GLEN IRIS ESTATE

STRUCTURE PLAN

BERRIGAN DRIVE, JANDAKOT

14 MAR 2024

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RECORD OF ENDORSEMENT

This Structure Plan is prepared under the provisions of the City of Cockburn Town Planning Scheme No. 3.

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

10 September 2024

Signed for and on behalf of the Western Australian Planning Commission:

.....

an officer of the Commission duly authorised by the Commission pursuant to section 24 of the Planning and Development Act 2005 for that purpose, in the presence of:

Witness: .....

Date: 12 September 2024

Date of Expiry: 12 September 2034

TABLE OF AMENDMENTS

AMENDMENT NO.	SUMMARY OF THE AMENDMENT	AMENDMENT TYPE	DATE APPROVED BY WAPC

EXECUTIVE SUMMARY

This Structure Plan has been prepared to guide the subdivision and development of Lot 3 on Diagram 30047, Lot 6 on Diagram 91027, Lot 7 on Plan 21402, Lot 512 on Diagram 94292, Lot 139 on Plan 18946, and Lot 509 (No. 76 Dean Road) on Diagram 91028 (herein referred to as the 'subject site'). The subject site comprises an area of approximately 53.74 hectares, located in Jandakot within the municipality of the City of Cockburn.

The subject site, a former golf course, comprises underutilised vacant land located within the Glen Iris Residential Estate, encompassing a total area of approximately 130 hectares. The existing residential neighbourhood is inherently confined by its adjacent land uses, including the Rural Residential land to the east, Kwinana Freeway to the west, freight rail to the north and industrial land uses to the south.

The site presents a unique opportunity for a site responsive, infill residential development which integrates with, and contributes to, the existing residential area. The future development of the site will respect the existing pattern of residential development and enhance the sense of community within the locality, whilst providing for a diverse range of housing opportunities, including aging in place.

The site is ideally located within proximity to major employment nodes and transport infrastructure, with direct vehicular connections to the broader metropolitan area. It is within proximity to the Cockburn Central Secondary Centre, which provides for significant community facilities and amenity to support the proposed development.

The urban design rationale for the site has been informed through an extensive community engagement process undertaken with representatives from the Glen Iris Project Reference Group. Through the community engagement process, the following priority areas for consideration were identified as:

- Traffic and Access;
- Future Housing;
- Open Space and Environment;
- Interface with existing residences; and
- Local Amenities.

The above elements have been considered within the Structure Plan to provide for a site responsive design that integrates with, and is in keeping with, the characteristics of the existing residential area. The increase in the residential population provides the impetus for improved community facilities (public open space) and services.

As a result, the design philosophy has been based around the following:

- The retention of some 500 existing mature trees;
- Providing a landscaped interface 'buffer' to the rear of existing single residential houses that abut the former golf course;
- Providing a design outcome which responds to the topography of the land, including retention of existing drainage;
- Enhancing local traffic management through such means as including a new traffic light-controlled intersection with Berrigan Drive, and directing traffic to the internal subdivisional roads, away from the existing Glen Iris precinct roads, to safely navigate through the new intersection onto Berrigan Drive; and
- Listening carefully to resident's requests and running a thorough and well-balanced design consultation process in order to arrive at a lineal parkland design that respects many of the wishes and wants of existing local residents.

The proposed Structure Plan has been prepared in accordance with the provisions of Part 4 of Schedule 2 of the *Planning and Development (Local Planning Schemes) Regulations 2015* ('Regulations') and provides the planning framework to guide and facilitate the urban residential development of the subject site.

The preparation of the Structure Plan has been undertaken in consultation with the City of Cockburn and other relevant stakeholders.

