2																						
3																						
4																						
5																						
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13																						
14																						
15																						

Relinquished By: Napolean Kwa	Received By: M. Bowen	Turn around Time : 5 Days	Method Of Shipment :
Date & Time : 19/07/2023	Date & Time : 19/7/23 15:00		Courier
Signature: N.K	Signature:	Comments : 7.0	Hand Delivered
	Report Number :		Postal

1009258

Western Environmental Pty Ltd
Unit 5, 162 Colin St
West Perth
WA 6005

NATA Accredited
Accreditation Number 2377
Site Number 2370

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Napolean Kwa**

Report **1009258-W**
Project name
Project ID 22.142
Received Date Jul 19, 2023

Client Sample ID			**TRIP01**
Sample Matrix			**Water**
Eurofins Sample No.			**L23-JI0040382**
Date Sampled			**Jul 19, 2023**
Test/Reference	LOR	Unit	
Total Recoverable Hydrocarbons - 1999 NEPM Fractions			
TRH C6-C9	0.02	mg/L	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1
TRH C10-C36 (Total)	0.1	mg/L	< 0.1
BTEX			
Benzene	0.001	mg/L	< 0.001
Toluene	0.001	mg/L	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002
o-Xylene	0.001	mg/L	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003
BTEX			
4-Bromofluorobenzene (surr.)	1	%	88
Volatile Organics			
1.1-Dichloroethane	0.001	mg/L	< 0.001
Methyl-tert-Butyl Ether	0.001	mg/L	< 0.001
1.1-Dichloroethene	0.001	mg/L	< 0.001
1.1.1-Trichloroethane	0.001	mg/L	< 0.001
1.1.1.2-Tetrachloroethane	0.001	mg/L	< 0.001
1.1.2-Trichloroethane	0.001	mg/L	< 0.001
1.1.2.2-Tetrachloroethane	0.001	mg/L	< 0.001
1.2-Dibromoethane	0.001	mg/L	< 0.001
1.2-Dichlorobenzene	0.001	mg/L	< 0.001
1.2-Dichloroethane	0.001	mg/L	< 0.001
1.2-Dichloropropane	0.001	mg/L	< 0.001
1.2.3-Trichloropropane	0.001	mg/L	< 0.001
1.2.4-Trimethylbenzene	0.001	mg/L	< 0.001
1.3-Dichlorobenzene	0.001	mg/L	< 0.001
1.3-Dichloropropane	0.001	mg/L	< 0.001
1.3.5-Trimethylbenzene	0.001	mg/L	< 0.001
1.4-Dichlorobenzene	0.001	mg/L	< 0.001
2-Butanone (MEK)	0.005	mg/L	< 0.005
2-Propanone (Acetone)	0.005	mg/L	< 0.005
4-Chlorotoluene	0.001	mg/L	< 0.001

Client Sample ID			TRIP01
Sample Matrix			Water
Eurofins Sample No.			L23-JI0040382
Date Sampled			Jul 19, 2023
Test/Reference	LOR	Unit	
Volatile Organics			
4-Methyl-2-pentanone (MIBK)	0.005	mg/L	< 0.005
Allyl chloride	0.001	mg/L	< 0.001
Bromobenzene	0.001	mg/L	< 0.001
Bromochloromethane	0.001	mg/L	< 0.001
Bromodichloromethane	0.001	mg/L	< 0.001
Bromoform	0.001	mg/L	< 0.001
Bromomethane	0.005	mg/L	< 0.005
Carbon disulfide	0.001	mg/L	< 0.001
Carbon Tetrachloride	0.001	mg/L	< 0.001
Chlorobenzene	0.001	mg/L	< 0.001
Chloroethane	0.005	mg/L	< 0.005
Chloroform	0.005	mg/L	< 0.005
Chloromethane	0.005	mg/L	< 0.005
cis-1.2-Dichloroethene	0.001	mg/L	< 0.001
cis-1.3-Dichloropropene	0.001	mg/L	< 0.001
Dibromochloromethane	0.001	mg/L	< 0.001
Dibromomethane	0.001	mg/L	< 0.001
Dichlorodifluoromethane	0.005	mg/L	< 0.005
Iodomethane	0.001	mg/L	< 0.001
Isopropyl benzene (Cumene)	0.001	mg/L	< 0.001
Methylene Chloride	0.005	mg/L	< 0.005
Styrene	0.001	mg/L	< 0.001
Tetrachloroethene	0.001	mg/L	< 0.001
trans-1.2-Dichloroethene	0.001	mg/L	< 0.001
trans-1.3-Dichloropropene	0.001	mg/L	< 0.001
Trichloroethene	0.001	mg/L	< 0.001
Trichlorofluoromethane	0.005	mg/L	< 0.005
Vinyl chloride	0.005	mg/L	< 0.005
Total MAH*	0.003	mg/L	< 0.003
Vic EPA IWRG 621 CHC (Total)*	0.005	mg/L	< 0.005
Vic EPA IWRG 621 Other CHC (Total)*	0.005	mg/L	< 0.005
4-Bromofluorobenzene (surr.)	1	%	88
Toluene-d8 (surr.)	1	%	95
Total Recoverable Hydrocarbons - 2013 NEPM Fractions			
Naphthalene[N02]	0.01	mg/L	< 0.01
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	< 0.05
TRH C6-C10	0.02	mg/L	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02
Total Recoverable Hydrocarbons - 2013 NEPM Fractions			
TRH >C10-C16	0.05	mg/L	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1
Semivolatile Organics			
Aldrin and Dieldrin (Total)*	0.0001	mg/L	< 0.005
DDT + DDE + DDD (Total)*	0.0001	mg/L	< 0.005
Total PAH*	0.001	mg/L	< 0.001
2-Methyl-4.6-dinitrophenol	0.03	mg/L	< 0.03
1-Chloronaphthalene	0.005	mg/L	< 0.005

Client Sample ID			TRIP01
Sample Matrix			Water
Eurofins Sample No.			L23-JI0040382
Date Sampled			Jul 19, 2023
Test/Reference	LOR	Unit	
Semivolatile Organics			
1-Naphthylamine	0.005	mg/L	< 0.005
1.2-Dichlorobenzene	0.005	mg/L	< 0.005
1.2.3-Trichlorobenzene	0.005	mg/L	< 0.005
1.2.3.4-Tetrachlorobenzene	0.005	mg/L	< 0.005
1.2.3.5-Tetrachlorobenzene	0.005	mg/L	< 0.005
1.2.4-Trichlorobenzene	0.005	mg/L	< 0.005
1.2.4.5-Tetrachlorobenzene	0.005	mg/L	< 0.005
1.3-Dichlorobenzene	0.005	mg/L	< 0.005
1.3.5-Trichlorobenzene	0.005	mg/L	< 0.005
1.4-Dichlorobenzene	0.005	mg/L	< 0.005
2-Chloronaphthalene	0.005	mg/L	< 0.005
2-Chlorophenol	0.003	mg/L	< 0.003
2-Fluorobiphenyl (surr.)	1	%	60
2-Methylnaphthalene	0.005	mg/L	< 0.005
2-Methylphenol (o-Cresol)	0.003	mg/L	< 0.003
2-Naphthylamine	0.005	mg/L	< 0.005
2-Nitroaniline	0.005	mg/L	< 0.005
2-Nitrophenol	0.01	mg/L	< 0.01
2-Picoline	0.005	mg/L	< 0.005
2.3.4.6-Tetrachlorophenol	0.01	mg/L	< 0.01
2.4-Dichlorophenol	0.003	mg/L	< 0.003
2.4-Dimethylphenol	0.003	mg/L	< 0.003
2.4-Dinitrophenol	0.03	mg/L	< 0.03
2.4-Dinitrotoluene	0.005	mg/L	< 0.005
2.4.5-Trichlorophenol	0.01	mg/L	< 0.01
2.4.6-Tribromophenol (surr.)	1	%	39
2.4.6-Trichlorophenol	0.01	mg/L	< 0.01
2.6-Dichlorophenol	0.003	mg/L	< 0.003
2.6-Dinitrotoluene	0.005	mg/L	< 0.005
3&4-Methylphenol (m&p-Cresol)	0.006	mg/L	< 0.006
3-Methylcholanthrene	0.005	mg/L	< 0.005
3.3'-Dichlorobenzidine	0.005	mg/L	< 0.005
4-Aminobiphenyl	0.005	mg/L	< 0.005
4-Bromophenyl phenyl ether	0.005	mg/L	< 0.005
4-Chloro-3-methylphenol	0.01	mg/L	< 0.01
4-Chlorophenyl phenyl ether	0.005	mg/L	< 0.005
4-Nitrophenol	0.03	mg/L	< 0.03
4.4'-DDD	0.005	mg/L	< 0.005
4.4'-DDE	0.005	mg/L	< 0.005
4.4'-DDT	0.005	mg/L	< 0.005
7.12-Dimethylbenz(a)anthracene	0.005	mg/L	< 0.005
a-HCH	0.005	mg/L	< 0.005
Acenaphthene	0.001	mg/L	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001
Acetophenone	0.005	mg/L	< 0.005
Aldrin	0.005	mg/L	< 0.005
Aniline	0.005	mg/L	< 0.005
Anthracene	0.001	mg/L	< 0.001
b-HCH	0.005	mg/L	< 0.005

Client Sample ID			TRIP01
Sample Matrix			Water
Eurofins Sample No.			L23-JI0040382
Date Sampled			Jul 19, 2023
Test/Reference	LOR	Unit	
Semivolatile Organics			
Benz(a)anthracene	0.001	mg/L	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001
Benzyl chloride	0.005	mg/L	< 0.005
Bis(2-chloroethoxy)methane	0.005	mg/L	< 0.005
Bis(2-chloroisopropyl)ether	0.005	mg/L	< 0.005
Bis(2-ethylhexyl)phthalate	0.005	mg/L	< 0.005
Butyl benzyl phthalate	0.005	mg/L	< 0.005
Chrysene	0.001	mg/L	< 0.001
d-HCH	0.005	mg/L	< 0.005
Di-n-butyl phthalate	0.005	mg/L	< 0.005
Di-n-octyl phthalate	0.005	mg/L	< 0.005
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001
Dibenz(a.j)acridine	0.005	mg/L	< 0.005
Dibenzofuran	0.005	mg/L	< 0.005
Dieldrin	0.005	mg/L	< 0.005
Diethyl phthalate	0.005	mg/L	< 0.005
Dimethyl phthalate	0.005	mg/L	< 0.005
Dimethylaminoazobenzene	0.005	mg/L	< 0.005
Diphenylamine	0.005	mg/L	< 0.005
Endosulfan I	0.005	mg/L	< 0.005
Endosulfan II	0.005	mg/L	< 0.005
Endosulfan sulphate	0.005	mg/L	< 0.005
Endrin	0.005	mg/L	< 0.005
Endrin aldehyde	0.005	mg/L	< 0.005
Endrin ketone	0.005	mg/L	< 0.005
Fluoranthene	0.001	mg/L	< 0.001
Fluorene	0.001	mg/L	< 0.001
g-HCH (Lindane)	0.005	mg/L	< 0.005
Heptachlor	0.005	mg/L	< 0.005
Heptachlor epoxide	0.005	mg/L	< 0.005
Hexachlorobenzene	0.005	mg/L	< 0.005
Hexachlorobutadiene	0.005	mg/L	< 0.005
Hexachlorocyclopentadiene	0.005	mg/L	< 0.005
Hexachloroethane	0.005	mg/L	< 0.005
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001
Methoxychlor	0.005	mg/L	< 0.005
N-Nitrosodibutylamine	0.005	mg/L	< 0.005
N-Nitrosodipropylamine	0.005	mg/L	< 0.005
N-Nitrosopiperidine	0.005	mg/L	< 0.005
Naphthalene	0.001	mg/L	< 0.001
Nitrobenzene	0.05	mg/L	< 0.05
Nitrobenzene-d5 (surr.)	1	%	60
Pentachlorobenzene	0.005	mg/L	< 0.005
Pentachloronitrobenzene	0.005	mg/L	< 0.005
Pentachlorophenol	0.01	mg/L	< 0.01
Phenanthrene	0.001	mg/L	< 0.001

Client Sample ID			TRIP01
Sample Matrix			Water
Eurofins Sample No.			L23-JI0040382
Date Sampled			Jul 19, 2023
Test/Reference	LOR	Unit	
Semivolatile Organics			
Phenol	0.003	mg/L	< 0.003
Phenol-d6 (surr.)	1	%	26
Pronamide	0.005	mg/L	< 0.005
Pyrene	0.001	mg/L	< 0.001
Trifluralin	0.005	mg/L	< 0.005
Alkalinity	5	mg CaCO3/L	51
Ammonia-N	0.02	mg/L	0.05
Bicarbonate	5	mg CaCO3/L	51
Carbonate	5	mg CaCO3/L	< 5
Chloride	5	mg/L	160
Conductivity	10	uS/cm	800
Filterable Reactive Phosphorus	0.01	mg/L	0.11
Hydroxide	5	mg CaCO3/L	< 5
Nitrate-N	0.01	mg/L	8.1
Nitrite-N	0.01	mg/L	0.02
NOx-N	0.01	mg/L	8.2
Organic Nitrogen	0.2	mg/L	-
pH	0.1	pH Units	7.0
Sulfate	1	mg/L	72
Total Kjeldahl Nitrogen	0.2	mg/L	-
Total Nitrogen	0.2	mg/L	6.5
Total Phosphorus	0.01	mg/L	0.02
Hardness mg equivalent CaCO3/L	5	mg/L	91
Alkali Metals			
Calcium	0.5	mg/L	15
Magnesium	0.5	mg/L	13
Potassium	0.5	mg/L	6.0
Sodium	0.5	mg/L	120
Heavy Metals			
Arsenic (filtered)	0.001	mg/L	< 0.001
Cadmium (filtered)	0.0001	mg/L	< 0.0001
Chromium (filtered)	0.001	mg/L	< 0.001
Copper (filtered)	0.001	mg/L	< 0.001
Lead (filtered)	0.001	mg/L	< 0.001
Mercury (filtered)	0.0001	mg/L	< 0.0001
Nickel (filtered)	0.001	mg/L	0.002
Zinc (filtered)	0.005	mg/L	0.013
Microbiology			
Heterotrophic Plate Count 37°C[N19]	1	CFU/mL	51000
Total Coliforms[N19]	1	CFU/100mL	33
E. Coli[N19]	1	CFU/100mL	< 1

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Eurofins Suite B1			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Jul 21, 2023	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Melbourne	Jul 21, 2023	14 Days
- Method: LTM-ORG-2010 BTEX and Volatile TRH			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Jul 21, 2023	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Jul 21, 2023	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Volatile Organics	Melbourne	Jul 21, 2023	7 Days
- Method: LTM-ORG-2150 VOCs in Soils Liquid and other Aqueous Matrices (USEPA 8260)			
Semivolatile Organics	Melbourne	Jul 27, 2023	7 Days
- Method: USEPA SW 846 8270			
Conductivity	Welshpool	Jul 20, 2023	28 Days
- Method: ARL019 - Conductivity and Salinity in Water			
pH	Welshpool	Jul 20, 2023	1 Day
- Method: ARL014 - pH in Water			
Metals M8 filtered	Welshpool	Jul 20, 2023	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Alkalinity	Welshpool	Jul 20, 2023	14 Days
- Method: ARL037 - Alkalinity in Water			
Bicarbonate	Welshpool	Jul 20, 2023	14 Days
- Method: ARL037 - Alkalinity in Water			
Carbonate	Welshpool	Jul 20, 2023	14 Days
- Method: ARL037 - Alkalinity in Water			
Hydroxide	Welshpool	Jul 20, 2023	14 Day
- Method: ARL037 - Alkalinity in Water			
Ammonia-N	Welshpool	Jul 20, 2023	28 Days
- Method: ARL303 - Ammonia in Water by Discrete Analyser			
Filterable Reactive Phosphorus	Welshpool	Jul 20, 2023	28 Days
- Method: ARL309 - Filterable Reactive Phosphorus in Water by Discrete Analyser			
Nitrate-N	Welshpool	Jul 20, 2023	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Nitrite-N	Welshpool	Jul 20, 2023	2 Days
- Method: ARL311 - Nitrite in Water by Discrete Analyser			
NOx-N	Welshpool	Jul 20, 2023	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Total Kjeldahl Nitrogen	Welshpool	Jul 19, 2023	28 Day
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Nitrogen	Welshpool	Jul 20, 2023	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Phosphorus	Welshpool	Jul 20, 2023	28 Days
- Method: ARL308 - Total Phosphorus in Water by Discrete Analyser			
Chloride	Welshpool	Jul 20, 2023	28 Days
- Method: ARL305 - Chloride in Water by Discrete Analyser			
Sulfate	Welshpool	Jul 20, 2023	28 Days
- Method: ARL301 - Sulfate in Water by Discrete Analyser			
Eurofins Suite B11D: Na/K/Ca/Mg and Hardness			
Hardness mg equivalent CaCO3/L	Welshpool	Jul 20, 2023	28 Months
- Method: APHA 2340B Hardness by Calculation			
Alkali Metals	Welshpool	Jul 20, 2023	6 Months
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			

eurofins

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Address: Unit 5, 162 Colin St
West Perth
WA 6005