STRUCTURE PLAN SUMMARY

ITEM	DATA	SECTION NUMBER REFERENCED IN PART TWO OF REPORT
Total area covered by the Structure Plan (Site Area)	53.74 hectares	2.2
Gross Subdivisible Area	49.01 hectares	5.3
Area of each land use proposed: Residential Local Centre Public Open Space Conservation	 27.92 hectares 0.72 hectares 8.80 hectares 0.42 hectares	 5.4 5.8 5.3 5.3
Total estimated lot yield	399 Residential lots 1 Local Centre lot	5.4 5.8
Estimated number of dwellings	550 residential dwellings	5.4
Estimated residential site density	19.69 dwellings per site hectare	5.4
Estimated population	1,595 people (based on 2.9 people per household)	5.4
Number of high schools	nil	5.7
Number of primary schools	nil	5.7
Estimated retail/ commercial floor space	2,500m²	5.8
Estimated area and percentage of public open space given over to Neighbourhood and Local Parks	8.88 hectares, (19 parks) 17.94% of gross subdivisible area	5.3
Estimate percentage of 'green' space (parks + landscape interface + conservation)	12.26 hectares, 25% of gross subdivisible area (22.8% of site area)	5.3

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

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1	Community Engagement Report	Supporting	-	-
2	Community Engagement Register	Supporting	-	-
3	Certificates of Title	Supporting	-	-
4	Environmental Assessment Report	Supporting	-	-
5	Bushfire Management Plan	Requires Approval	DFES and City of Cockburn	Awaiting approval
6	Acoustic Assessment	Requires Approval	MRWA and City of Cockburn	Awaiting approval
7	Landscape and Public Open Space Strategy	Requires Approval	City of Cockburn	Awaiting approval
8	Prinsep Park Flora and Vegetation Assessment	Supporting	-	-
9	Transport Impact Assessment	Requires Approval	MRWA and City of Cockburn	Awaiting approval
10	Local Water Management Strategy	Requires Approval	DWER and City of Cockburn	Awaiting approval
11	Sustainability Initiatives	Supporting	-	-
12	Dept of Education Correspondence	Supporting	-	-
13	Retail Needs Assessment	Supporting	-	-
14	Local Centre Concept Plan	Supporting	-	-
15	Engineering Services Report	Supporting	-	-

GLEN IRIS ESTATE

PART ONE
IMPLEMENTATION

1 STRUCTURE PLAN AREA

This Structure Plan applies to Lot 3 Dean Road on Diagram 30047, Lot 6 on Diagram 91027, Lot 7 on Plan 21402, Lot 512 on Diagram 94292, Lot 139 on Plan 18946, and Lot 509 (No. 76 Dean Road) on Diagram 91028, being the land contained within the inner edge of the line denoting the Structure Plan boundary on the Structure Plan map (Refer **Plan 1** situated at the end of Part 1 of this Structure Plan report).

2 OPERATION

In accordance with Schedule 2, Part 4 of the *Planning and Development (Local Planning Schemes) Regulations 2015* (Regulations), this Structure Plan shall come into operation when it is approved by the Western Australian Planning Commission (WAPC) pursuant to Schedule 2, Part 4, Clause 22 of the Regulations.

Pursuant to clause 27(1) of Schedule 2 of the Regulations:

> *A decision-maker for an application for development approval or subdivision approval in an area covered by a structure plan that has been approved by the Commission is to have due regard to, but is not bound by, the structure plan when deciding the application.*

Pursuant to clause 28(1) of Schedule 2 of the Regulations, this Structure Plan has effect for a period of 10 years, commencing on the day the WAPC approves the plan.

3 STAGING

Staging of the Structure Plan area is anticipated to commence generally from the intersection of Hartwell Parade and Dean Road, progressively extending to the north and south from this point. The development is likely to be undertaken over 17 stages of approximately 30 to 40 lots each.

It is anticipated full build out will be complete within approximately 5 years of Structure Plan and Subdivision approval, depending on sales rates.

4 SUBDIVISION & DEVELOPMENT REQUIREMENTS

4.1 LAND USE AND ZONES

The Structure Plan Map (**Plan 1**) outlines the land use, zones and reserves applicable within the Structure Plan area. The zones and reserves designated under this Structure Plan apply to the land within it as if the zones and reserves were incorporated into the Scheme.