Project Name:
Project ID: 22.142

Order No.: 22.142
Report #: 1009258
Phone: 08 6162 8980
Fax:

Received: Jul 19, 2023 3:00 PM
Due: Jul 26, 2023
Priority: 5 Day
Contact Name: Napolean Kwa

Eurofins Analytical Services Manager : Andrew Harvey

Sample Detail						Conductivity	E. Coli	Heterotrophic Plate Count 37°C	pH	Total Coliforms	Metals M8 filtered	Eurofins Suite B1	Eurofins Suite SVV: SVOC/VOC	Eurofins Suite B11D: Na/K/Ca/Mg and Hardness	Eurofins Suite B19E	Eurofins Suite B11E
Perth Laboratory - NATA # 2377 Site # 2370						X			X		X			X	X	X
Melbourne Laboratory - NATA # 1261 Site # 1254												X	X			
External Laboratory							X	X		X						
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**											
1	TRIP01	Jul 19, 2023		Water	L23-Jl0040382	X	X	X	X	X	X	X	X	X	X	X
Test Counts						1	1	1	1	1	1	1	1	1	1	1

eurofins | Environment Testing

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/ g: milligrams per kilogram
mg/L: milligrams per litre
g/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method lan	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPI E	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
T TO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
TRH C10-C14	mg/L	< 0.05			0.05	Pass	
TRH C15-C28	mg/L	< 0.1			0.1	Pass	
TRH C29-C36	mg/L	< 0.1			0.1	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total*	mg/L	< 0.003			0.003	Pass	
Method Blank							
Volatile Organics							
1.1-Dichloroethane	mg/L	< 0.001			0.001	Pass	
Methyl-tert-Butyl Ether	mg/L	< 0.001			0.001	Pass	
1.1-Dichloroethene	mg/L	< 0.001			0.001	Pass	
1.1.1-Trichloroethane	mg/L	< 0.001			0.001	Pass	
1.1.1.2-Tetrachloroethane	mg/L	< 0.001			0.001	Pass	
1.1.2-Trichloroethane	mg/L	< 0.001			0.001	Pass	
1.1.2.2-Tetrachloroethane	mg/L	< 0.001			0.001	Pass	
1.2-Dibromoethane	mg/L	< 0.001			0.001	Pass	
1.2-Dichlorobenzene	mg/L	< 0.001			0.001	Pass	
1.2-Dichloroethane	mg/L	< 0.001			0.001	Pass	
1.2-Dichloropropane	mg/L	< 0.001			0.001	Pass	
1.2.3-Trichloropropane	mg/L	< 0.001			0.001	Pass	
1.2.4-Trimethylbenzene	mg/L	< 0.001			0.001	Pass	
1.3-Dichlorobenzene	mg/L	< 0.001			0.001	Pass	
1.3-Dichloropropane	mg/L	< 0.001			0.001	Pass	
1.3.5-Trimethylbenzene	mg/L	< 0.001			0.001	Pass	
1.4-Dichlorobenzene	mg/L	< 0.001			0.001	Pass	
2-Butanone (MEK)	mg/L	< 0.005			0.005	Pass	
2-Propanone (Acetone)	mg/L	< 0.005			0.005	Pass	
4-Chlorotoluene	mg/L	< 0.001			0.001	Pass	
4-Methyl-2-pentanone (MIBK)	mg/L	< 0.005			0.005	Pass	
Allyl chloride	mg/L	< 0.001			0.001	Pass	
Bromobenzene	mg/L	< 0.001			0.001	Pass	
Bromochloromethane	mg/L	< 0.001			0.001	Pass	
Bromodichloromethane	mg/L	< 0.001			0.001	Pass	
Bromoform	mg/L	< 0.001			0.001	Pass	
Bromomethane	mg/L	< 0.005			0.005	Pass	
Carbon disulfide	mg/L	< 0.001			0.001	Pass	
Carbon Tetrachloride	mg/L	< 0.001			0.001	Pass	
Chlorobenzene	mg/L	< 0.001			0.001	Pass	
Chloroethane	mg/L	< 0.005			0.005	Pass	
Chloroform	mg/L	< 0.005			0.005	Pass	
Chloromethane	mg/L	< 0.005			0.005	Pass	
cis-1.2-Dichloroethene	mg/L	< 0.001			0.001	Pass	
cis-1.3-Dichloropropene	mg/L	< 0.001			0.001	Pass	
Dibromochloromethane	mg/L	< 0.001			0.001	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Dibromomethane	mg/L	< 0.001			0.001	Pass	
Dichlorodifluoromethane	mg/L	< 0.005			0.005	Pass	
Iodomethane	mg/L	< 0.001			0.001	Pass	
Isopropyl benzene (Cumene)	mg/L	< 0.001			0.001	Pass	
Methylene Chloride	mg/L	< 0.005			0.005	Pass	
Styrene	mg/L	< 0.001			0.001	Pass	
Tetrachloroethene	mg/L	< 0.001			0.001	Pass	
trans-1.2-Dichloroethene	mg/L	< 0.001			0.001	Pass	
trans-1.3-Dichloropropene	mg/L	< 0.001			0.001	Pass	
Trichloroethene	mg/L	< 0.001			0.001	Pass	
Trichlorofluoromethane	mg/L	< 0.005			0.005	Pass	
Vinyl chloride	mg/L	< 0.005			0.005	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/L	< 0.01			0.01	Pass	
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	mg/L	< 0.05			0.05	Pass	
TRH >C16-C34	mg/L	< 0.1			0.1	Pass	
TRH >C34-C40	mg/L	< 0.1			0.1	Pass	
Method Blank							
Semivolatile Organics							
2-Methyl-4.6-dinitrophenol	mg/L	< 0.03			0.03	Pass	
1-Chloronaphthalene	mg/L	< 0.005			0.005	Pass	
1-Naphthylamine	mg/L	< 0.005			0.005	Pass	
1.2-Dichlorobenzene	mg/L	< 0.005			0.005	Pass	
1.2.3-Trichlorobenzene	mg/L	< 0.005			0.005	Pass	
1.2.3.4-Tetrachlorobenzene	mg/L	< 0.005			0.005	Pass	
1.2.3.5-Tetrachlorobenzene	mg/L	< 0.005			0.005	Pass	
1.2.4-Trichlorobenzene	mg/L	< 0.005			0.005	Pass	
1.2.4.5-Tetrachlorobenzene	mg/L	< 0.005			0.005	Pass	
1.3-Dichlorobenzene	mg/L	< 0.005			0.005	Pass	
1.3.5-Trichlorobenzene	mg/L	< 0.005			0.005	Pass	
1.4-Dichlorobenzene	mg/L	< 0.005			0.005	Pass	
2-Chloronaphthalene	mg/L	< 0.005			0.005	Pass	
2-Chlorophenol	mg/L	< 0.003			0.003	Pass	
2-Methylnaphthalene	mg/L	< 0.005			0.005	Pass	
2-Methylphenol (o-Cresol)	mg/L	< 0.003			0.003	Pass	
2-Naphthylamine	mg/L	< 0.005			0.005	Pass	
2-Nitroaniline	mg/L	< 0.005			0.005	Pass	
2-Nitrophenol	mg/L	< 0.01			0.01	Pass	
2-Picoline	mg/L	< 0.005			0.005	Pass	
2.3.4.6-Tetrachlorophenol	mg/L	< 0.01			0.01	Pass	
2.4-Dichlorophenol	mg/L	< 0.003			0.003	Pass	
2.4-Dimethylphenol	mg/L	< 0.003			0.003	Pass	
2.4-Dinitrophenol	mg/L	< 0.03			0.03	Pass	
2.4-Dinitrotoluene	mg/L	< 0.005			0.005	Pass	
2.4.5-Trichlorophenol	mg/L	< 0.01			0.01	Pass	
2.4.6-Trichlorophenol	mg/L	< 0.01			0.01	Pass	
2.6-Dichlorophenol	mg/L	< 0.003			0.003	Pass	
2.6-Dinitrotoluene	mg/L	< 0.005			0.005	Pass	
3&4-Methylphenol (m&p-Cresol)	mg/L	< 0.006			0.006	Pass	
3-Methylcholanthrene	mg/L	< 0.005			0.005	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
3.3'-Dichlorobenzidine	mg/L	< 0.005			0.005	Pass	
4-Aminobiphenyl	mg/L	< 0.005			0.005	Pass	
4-Bromophenyl phenyl ether	mg/L	< 0.005			0.005	Pass	
4-Chloro-3-methylphenol	mg/L	< 0.01			0.01	Pass	
4-Chlorophenyl phenyl ether	mg/L	< 0.005			0.005	Pass	
4-Nitrophenol	mg/L	< 0.03			0.03	Pass	
4.4'-DDD	mg/L	< 0.005			0.005	Pass	
4.4'-DDE	mg/L	< 0.005			0.005	Pass	
4.4'-DDT	mg/L	< 0.005			0.005	Pass	
7.12-Dimethylbenz(a)anthracene	mg/L	< 0.005			0.005	Pass	
a-HCH	mg/L	< 0.005			0.005	Pass	
Acenaphthene	mg/L	< 0.001			0.001	Pass	
Acenaphthylene	mg/L	< 0.001			0.001	Pass	
Acetophenone	mg/L	< 0.005			0.005	Pass	
Aldrin	mg/L	< 0.005			0.005	Pass	
Aniline	mg/L	< 0.005			0.005	Pass	
Anthracene	mg/L	< 0.001			0.001	Pass	
b-HCH	mg/L	< 0.005			0.005	Pass	
Benz(a)anthracene	mg/L	< 0.001			0.001	Pass	
Benzo(a)pyrene	mg/L	< 0.001			0.001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.001			0.001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzyl chloride	mg/L	< 0.005			0.005	Pass	
Bis(2-chloroethoxy)methane	mg/L	< 0.005			0.005	Pass	
Bis(2-chloroisopropyl)ether	mg/L	< 0.005			0.005	Pass	
Bis(2-ethylhexyl)phthalate	mg/L	< 0.005			0.005	Pass	
Butyl benzyl phthalate	mg/L	< 0.005			0.005	Pass	
Chrysene	mg/L	< 0.001			0.001	Pass	
d-HCH	mg/L	< 0.005			0.005	Pass	
Di-n-butyl phthalate	mg/L	< 0.005			0.005	Pass	
Di-n-octyl phthalate	mg/L	< 0.005			0.005	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.001			0.001	Pass	
Dibenz(a.j)acridine	mg/L	< 0.005			0.005	Pass	
Dibenzofuran	mg/L	< 0.005			0.005	Pass	
Dieldrin	mg/L	< 0.005			0.005	Pass	
Diethyl phthalate	mg/L	< 0.005			0.005	Pass	
Dimethyl phthalate	mg/L	< 0.005			0.005	Pass	
Dimethylaminoazobenzene	mg/L	< 0.005			0.005	Pass	
Diphenylamine	mg/L	< 0.005			0.005	Pass	
Endosulfan I	mg/L	< 0.005			0.005	Pass	
Endosulfan II	mg/L	< 0.005			0.005	Pass	
Endosulfan sulphate	mg/L	< 0.005			0.005	Pass	
Endrin	mg/L	< 0.005			0.005	Pass	
Endrin aldehyde	mg/L	< 0.005			0.005	Pass	
Endrin ketone	mg/L	< 0.005			0.005	Pass	
Fluoranthene	mg/L	< 0.001			0.001	Pass	
Fluorene	mg/L	< 0.001			0.001	Pass	
g-HCH (Lindane)	mg/L	< 0.005			0.005	Pass	
Heptachlor	mg/L	< 0.005			0.005	Pass	
Heptachlor epoxide	mg/L	< 0.005			0.005	Pass	
Hexachlorobenzene	mg/L	< 0.005			0.005	Pass	
Hexachlorobutadiene	mg/L	< 0.005			0.005	Pass	
Hexachlorocyclopentadiene	mg/L	< 0.005			0.005	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Hexachloroethane	mg/L	< 0.005			0.005	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.001			0.001	Pass	
Methoxychlor	mg/L	< 0.005			0.005	Pass	
N-Nitrosodibutylamine	mg/L	< 0.005			0.005	Pass	
N-Nitrosodipropylamine	mg/L	< 0.005			0.005	Pass	
N-Nitrosopiperidine	mg/L	< 0.005			0.005	Pass	
Naphthalene	mg/L	< 0.001			0.001	Pass	
Nitrobenzene	mg/L	< 0.05			0.05	Pass	
Pentachlorobenzene	mg/L	< 0.005			0.005	Pass	
Pentachloronitrobenzene	mg/L	< 0.005			0.005	Pass	
Pentachlorophenol	mg/L	< 0.01			0.01	Pass	
Phenanthrene	mg/L	< 0.001			0.001	Pass	
Phenol	mg/L	< 0.003			0.003	Pass	
Pronamide	mg/L	< 0.005			0.005	Pass	
Pyrene	mg/L	< 0.001			0.001	Pass	
Trifluralin	mg/L	< 0.005			0.005	Pass	
Method Blank							
Alkalinity	mg CaCO3/L	< 5			5	Pass	
Ammonia-N	mg/L	< 0.02			0.02	Pass	
Bicarbonate	mg CaCO3/L	< 5			5	Pass	
Carbonate	mg CaCO3/L	< 5			5	Pass	
Chloride	mg/L	< 5			5	Pass	
Conductivity	uS/cm	< 10			10	Pass	
Filterable Reactive Phosphorus	mg/L	< 0.01			0.01	Pass	
Hydroxide	mg CaCO3/L	< 5			5	Pass	
Nitrate-N	mg/L	< 0.01			0.01	Pass	
Nitrite-N	mg/L	< 0.01			0.01	Pass	
NOx-N	mg/L	< 0.01			0.01	Pass	
Sulfate	mg/L	< 1			1	Pass	
Total Nitrogen	mg/L	< 0.2			0.2	Pass	
Total Phosphorus	mg/L	0.01			0.01	Pass	
Hardness mg equivalent CaCO3/L	mg/L	< 5			5	Pass	
Method Blank							
Alkali Metals							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
Method Blank							
Heavy Metals							
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)	mg/L	< 0.0001			0.0001	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Copper (filtered)	mg/L	< 0.001			0.001	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Mercury (filtered)	mg/L	< 0.0001			0.0001	Pass	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Zinc (filtered)	mg/L	< 0.005			0.005	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	109			70-130	Pass	
TRH C10-C14	%	78			70-130	Pass	
LCS - % Recovery							
BTEX							

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Benzene	%	93			70-130	Pass	
Toluene	%	88			70-130	Pass	
Ethylbenzene	%	88			70-130	Pass	
m&p-Xylenes	%	85			70-130	Pass	
Xylenes - Total*	%	85			70-130	Pass	
LCS - % Recovery							
Volatile Organics							
Methyl-tert-Butyl Ether	%	75			70-130	Pass	
1.1-Dichloroethene	%	111			70-130	Pass	
1.1.1-Trichloroethane	%	110			70-130	Pass	
1.2-Dichlorobenzene	%	95			70-130	Pass	
1.2-Dichloroethane	%	113			70-130	Pass	
Trichloroethene	%	116			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	83			70-130	Pass	
TRH C6-C10	%	106			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	%	73			70-130	Pass	
LCS - % Recovery							
Semivolatile Organics							
2-Methyl-4.6-dinitrophenol	%	95			25-140	Pass	
2-Chlorophenol	%	68			25-140	Pass	
2-Methylphenol (o-Cresol)	%	88			25-140	Pass	
2-Nitrophenol	%	90			25-140	Pass	
2.4-Dichlorophenol	%	102			25-140	Pass	
2.4-Dimethylphenol	%	46			25-140	Pass	
2.4.5-Trichlorophenol	%	101			25-140	Pass	
2.4.6-Trichlorophenol	%	105			25-140	Pass	
2.6-Dichlorophenol	%	70			25-140	Pass	
3&4-Methylphenol (m&p-Cresol)	%	34			25-140	Pass	
4-Chloro-3-methylphenol	%	67			25-140	Pass	
Acenaphthene	%	82			70-130	Pass	
Acenaphthylene	%	84			70-130	Pass	
Anthracene	%	78			70-130	Pass	
Benz(a)anthracene	%	80			70-130	Pass	
Benzo(a)pyrene	%	90			70-130	Pass	
Benzo(b&j)fluoranthene	%	70			70-130	Pass	
Benzo(g.h.i)perylene	%	120			70-130	Pass	
Benzo(k)fluoranthene	%	87			70-130	Pass	
Chrysene	%	84			70-130	Pass	
Dibenz(a.h)anthracene	%	74			70-130	Pass	
Fluoranthene	%	72			70-130	Pass	
Fluorene	%	108			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	76			70-130	Pass	
Naphthalene	%	78			70-130	Pass	
Pentachlorophenol	%	88			25-140	Pass	
Phenanthrene	%	76			70-130	Pass	
Phenol	%	110			25-140	Pass	
Pyrene	%	72			70-130	Pass	
LCS - % Recovery							
Conductivity	%	96			80-120	Pass	
Total Phosphorus	%	96			80-120	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery							
Alkali Metals							
Calcium	%	83			80-120	Pass	
Magnesium	%	102			80-120	Pass	
Potassium	%	100			80-120	Pass	
Sodium	%	99			80-120	Pass	
LCS - % Recovery							
Heavy Metals							
Arsenic (filtered)	%	107			80-120	Pass	
Cadmium (filtered)	%	102			80-120	Pass	
Chromium (filtered)	%	100			80-120	Pass	
Copper (filtered)	%	100			80-120	Pass	
Lead (filtered)	%	104			80-120	Pass	
Mercury (filtered)	%	107			80-120	Pass	
Nickel (filtered)	%	101			80-120	Pass	
Zinc (filtered)	%	105			80-120	Pass	
CRM - % Recovery							
Nitrite-N	%	107			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C10-C14	M23-JI0060229	NCP	%	117			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	M23-JI0060229	NCP	%	113			70-130	Pass	
Spike - % Recovery									
				Result 1					
Ammonia-N	L23-JI0042125	NCP	%	110			80-120	Pass	
Chloride	L23-JI0039800	NCP	%	90			70-130	Pass	
Filterable Reactive Phosphorus	L23-JI0042125	NCP	%	105			80-120	Pass	
Nitrate-N	L23-JI0040244	NCP	%	107			70-130	Pass	
Nitrite-N	L23-JI0040244	NCP	%	94			80-120	Pass	
NOx-N	L23-JI0040244	NCP	%	102			80-120	Pass	
Sulfate	L23-JI0039800	NCP	%	118			70-130	Pass	
Total Nitrogen	L23-JI0039577	NCP	%	103			70-130	Pass	
Total Phosphorus	L23-JI0042125	NCP	%	113			80-120	Pass	
Spike - % Recovery									
Alkali Metals				Result 1					
Calcium	L23-JI0039102	NCP	%	100			75-125	Pass	
Magnesium	L23-JI0039102	NCP	%	120			75-125	Pass	
Potassium	L23-JI0039102	NCP	%	114			75-125	Pass	
Sodium	L23-JI0039102	NCP	%	121			75-125	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic (filtered)	L23-JI0039824	NCP	%	84			75-125	Pass	
Cadmium (filtered)	L23-JI0039824	NCP	%	76			75-125	Pass	
Chromium (filtered)	L23-JI0039824	NCP	%	75			75-125	Pass	
Copper (filtered)	L23-JI0039824	NCP	%	74			75-125	Fail	Q08
Lead (filtered)	L23-JI0039824	NCP	%	77			75-125	Pass	
Mercury (filtered)	L23-JI0039824	NCP	%	74			75-125	Fail	Q08
Nickel (filtered)	L23-JI0039824	NCP	%	75			75-125	Pass	
Zinc (filtered)	L23-JI0039824	NCP	%	76			75-125	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C10-C14	M23-JI0060230	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH C15-C28	M23-JI0060230	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH C29-C36	M23-JI0060230	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH >C10-C16	M23-JI0060230	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH >C16-C34	M23-JI0060230	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH >C34-C40	M23-JI0060230	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Alkalinity	L23-JI0041313	NCP	mg CaCO3/L	< 5	< 5	<1	30%	Pass	
Ammonia-N	L23-JI0040382	CP	mg/L	0.05	0.05	4.3	20%	Pass	
Bicarbonate	L23-JI0041313	NCP	mg CaCO3/L	< 5	< 5	<1	20%	Pass	
Carbonate	L23-JI0041313	NCP	mg CaCO3/L	< 5	< 5	<1	20%	Pass	
Chloride	L23-JI0040382	CP	mg/L	160	160	2.1	30%	Pass	
Conductivity	L23-JI0040382	CP	uS/cm	800	770	3.5	20%	Pass	
Filterable Reactive Phosphorus	L23-JI0040382	CP	mg/L	0.11	0.09	16	20%	Pass	
Hydroxide	L23-JI0041313	NCP	mg CaCO3/L	< 5	< 5	<1	20%	Pass	
Nitrate-N	L23-JI0040382	CP	mg/L	8.1	8.2	<1	30%	Pass	
Nitrite-N	L23-JI0040382	CP	mg/L	0.02	0.03	8.0	20%	Pass	
NOx-N	L23-JI0040382	CP	mg/L	8.2	8.2	<1	20%	Pass	
pH	L23-JI0040382	CP	pH Units	7.0	7.0	1.0	30%	Pass	
Sulfate	L23-JI0040382	CP	mg/L	72	71	1.4	30%	Pass	
Total Nitrogen	L23-JI0040356	NCP	mg/L	3.0	3.2	8.6	30%	Pass	
Total Phosphorus	L23-JI0042124	NCP	mg/L	0.23	0.09	17	20%	Pass	
Duplicate									
Alkali Metals				Result 1	Result 2	RPD			
Calcium	L23-JI0039782	NCP	mg/L	< 0.5	< 0.5	<1	30%	Pass	
Magnesium	L23-JI0039782	NCP	mg/L	< 0.5	< 0.5	<1	30%	Pass	
Potassium	L23-JI0039782	NCP	mg/L	< 0.5	< 0.5	<1	30%	Pass	
Sodium	L23-JI0039782	NCP	mg/L	3.0	2.8	4.5	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic (filtered)	L23-JI0039822	NCP	mg/L	0.003	0.002	13	30%	Pass	
Cadmium (filtered)	L23-JI0039822	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Chromium (filtered)	L23-JI0039822	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Copper (filtered)	L23-JI0039822	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Lead (filtered)	L23-JI0039822	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Mercury (filtered)	L23-JI0039822	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel (filtered)	L23-JI0039822	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Zinc (filtered)	L23-JI0039822	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	