4.2 ENVIRONMENTAL FEATURES

The Structure Plan proposes to retain approximately 500 mature trees across the site. The retention and protection of these trees during and post construction is to be considered through detailed design and construction methodologies. The lineal parkland design incorporated in the Structure Plan allows for Water Sensitive Urban Design outcomes with swales and at-source infiltration a key feature of the drainage strategy, providing improved soil moisture levels around retained mature trees and additional planted street trees.

4.3 INTERFACE WITH ADJOINING LAND

The Structure Plan is surrounded by existing residential development with 220 residential dwellings directly abutting the land. To ensure appropriate management of this interface, a landscaped buffer is identified for the majority of the perimeter of the site. This is achieved through the provision of public open space, landscaped pedestrian access ways, and widened road reserves with landscaped streetscapes; or otherwise adjoining an existing road reserve, as depicted on Plan 1.

Where a landscaped buffer and/or widened road reserve adjoins the rear of existing residential properties, where appropriate, a 0.1 metre wide Pedestrian Access Way may be applied to the landscaped buffer and/or widened road reserve as a means of preventing vehicular access from the existing residential property to the landscaped buffer and/or widened road reserve.

There are only limited portions of the site in the south of the Structure Plan area where residential development is proposed to directly abut existing residential development. These interfaces will be managed by a Local Development Plan and in instances could include retention of trees and vegetation.

To ensure the appropriate management of the existing residential interface, at the time of subdivision, the Applicant must:

a) Generally maintain a 10 metre wide minimum separation distance between the kerb of any new road carriageway and the boundary of existing adjoining residential lots. Any proposed reduction to the 10 metre minimum separation distance would only be considered subject to there being a demonstrated improved environmental outcome such as achieving the ability to retain a significant tree or trees.

b) Review the alignment of roads and the landscaped interface treatment/buffer width at each stage of subdivision, to maximise the number of mature trees retained.

c) Consult with adjoining landowners regarding preferences for future fencing adjustments based on a palette of compatible options.

d) Ensure street and path lighting is located and arranged to avoid any adverse light spill onto adjoining residences, in accordance with the Western Australian Planning Commission's Position Statement: Dark Sky and Astrotourism.

4.4 PUBLIC OPEN SPACE

In accordance with Liveable Neighbourhoods, a minimum of 10% of the gross subdivisible area shall be provided as public open space, comprising a minimum of 8% unrestricted open space.

Notwithstanding the minimum requirements set out under Liveable Neighbourhoods, consistent with the provisions set out under Table 9 (DA45) of the City of Cockburn Local Planning Scheme No. 3, public open space and the use of wider landscaped road reserves shall be arranged to:

a) Promote the retention of significant mature trees and provide an amount of public open space beyond minimum standards in recognition of the character of the area and the former use as a private recreational space;

b) Retain where practicable an appropriate, amount of black cockatoo habitat, in consultation with the Department of Biodiversity, Conservation and Attractions;

c) Provide for future active recreational needs of the community; and

d) Provide an appropriate interface to surrounding landholdings.

Compliance with the above will result in greater than 10% of the gross subdivisible area being provided as public open space.

Public open space should be provided generally in accordance with the Structure Plan Map (Plan 1).

4.5 RESIDENTIAL DENSITY TARGETS

The residential density codes applicable to the Structure Plan shall be in accordance with those shown on the Structure Plan Map (**Plan 1**). The Structure Plan prescribes a base code of R20, with areas of R30 and R40 dispersed throughout in strategic locations.

The Structure Plan area shall provide for an average minimum of 15-20 dwellings per residential site hectare and 10 dwellings per gross urban hectare, generally consistent with surrounding residential densities.

4.6 LOCAL CENTRE

A Local Centre is to be provided generally as identified on the Structure Plan Map (**Plan 1**).