Comments

Microbiological analysis has been completed by Eurofins Promicro, NATA Accreditation Number 2561, report reference 23-05746

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
N19	Analysis performed by Eurofins Promicro Pty Ltd under NATA Accreditation No. 2561
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference.

Authorised by:

Andrew Harvey	Analytical Services Manager
Douglas Todd	Senior Analyst-Metal
Harry Bacalis	Senior Analyst-Volatile
Joseph Edouard	Senior Analyst-Organic
Sam Becker	Senior Analyst-Inorganic

Kim Rodgers
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

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Appendix G
Groundwater Sampling Logs and Calibration Certificate

GROUNDWATER SAMPLING RECORD

Location ID:	GW01
Date:	17/07/2023
Project No:	P22.142
Project Title:	LOT 3 (NO. 392) BALDIVIS ROAD, BALDIVIS, WA: DETAILED SITE INVESTIGATION FOR POTENTIAL CONTAMINATION
Sampling Device:	YSI, Dipper, Typhoon Pump.
Field Scientist:	Napolean Kwa

Well Information	
Start/Finish time:	
Stickup of mm casing (m):	

Total well depth (mbtoc):	10.97
Depth to water (mbtoc):	8.625
Depth to water (mbgl):	
Depth of slotted interval (mbtoc):	
Depth of extraction (mbtoc):	
Well survey (toc mAHD)	

Time/Duration (mins)	Depth to Water (mbtoc)	Purge Vol (L)	Rate (L/min)	pH	EC (Sp) (µS/cm)	TDS (mg/L)	ORP (mV)	DO (mg/L)	Temp (°C)	Sal (ppt)	TTA	TAlk	Comment
Stablisation Criteria	Δ < -0.1m	-	<1L/min	±0.1	±5%	-	±10 mV	±10%	±0.5	-	-	-	
0	8.625			6.03	668		77.6	1.94	18.7				
3	8.65			6.16	638		54	0.88	19.8				
6	8.65			6.16	631		44.3	0.8	20				
9	8.65			6.15	626		33.6	0.72	20.2				
12	8.65			6.16	627		24	0.65	20.1				
15	8.65			6.16	631		12.8	0.71	20.2				

Observations: weather, well/location condition, safety hazards	
Water quality: sample, colour, turbidity, odour, sheen	milky yellow, no odour
Analysis: analytical suite, dup/trip/QC samples	DUP_01 & TRIP01 collected
Notes	

WESTERN ENVIRONMENTAL

GROUNDWATER SAMPLING RECORD

Location ID:	GW02
Date:	17/07/2023
Project No:	P22.142
Project Title:	LOT 3 (NO. 392) BALDIVIS ROAD, BALDIVIS, WA: DETAILED SITE INVESTIGATION FOR POTENTIAL CONTAMINATION
Sampling Device:	YSI, Dipper, Typhoon Pump.
Field Scientist:	Napolean Kwa

Well Information	
Start/Finish time:	
Stickup of mm casing (m):	

Total well depth (mbtoc):	12.58
Depth to water (mbtoc):	10.19
Depth to water (mbgl):	
Depth of slotted interval (mbtoc):	
Depth of extraction (mbtoc):	
Well survey (toc mAHD)	