The identified Local Centre is to have a maximum retail floorspace of 2,500m² net lettable area, specific to the shop/retail (SHP) planning land use category. This does not restrict the inclusion of other non-retail land uses, such as medical offerings. This retail floorspace restriction applies to the Local Centre zoned land within the Structure Plan area only, and does not include the existing Local Centre zoned land on Berrigan Drive/ Dean Road.

4.7 BUSHFIRE RISK

This Structure Plan is supported by a Bushfire Management Plan. For any future applications for subdivision and/or development approval, it is the responsibility of the applicant/landowner to demonstrate compliance with *State Planning Policy 3.7 – Planning in Bushfire Prone Areas and the associated Guidelines for Planning in Bushfire Prone Areas*.

Where future residential lots are impacted by a high Bushfire Attack Level (BAL 40 or above), additional information should be provided to demonstrate the lot can appropriately accommodate a dwelling within an appropriate BAL contour.

4.8 INFRASTRUCTURE WORKS

In accordance with the provisions set out under Table 9 (DA45) of the City of Cockburn Local Planning Scheme No. 3, future subdivision and development of the DA 45 area is limited to a maximum of 250 dwellings, until such time as a new traffic-light controlled intersection on Berrigan Drive is approved by Main Roads Western Australia and constructed at the subdivider/developer's expense.

This clause relates to the creation of new titles only and does not impact the number of lots which can be created by subdivision approval/s, or works relating to the implementation of those approval/s. Such works may include the clearing of vegetation, works to grade, stabilise and drain the land, and provide standard service infrastructure.

As part of road construction and subdivision works, it is possible the Berrigan Drive underpass may need to be permanently closed. Investigations are ongoing in this regard and any requirement for closure of the underpass shall be determined at subdivision implementation stage.

4.9 POTENTIAL BLACK COCKATOO HABITAT

Where the Structure Plan Map identifies a potential black cockatoo habitat tree to be retained (as shown on Plan 1 – Structure Plan Map), a condition of subdivision approval shall be implemented requiring the tree to be protected during subdivisional works in accordance with the *Australian Standard 4970-2009: Protection of Trees on Development Site*.

Any application for subdivision or development approval for land abutting the identified conservation reserve in the north of the Structure Plan area shall be subject to a condition of approval requiring fencing of the reserve to limit human access and promote the preservation of the remaining environmental qualities of the vegetation.

4.10 REVEGETATION

At the time of subdivision, the proponent/ developer is required to reinstate native vegetation within the Structure Plan area, at a rate of (minimum) two trees per each new residential lot.

4.11 FAUNA MANAGEMENT

A Fauna Relocation Management Plan is required to be prepared and approved prior to the commencement of subdivisional works. The Fauna Relocation Management Plan shall be prepared in consultation with the City of Cockburn, with satisfactory arrangements being made for the implementation of the approved plan.

4.12 CONSTRUCTION MANAGEMENT

A Construction Management Plan is required to be prepared and approved prior to the commencement of subdivisional works, with satisfactory arrangements being made for the implementation of the approved plan.

The approved Construction Management Plan is to include provisions requiring the preparation of dilapidation reports, in consultation with the landowners likely to be affected by subdivisional works.

4.13 NEIGHBOURHOOD CONNECTOR

The proposed Neighbourhood Connector roads, as identified on Plan 1 – Structure Plan Map, shall comprise the following minimum standards:

a) Neighbourhood Connector A: typically 20 metre reserve width, allowing for traffic lanes, a dual use path on one side, with trees, light poles and drainage structures to be provided either within the verge area or proposed central median.

b) Neighbourhood Connector B: typically 13.5 – 15 metre reserve width, allowing for traffic lanes, and a dual use path on one side of the road.