Time/Duration (mins)	Depth to Water (mbtoc)	Purge Vol (L)	Rate (L/min)	pH	EC (Sp) (µS/cm)	TDS (mg/L)	ORP (mV)	DO (mg/L)	Temp (°C)	Sal (ppt)	TTA	TAlk	Comment
Stablisation Criteria	Δ < -0.1m	-	<1L/min	±0.1	±5%	-	±10 mV	±10%	±0.5	-	-	-	
0	10.19			6.07	500.2		7	2.48	19.6				
3	10.23			5.9	488.8		3.9	2.14	20.8				
6	10.23			5.82	503.9		1.9	1.78	20.9				
9	10.23			5.78	512.3		-4.8	1.64	21				
12	10.23			5.75	515.8		-16.5	1.77	21				
15	10.23			5.75	511.5		-13.8	1.57	21				
18	10.23			5.76	514.3		-11.7	1.54	21				

Observations: weather, well/location condition, safety hazards	
Water quality: sample, colour, turbidity, odour, sheen	milky yellow, no odour
Analysis: analytical suite, dup/trip/QC samples	
Notes	

GROUNDWATER SAMPLING RECORD

Location ID:	GW03
Date:	17/07/2023
Project No:	P22.142
Project Title:	LOT 3 (NO. 392) BALDIVIS ROAD, BALDIVIS, WA: DETAILED SITE INVESTIGATION FOR POTENTIAL CONTAMINATION
Sampling Device:	YSI, Dipper, Typhoon Pump.
Field Scientist:	Napolean Kwa

Well Information	
Start/Finish time:	
Stickup of mm casing (m):	

Total well depth (mbtoc):	11.07
Depth to water (mbtoc):	8.9
Depth to water (mbgl):	
Depth of slotted interval (mbtoc):	
Depth of extraction (mbtoc):	
Well survey (toc mAHD)	

Time/Duration (mins)	Depth to Water (mbtoc)	Purge Vol (L)	Rate (L/min)	pH	EC (Sp) (µS/cm)	TDS (mg/L)	ORP (mV)	DO (mg/L)	Temp (°C)	Sal (ppt)	TTA	TAlk	Comment
Stablisation Criteria	Δ < -0.1m	-	<1L/min	±0.1	±5%	-	±10 mV	±10%	±0.5	-	-	-	
0	8.9			6.31	177.1		10.1	2.64	19.3				
3	8.95			6.27	173.2		0.8	2.16	20.3				
6	8.95			6.29	166.9		-0.5	2.22	20.4				
9	8.95			6.26	165.6		2.9	2.35	20.5				
12	8.95			6.24	165		7.2	2.46	20.6				
15	8.95			6.21	165		11.1	2.61	20.7				

Observations: weather, well/location condition, safety hazards	
Water quality: sample, colour, turbidity, odour, sheen	milky orange, earthy odour
Analysis: analytical suite, dup/trip/QC samples	
Notes	

WESTERN ENVIRONMENTAL

GROUNDWATER SAMPLING RECORD

Location ID:	GW04
Date:	17/07/2023
Project No:	P22.142
Project Title:	LOT 3 (NO. 392) BALDIVIS ROAD, BALDIVIS, WA: DETAILED SITE INVESTIGATION FOR POTENTIAL CONTAMINATION
Sampling Device:	YSI, Dipper, Typhoon Pump.
Field Scientist:	Napolean Kwa

Well Information	
Start/Finish time:	
Stickup of mm casing (m):	

Total well depth (mbtoc):	5.96
Depth to water (mbtoc):	3.74
Depth to water (mbgl):	
Depth of slotted interval (mbtoc):	
Depth of extraction (mbtoc):	
Well survey (toc mAHD)	

Time/Duration (mins)	Depth to Water (mbtoc)	Purge Vol (L)	Rate (L/min)	pH	EC (Sp) (µS/cm)	TDS (mg/L)	ORP (mV)	DO (mg/L)	Temp (°C)	Sal (ppt)	TTA	TAlk	Comment
Stablisation Criteria	Δ < -0.1m	-	<1L/min	±0.1	±5%	-	±10 mV	±10%	±0.5	-	-	-	
0	3.74			6.64	417.5		4.9	1.07	18.7				
3	3.9			6.63	418.6		-28	0.62	19.5				
6	3.9			6.62	416.5		-54.8	0.51	19.7				
9	3.9			6.61	418		-73.1	0.48	19.8				
12	3.9			6.6	423.2		-84.6	0.45	19.9				
15	3.9			6.6	426.5		-89.9	0.42	19.9				

Observations: weather, well/location condition, safety hazards	
Water quality: sample, colour, turbidity, odour, sheen	milky orange, no odour
Analysis: analytical suite, dup/trip/QC samples	
Notes	

WESTERN ENVIRONMENTAL

YSI Calibration Certificate

Date of Calibration 7/19/23

Name of Technician Napolean Kwa

Temperature Reading	17.00	
Temperature Accurate?	Yes ✔	No

DO Sensor in use:	Galvanic	
Sensor notated in Sensor menu?	Yes ✔	No
DO membrane changed?	Yes	No ✔
Colour of Membrane	Gold	
Colour notated in Sensor menu?	Yes	No ✔

Record the following calibration values:				
	Pre Cal	**After Cal**		
Conductivity	1,145.00	1,197.00		
ORP	181.40	227.40		
DO	137.90	100		
True Barometric Pressure at time of calibration:		758.60		
pH 7	6.72	7.03	pH mV value	Range 0 mV + 50 mV
pH 4	3.52	4.00	pH mV value	Range +165 to +180 from 7 buffer mV value

WESTERN ENVIRONMENTAL

Appendix H
Laboratory QA/QC Assessment

Work order	Criteria not conforming	Outliers	Sample	Comments
Soil				
EP2309599	Holding time	VOCs in so	TP02_0-0.15, TP03_0-0.15, TP05_0-0.15, TP06_0-0.15, Dup03	Given the small number of samples involved, short holding time breach (1 day) and the consistency of the reported results with samples where analysis was completed within the holding time, there is not considered to be an adverse impact on interpretation of the data.
	Laboratory Control Spike (LCS) Recoveries	1-Naphthylamine 4-Nitroquinoline-N-oxide 4-Chloroaniline	-	Recovery greater than upper control limit. This represents a conservative error where actual concentration may be over-estimated. As all reported concentrations in all samples were below the LoR, there has not been an impact on interpretation of the dataset.
		VOCs in Water	-	This relates to the rinsate sample only where all results were below the LoR and does not have a material impact on interpretation of the dataset.
	Matrix Spike (MS) Recoveries	Manganese Zinc	SED01 TP03_0-0.15	MS recovery out of target range due to sample concentration exceeding the spike level. Given valid MS recoveries were reported for the majority of the samples, the laboratory data is considered suitably accurate for the soil conditions present at the Site.
		SVOCs in water	-	MS recovery completed at a rate lower than the target 5%. This relates to the rinsate sample only where all results were below the LoR and does not have a material impact on interpretation of the dataset.
EP2310835	Holding time	OCP	TP04_0.5	This delineation sample was analysed approximately 14 days outside of the recommended holding time. However, the reported concentration was consistent with the shallower sample from the same borehole and as such the holding time exceedance has not impacted the analytical data.
	Holding time	PAH and TRH	TP20_0.5 TP18_0.5	These delineation samples were analysed approximately 14 days outside of the recommended holding time. These two samples reported concentrations consistent with what would be expected based on the shallow sample at each soil bore and as such the holding time exceedance has not impacted the analytical data.
	MS Recovery	PAH and OCP	-	MS recovery completed at a rate lower than the target 5%. MS recoveries on other work orders indicate that MS recovery for soils within the Site are typically acceptable. Given the small number of samples on this work order there is not considered to be a material impact on the dataset.
1009147-S	MS Recovery	Sb, As, Ba, Be, Cd, Cr, Mn, Ni, Se, SN	-	The matrix spike recovery is outside of the recommended acceptance criteria, ranging from 61%-75% compared to the minimum criteria of 80%. Given the minor nature of the non-compliance and the low concentrations reported across the site, there has not been a material impact on the dataset.
	Duplicate RPD	Mn		RPD of 23% exceeds the target of 20% The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and is therefore considered suitably accurate.
Groundwater				

Work order	Criteria not conforming	Outliers	Sample	Comments
EP2309684	LCS Recoveries	1.2-Dibromoethane	-	Recovery greater than upper control limit. This represents a conservative error where actual concentration may be over-estimated. As all reported concentrations in all samples were below the LoR, there has not been an impact on interpretation of the dataset.
	MS Recoveries	NH3, NOX	Anonymous	MS recovery out of target range due to sample concentration exceeding the spike level. Tis relates to an anonymous sample form an unknown work order and is not representative of site conditions.
	Sample surrogate (SS) recovery	4-Bromofluoro benzene	Rinsate	Recovery (80.5%) less than lower data quality objective (80.8%). Given all VOC compounds were below the LoR forte rinsate sample there is not considered to be a material impact on the dataset, especially given the magnitude of the non-compliance.
	Holding time	pH	All samples	pH measured 3 days outside of recommended holding time which is 6 hours. As the laboratory values are consistent with the field readings, there is not considered to be a significant influence on the dataset.
1009258-W	MS Recoveries	Cu, Hg	-	The matrix spike recovery (74%) is below the recommended acceptance criteria (75%). Given the very minor nature of the non-compliance, any underreporting of concentration will not be sufficient to impact interpretation of the dataset.

Appendix I
USEPA Hydraulic Gradient Calculator Outputs

EPA On-line Tools for Site Assessment Calculation

Hydraulic Gradient -- Magnitude and Direction

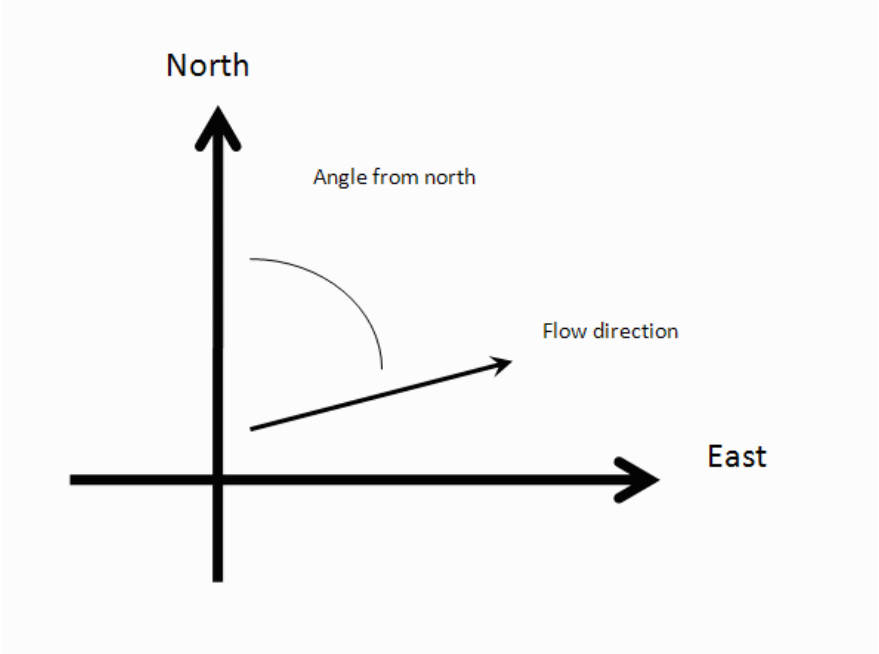
Gradient Calculation from fitting a plane to as many as thirty points

$a\,x_1 + b\,y_1 + c = h_1$
$a\,x_2 + b\,y_2 + c = h_2$
$a\,x_3 + b\,y_3 + c = h_3$
. . .
$a\,x_{30} + b\,y_{30} + c = h_{30}$

where (x_i,y_i) are the coordinates of the well and
h_i is the head

i = 1,2,3, ... , 30
The coefficients a, b, and c are calculated by a least-squares fitting of the the data to a plane

The gradient is calculated from the square root of $(a^2 + b^2)$ and the angle from the arctangent of a/b or b/a depending on the quadrant



Inputs

Example Data Set 1 | Example Data Set 2 | Calculate | Clear
Save Data | Recall Data | Go Back
Site Name: P22.142
Date: | Current Date
Calculation basis: Head
Coordinates: m

I.D.		x-coordinate	y-coordinate	head (m)
1)	GW01	388695.495	6424482.600	2.372
2)	GW02	388815.768	6424493.156	2.518
3)	GW03	388842.808	6424438.195	2.614
4)				
5)				
6)				
7)				
8)				
9)				
10)				
11)				
12)				
13)				
14)				
15)				
16)				
17)				
18)				
19)				
20)				
21)				
22)				
23)				

24)				
25)				
26)				
27)				
28)				
29)				
30)				

Results

Number of Points Used in Calculation	3
Max. Difference Between Head Values	0.2420
Gradient Magnitude (i)	0.001712
Flow direction as degrees from North (positive y axis)	310.1
Coefficient of Determination (R^2)	1.00

WCMS

Last updated on 9/1/2021

EPA On-line Tools for Site Assessment Calculation

Hydraulic Gradient -- Magnitude and Direction

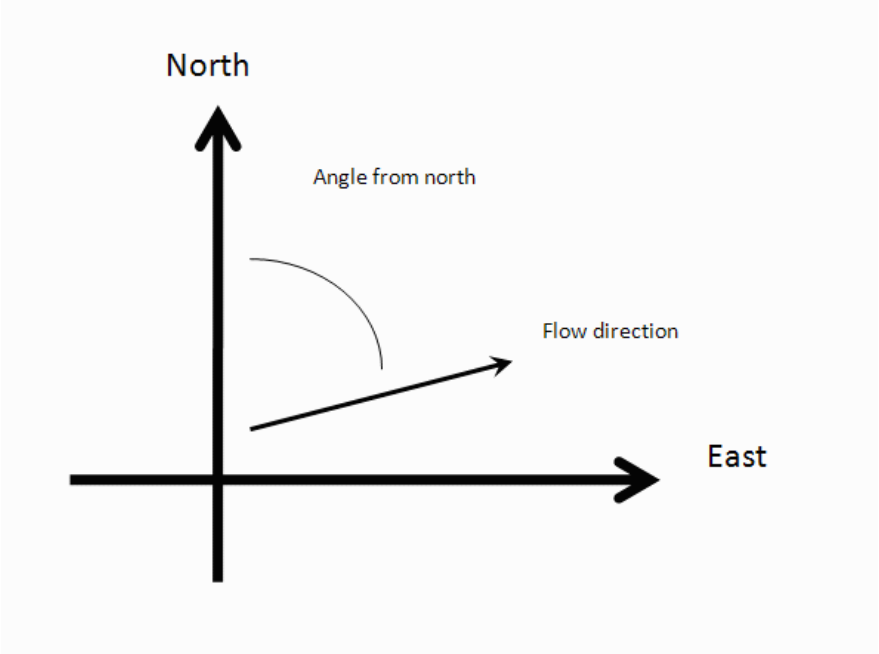
Gradient Calculation from fitting a plane to as many as thirty points

$a\,x_1 + b\,y_1 + c = h_1$
$a\,x_2 + b\,y_2 + c = h_2$
$a\,x_3 + b\,y_3 + c = h_3$
. . .
$a\,x_{30} + b\,y_{30} + c = h_{30}$

where (x_i,y_i) are the coordinates of the well and
h_i is the head

i = 1,2,3, ... , 30
The coefficients a, b, and c are calculated by a least-squares fitting of the the data to a plane

The gradient is calculated from the square root of $(a^2 + b^2)$ and the angle from the arctangent of a/b or b/a depending on the quadrant



Inputs

Example Data Set 1 | Example Data Set 2 | Calculate | Clear
Save Data | Recall Data | Go Back
Site Name: P22.142
Date: | Current Date
Calculation basis: Head
Coordinates: m

I.D.		x-coordinate	y-coordinate	head (m)
1)	GW01	388695.495	6424482.600	2.372
2)	GW02	388815.768	6424493.156	2.518
3)	GW03	388842.808	6424438.195	2.614
4)	GW04	389053.280	6424478.137	3.636
5)				
6)				
7)				
8)				
9)				
10)				
11)				
12)				
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29)				
30)				

Results

Number of Points Used in Calculation	4
Max. Difference Between Head Values	1.264
Gradient Magnitude (i)	0.004491
Flow direction as degrees from North (positive y axis)	236.7
Coefficient of Determination (R^2)	0.935

WCMS

Last updated on 9/1/2021

APPENDIX 7: SERVICING REPORT

DEVELOPMENT
ENGINEERING
CONSULTANTS

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CARCIONE NOMINEES PTY LTD
LOTS 9003, 9501, 3 AND 4 BALDIVIS ROAD/EVEREST WAY, BALDIVIS
ENGINEERING SERVICES REPORT

1. General:

The subject site is approximately 11.7 hectares in size and is located on the south west corner of Baldivis Road and Fifty Road, Baldivis.

It is to be ultimately developed into around 160 residential lots plus two POS areas of 10,711m^2 and 3,168m^2.

This report covers existing and proposed services, plus proposals for earthworks, retaining walls, roads, drainage, groundwater, water supply, sewerage, power supply, gas, telecommunication as required for current urban development standards.