5 LOCAL DEVELOPMENT PLANS

The Western Australian Planning Commission may require, as a condition of subdivision approval, that a Local Development Plan(s) be prepared in accordance with Part 6 Schedule 2 of the *Planning and Development (Local Planning Schemes) Regulations 2015*, prior to the creation or development of:

a) Lots with an area less than 260m²;

b) Lots with an irregular configuration;

c) Lots where specific vehicle access and egress control is required;

d) Lots abutting public open space, a pedestrian access way or an area of landscape interface;

e) Lots zoned 'Local Centre';

f) Lots with particular site constraints (e.g. steeply sloping land);

g) Lots directly abutting existing residential development;

h) Lots affected by road or rail noise exceeding the targets set out in *State Planning Policy 5.4: Road and Rail Noise and the associated implementation guidelines*; and/or

i) Any lots requiring variations to the Residential Design Codes to achieve specific built form and streetscape outcomes.

6 OTHER REQUIREMENTS

6.1 BUSHFIRE CONSTRUCTION STANDARDS

This Structure Plan is supported by a Bushfire Management Plan. Regardless of whether the land has been formally designated as bushfire prone, any buildings on land identified as falling within 100 metres of a bushfire hazard shall comply with the requirements of *Australian Standard 3959* under the *Building Code of Australia*.

6.2 DEVELOPER CONTRIBUTION ARRANGEMENTS

The Structure Plan area is located within Development Contribution Areas 13 and 15 ('DCA 13' and 'DCA 15'), as identified in Table 10 of the *City of Cockburn Town Planning Scheme No. 3* ('TPS 3'). Under TPS 3, a Development Contribution Plan applies to the Structure Plan area and should be read in conjunction with this Structure Plan.

The landowner/developer is to contribute towards key service and community infrastructure within the latest Development Contribution Plan for DCA's 13 and 15. A cost contribution payment based on the area being developed will be required in accordance with the relevant contribution rate in the DCP in DCA's 13 and 15 at the time that development is implemented.

6.3 NOTIFICATIONS ON TITLE

In respect of an application to subdivide land within the Structure Plan area, the Western Australian Planning Commission may require a notification, pursuant to Section 165 of the Planning and Development Act 2005, be placed on the certificate(s) of title of:

a) All residential lots:

"This lot is in close proximity to known mosquito breeding areas. The predominant mosquito species is known to carry viruses and other diseases".

b) All residential lots:

"This lot is situated in the vicinity of Jandakot Airport, and is currently affected, or may be in the future, be affected by aircraft noise. Noise exposure levels are likely to increase in the future as a result of increases in numbers of aircraft using the airport, changes in aircraft type or other operational changes. Further information about aircraft noise, including development restrictions and noise insulation requirements for noise-affected properties, are available on request from the relevant local government offices".

c) All residential lots and/or commercial zoned lots located in area declared bushfire prone:

"This land is within a bushfire prone area as designed by an Order made by the Fire and Emergency Services Commissioner and is subject to a bushfire management plan. Additional planning and building requirements may apply to development on this land".

d) All lots affected by road and rail noise exceeding the targets set out in State Planning Policy 5.4: Road and Rail Noise:

"This lot is situated in the vicinity of a transport corridor and is currently affected or may in the future be affected by transport noise. Additional planning and building requirements may apply to development of this land to achieve an acceptable level of noise reduction".

6.4 RESTRICTIVE COVENANTS

At the time of subdivision, the Western Australian Planning Commission may require restrictive covenants to be placed on certificate(s) of titles for new lots to:

a) Prevent direct access to Berrigan Drive; and/or

b) Prevent the construction of dwellings in areas subject to Bushfire Attack Level of 40 or above.

6.5 JANDAKOT AIRPORT AIRSPACE PROTECTION

Jandakot Airport's airspace is protected by Australian Government legislation and regulation, and development or works which intrude into Jandakot Airport's protected airspace may require the approval of the airport operator.

This requirement may apply to permanent structures (such as buildings), temporary structures (such as a crane) and/or activities causing intrusions into the protected airspace through glare from artificial light or reflected sunlight, air turbulence from stacks or vents, smoke, dust, steam of other gasses or particulate matter.