2. Executive Summary

The land the subject of this report is located between Everest Way and Baldivis Road in Baldivis, extending north from Rialto Way to Fifty Road in the City of Rockingham. It can be easily developed immediately by extending all required services from abutting roads.

The land is currently undeveloped and is partially cleared. The land has been previously used for a hatchery in the case of Lot 3 and agriculture in the case of the other lots. The land was largely cleared in the 1960's and 1970's and some regrowth has occurred particularly for Lot 3.

Both abutting roads are typical rural road standard, sealed in fair condition. Baldivis Road is proposed to be upgraded to a boulevard treatment to match areas that have already been upgraded to the south. Everest Way is the old Eighty Road pavement which is unkerbed and undrained. This will need to be upgraded to an urban standard which will require kerbing and drainage.

The basic land form is Bassendean sand. The Perth Environmental Geology mapping indicates that the site area consists of Bassendean Sand, very light grey at surface, yellow at depth, fine- to medium-grained, sub-rounded quartz, moderately well sorted, of eolian origin. It is noted as compatible with urbanisation, being well drained and a good groundwater recharge area.

Maximum groundwater levels are a minimum of 3.0m below natural ground levels.

No visual or anecdotal evidence of water ponding has occurred in this area.

The land can be connected to all services, either by extension and upgrading from existing infrastructure, or by provision of new infrastructure as set out below. Power, telephone, gas, sewer and water services already pass along the site frontage.

It is proposed that all road stormwater from the development up to and including the 1% AEP (1 in 100yr) event will be retained on site. Houses will discharge roof stormwater into on site soakwells.

Because of the minimal undulation nature of the site, lots will be developed with low to medium height retaining walls in order to provide level building blocks.

3. Site

The land is currently undeveloped and is partially cleared. The land has been previously used for a hatchery in the case of Lot 3 and agriculture in the case of the other lots.

The basic land form is Bassendean sand. Work in adjoining areas and with environmental investigations across the site indicate that it is underlain by deep free draining Bassendean sand, which should yield am "A" Site Classification for residential construction under AS2870.

The site is adjacent to existing Water Corporation sewer and scheme water, as well as telephone, gas and power. Access is from the existing abutting sealed roads; Baldivis Road and Everest Way. Lot 3 has an existing driveway off Baldivis Road mid-way along its Baldivis Road frontage and in a similar location off Everest Way. Baldivis Road and Everest Way abutting the site are both constructed to rural standard, and are of fair quality, having been built many years ago. A path is located along the eastern verge of Everest Way and there is currently no path along Baldivis Road.

A major fibre optic cable is located along the western verge of Baldivis Road adjacent to the site, as is an ATCO gas main. Another fibre optic cable is located along the eastern verge of Everest Way.

Aerial power lines are located along the eastern side of Baldivis Road.

4. Development Proposal

It is proposed to develop the land to around 160 residential lots plus POS areas.

Access to the proposed subdivision will be by way of two new subdivisional roads off Everest way given that once Nairn Drive is extended through, Everest way will revert to a low trafficked road. In addition access will occur from the existing development to the south. The development is proposed to be staged from south to north, allowing services to be extended organically.

The development will be provided with all normal services, with links to abutting developments for sewer, water, power, roads, gas and telephone services, with all drainage to be disposed on site via soakage.

Water Corporation reticulated sewer and water services exist in Baldivis Road and Rialto way to which the development will be connected. Sewer reticulation will be extended from the east side of Baldivis Road by either trenchless installation or open digging depending on timing of road upgrades. The water main along the eastern verge of Everest way will be extended into the new subdivision.

Aerial power lines are located along Baldivis Road on the opposite verge to the development, so following normal protocol, these will remain, with underground connections to be made as approved and extended within the development.

The development will entail earthworks largely via a cut to fill balance to provide level, free draining building blocks with low to medium height retaining walls.

All residential lot storm runoff will be directed to individual site soakage. Internal road stormwater will be directed to a proposed storage basin to be located both the northern and southern POS areas. Based on geotechnical investigations, the site is Bassendean sand capable of infiltration of the stormwater. The GWL at this proposed basin position is a minimum of 1.0m below the base of the basin.

It is expected that some upgrading of the abutting roads will be required as part of the development.

5. Earthworks & Retaining Walls

Earthworks will be carried out over the site to essentially cut from the existing ridge that runs north south through the site and fill the areas abutting Baldivis Road. The lots will be filled to a minimum of around RL 7.3m AHD in the southern catchment at to RL6.30mAHD in the northern catchment to ensure separation from basin top water levels. No fill is required to provide clearance to the MGL, which is at a maximum of RL 3.3m AHD at the north east corner and 3.8mAHD abutting Baldivis Road.

Some low to medium height retaining walls will be required, especially where the site rises from Baldivis Road to the ridgeline.

All retaining walls will be subject to Council building approval.

Earthworks on site will entail removal of topsoil and cut and fill – it is unlikely that any imported fill will be required.

6. Roads

All new subdivisional roads will be constructed to City of Rockingham standards and approval, including kerbing and piped drainage plus provision of footpaths as required. Access to the site will be by way of new subdivisional roads off Everest Way and access off existing Rialto Way to the south and Duomo Chase to the north.

The existing Everest way is an 9.7m wide rural standard carriageway in fair condition, which includes a 2.5m wide cycle lane on the eastern side. The road is kerbed only at the junction with Fifty Road.

Baldivis Road is a 7m wide rural standard road in fair condition, with no kerbing or formal drainage. There is a DUP along the eastern verge of Baldivis Road located within the “tramway” area on the eastern side of the roadway.

It is expected that upgrades to both Baldivis Road and Fifty Road will be incorporated into the subdivision approval requirements.

7. Drainage

Drainage from the whole site is wholly contained within the proposed drainage basins in the north eastern and central southern POS areas of the site.

Lot drainage will be self-contained in soakwells. The soil characteristics of the site in conjunction with the depth to groundwater will allow site soakage.

Stormwater design will be done to the standards of the City of Rockingham and in accord with the Local Water Management Strategy (LWMS) submitted with the structure plan documentation.

8. Groundwater

The maximum groundwater level generally flows from east to west, from a peak of around RL3.80mAHD on the western boundary to around RL2.10mAHD on the eastern boundary. Given the landform ranges from RL6.8mAHD up to around RL12.5mAHD, the minimum separation is some 3.0m.

9. Power

Sufficient power supply exists in the area to supply the development. A high and low voltage aerial power line is located along the eastern verge Baldivis Road. Underground cables are in place along Rialto Way and In Duomo Chase which will allow extension to service this development.

It is expected that the aerial lines will remain, and that connection to the development will be made from Baldivis Road and Rialto way.

All subdivisional power reticulation lines and transformer installations will be constructed at the cost of the developer. Transformer sites will be determined at the detailed subdivision design stage.

10. Water Supply

Sufficient water supply exists in the area to service this development.

At present there is a 250mm reticulation water main located along the eastern verge of Everest Way, to which the development will be connected.

A 1400mm steel trunk water main is located approximately along and under the middle of Everest way, and 900 mm steel main is located along the western verge of Everest Way. These mains are known as distribution mains and as such are unavailable for reticulation connection.

11. Sewer

The site is not currently connected to sewer, although a reticulation sewer main is located along the eastern verge of Baldivis Road, to which it is proposed to connect.

The site sewer connection will be made by drilling a 150mm reticulation sewer under Baldivis Road to the existing main on the eastern side. This connection will need to connect under the major Fibre Optic cable, high pressure gas main and 600mm trunk water main, all of which are located along Baldivis Road.

Internal sewers will allow for future extensions to abutting properties as required.

12. Telephone & NBN

Telstra underground infrastructure services exist adjacent to the site along the frontage to the site in both Baldivis Road and Everest Way. Underground infrastructure is located on both verges of Fifty Road. These are most likely to be able to be extended or upgraded to service this proposed development.

Fibre Optic cables are located in this area. A NEXTGEN cable is located along the eastern verge of Everest Way abutting the development, and an NBN major fibre optic cable is located along the western verge of Baldivis Road abutting the development.

Caution will need to be taken with subdivisional services connections and road construction where crossings are required.

In accordance with recent requirements, the developer is required to install NBN "pipe and pit" to allow for future installation of cables for the NBN. The design of the "pipe & pit" is the responsibility of the developer, and will be designed in conjunction with the underground power network, and installed during the construction phase of the development.

13. Gas

Gas mains are installed in this area, with a 160mm high pressure main located along the western verge of Baldivis Road adjacent to the development. It is expected that reticulated gas services will be extended into this development by ATCO in the normal way, with trenching done by the developer.

DEVELOPMENT ENGINEERING CONSULTANTS PTY LTD

THIS REPORT IS DATED 19TH SEPTEMBER 2023.