7 ADDITIONAL INFORMATION

ADDITIONAL INFORMATION	APPROVAL STAGE	CONSULTATION REQUIRED
Bushfire Attack Level Contour Plan	Subdivision Application	Department of Fire and Emergency Services; and City of Cockburn
Bushfire Attack Level Certification	Building Licence	City of Cockburn
Noise Management Plan (including the need for Memorials on Title relating to transport and aircraft noise)	Condition of Subdivision Approval	City of Cockburn
Mosquito Management Plan (including the need for Memorials on Title)	Condition of Subdivision Approval	City of Cockburn
Technical investigations regarding the need for a Telecommunications Base Station, and provision made for such if required.	Development Application for Local Centre	City of Cockburn

PLAN 1 - STRUCTURE PLAN MAP

GLEN IRIS ESTATE

PART TWO
EXPLANATORY SECTION

1 INTRODUCTION AND PURPOSE

The purpose of this Structure Plan is to facilitate the development of the vacant land comprising Lot 3 Dean Road on Diagram 30047, Lot 6 on Diagram 91027, Lot 7 on Plan 21402, Lot 512 on Diagram 94292, Lot 139 on Plan 18946, and Lot 509 (No. 76 Dean Road) on Diagram 91028 (the 'subject site') for residential purposes.

A Scheme Amendment request has been lodged concurrently with this Structure Plan to appropriately zone the site for 'Development' under the provisions of the City of Cockburn Town Planning Scheme No. 3 ('TPS 3'). The Scheme Amendment will facilitate the inclusion of all of the land within the same zoning and will facilitate the development of the land in the manner proposed by this Structure Plan.

This Structure Plan will provide a general planning framework to guide the future subdivision and development of the land in an integrated and cohesive manner.

Refer **Plan 1** – Proposed Local Structure Plan.

1.1 PROJECT TEAM

The following multi-disciplinary project team has been engaged by the proponent to progress the preparation of the Structure Plan:

DISCIPLINE	CONSULTANT
Acoustic	Herring Storer Acoustics
Bush Fire	Ecological Australia
Civil Engineering	JDSI Consulting Engineers
Community Engagement	Louise Richardson & Associates
Environmental	Emerge Associates
Hydrological	Hyd2o
Landscape	Emerge Associates
Retail	Taktics4
Survey	MNG
Town Planning and Design	Rowe Group
Traffic	GTA Consultants (Stantec)
Sustainability	Active Sustainability

Table 1: Project Team

Rowe Group is the primary point of contact for all matters relating to this Structure Plan submission.

1.2 PRE-LODGEMENT CONSULTATION

Prior to lodging this Structure Plan, the proponent undertook a programme of consultation, which included meetings and discussions with Technical Officers from the City of Cockburn, and a series of information sessions and workshops with members of the local community. It should be noted that this consultation was undertaken by the proponent at the proponent's initiative to assist in informing the preparation of this Structure Plan and does not replace or avoid the need for formal consultation to be undertaken by the City of Cockburn pursuant to the requirements of the Planning and Development (Local Planning Schemes) Regulations 2015.

The subject site was historically used as a private golf course, overlooked by existing residential lots, comprising the Glen Iris Golf Course Estate. Whilst the golf course is no longer operational, the development of the land for residential purposes is considered a significant change for the local residents, and as such, the landowner/developer were committed to a proactive community engagement program, that commenced in April 2020.

The community engagement program was undertaken using the IAP2 Framework, facilitated by Louise Richardson & Associates (LRA). LRA worked with a specialist communication advisor and the Project Team to deploy a range of community engagement tools. These were designed to ensure optimum accessibility and two-way communication.

To date, the community engagement program has comprised the following:

- **Dedicated project information telephone line and email address,** directly linked to LRA. Between March 2020 and April 2021, the project team received a total of 290 enquiries from 220 individuals. All contact was logged in a comprehensive engagement register, analysed weekly to determine key topics of community discussion and concern, as well as informing project team responses.
- **Website.** www.HaveYourSayGlenIrisEstate.com.au was set up as a central source of project information and communication. Community members were encouraged to subscribe to the website to receive updates as the project progresses. These updates included information and feedback on the engagement process milestones, as well as notification of on-site activity (such as ATCO gas works).
- **Letters and Project Newsletter.** Hard copy letters were hand delivered to residents' mailboxes, ensuring maximum accessibility. The following letters were delivered:
  - 9 March 2020 – Community Notice announcing closure of Glen Iris Golf Course by the previous landowners.
  - 6 April 2020 – Letter announcing land purchase settlement.
  - 27 April 2020 – Letter announcing residents' survey.
  - August 2020 – Newsletter delivered to all households in Glen Iris.
  - December 2020 – Newsletter delivered to all households in Glen Iris.
  - 28 April 2021 – Letter announcing release of the draft concept plan.

- **Resident Survey (May - June 2020).** Market Research company, Metrix Consulting, was commissioned to develop and implement a detailed survey of existing Glen Iris residents. The survey was hand delivered to 750 homes within Glen Iris, and could also be completed online a www.HaveYourSayGlenIrisEstate.com.au.

- **Advertising.** To facilitate maximum awareness of pivotal engagement opportunities and milestones, paid advertisements were placed in the Cockburn Gazette and the Fremantle Gazette. Advertisements were placed on 3 September 2020, and 29 April 2021.

- **Briefing notes and stakeholder updates** were prepared for the City of Cockburn, the Department of Planning, Lands and Heritage, the Minister for Planning and Transport, the Member for Jandakot, and State Parliamentary MLC's for the South Metropolitan Region. These were designed to ensure key government stakeholders remained up to date on all aspects of the project planning and community engagement, and to assist with responding to queries received from members of the public.

- **Project Information Sheets** were created to provide comprehensive responses to frequently asked questions and requests for further details about topics of significant interest. These were provided to the City of Cockburn to assist its Technical Officers in responding to correspondence and questions from Residents and Ratepayers. They were also made publicly available through the www.HaveYourSayGlenIrisEstate.com.au website.

- **Frequently Asked Questions.** Monitoring and analysis of the Engagement Register and queries submitted to the City of Cockburn enabled the Project Team to generate a list of Frequently Asked Questions (FAQs) and responses. The FAQs were made available on www.HaveYourSayGlenIrisEstate.com.au and updated regularly in response to community requirements.

- **Precinct Reference Group.** In August 2020, the Project Team invited residents to nominate for inclusion in Precinct Reference Groups (PRG) with the aim of further engaging the Glen Iris community members in discussion about the future development of the site. Three PRGs covering the North, Central and Southern areas of the site were proposed to allow the Project Team to identify and resolve both big picture issues and location-specific concerns. The PRG initially comprised 26 residents, increasing to 32 residents as the process progressed. Given the lower than expected nominations for the PRG's, the three precincts were considered concurrently in the PRG workshops.

- **Visioning Workshops.** The PRG met four times in September, October and November 2020, and May 2021, with workshops independently facilitated by Metrix Consulting. The Project Team (planning, traffic, engineering, landscaping, and environmental) attended the sessions to participate in the discussions. The workshops were critical to ensuring the Project Team understood the key concerns of the Glen Iris community and to discuss their thoughts on the most suitable ways to address those concerns as part of any future development outcomes. The focus of the workshops were as follows:

    - **Workshop 1 (September 2020)** – identified five key issues for the community, being traffic and access, future housing, open space and environment, interface with existing residential lots, local amenities.

    - **Workshop 2 (October 2020)** – provided the opportunity for the PRG to further define the key issues and explore potential solutions from the community's perspective.

    - **Workshop 3 (November 2020)** – participants were given the opportunity to start to draw aspects of the concept development plan with the Project Team.

    - **Information Session (May 2021)** – presentation of the draft concept plan by the project team, with opportunities for questions from the PRG.

Whilst the upfront community engagement program is now complete, residents will remain informed and updated on the project through www.HaveYourSayGlenIrisEstate.com.au, and as otherwise required by the planning process.

A pre-lodgement briefing session was held with the City of Cockburn (May 2021) to present the final draft concept plan and discuss various matters relating to the delivery of the Structure Plan, such as public open space, traffic management and drainage.

Continued engagement with the City of Cockburn and relevant agencies and key stakeholders will be undertaken through the structure planning process.

Refer **Appendix 1** – Community Engagement Report.

Refer **Appendix 2** – Community Engagement Register.

2 LAND DESCRIPTION

2.1 LOCATION

The subject site is located within the municipality of the City of Cockburn, within the suburb of Jandakot. The site is situated approximately 16 kilometres south of the Perth Central Area and is accessible via the Kwinana Freeway (via Berrigan Drive). The Cockburn Central passenger railway station and Cockburn Gateway Shopping Centre are located approximately 1.5 kilometres south west of the subject site.

The site is elongated in shape, extending approximately 2.2 kilometres from Glen Iris Drive in the north to Imlah Court in the south. West to east, the site extends from Glen Iris Drive, Hartwell Parade and The Lakes Boulevard to Dean Road and Prinsep Road. A large proportion of the site boundary abuts the rear of existing residential dwellings.

Berrigan Drive extends east to west through the southern part of the site, effectively dividing the site into a northern and a southern cell.

The site's elongated configuration and location abutting residential dwellings is characteristic of its former use as a golf course.

Refer to **Figure 1** – Regional Location and **Figure 2** – Local Location.

2.2 AREA AND LAND USE

The subject site comprises a total area of approximately 53.74 hectares.

The site was previously utilised as a private golf course (including restaurant and clubhouse), comprising the Glen Iris Golf Course. The golf course officially ceased operation in March 2020, and the land currently remains generally vacant and unused. It is intended for the land to be redeveloped for residential purposes.

Characteristic of its most recent use, the site contains large open grassed areas, with existing vegetation predominantly limited to the periphery. The majority of existing vegetation on site comprises planted trees and shrubs, with native vegetation comprising only approximately 4% of the site, occurring as scattered patches. Two pockets of Banksia scrubland are proposed to be retained on site in public open space, one in the north and one in the south of the site.

The subject site is surrounded by low to medium density housing and associated land uses. A small commercial precinct comprising shops, restaurants and medical uses is located to the immediate east of the site along Berrigan Drive. The land further east of the site is predominantly used for semi-rural purposes, and the land to the south comprises mixed business and industrial land uses.

Refer **Figure 3** – Site Plan.

2.3 LEGAL DESCRIPTION AND OWNERSHIP

The Structure Plan area comprises six (6) lots, legally described as follows:

LOT NO.	DEPOSITED PLAN / DIAGRAM	VOLUME / FOLIO	APPROX. AREA	PROPRIETOR/S
3	D 30047	2190 / 500	0.40 ha	ECP Acquisitions 7 Pty Ltd
6	D 91027	2765 / 992	10.81 ha	ECP Acquisitions 9 Pty Ltd
7	P 21402	2195 / 189	17.58 ha	ECP Acquisitions 7 Pty Ltd
512	D 94292	2183 / 872	2.79 ha	ECP Acquisitions 7 Pty Ltd
139	P 18946	1947 / 547	20.81 ha	ECP Acquisitions 8 Pty Ltd
509 (No. 76 Dean Road)	D 91028	2183 / 871	1.35 ha	ECP Acquisitions 7 Pty Ltd

Table 2: Lot Details

The site has a total area of approximately 53.74 hectares.

Refer **Appendix 3** - Certificates of Title.

A review of the Certificates of Title reveal the following encumbrances relate to the subject site:

LOT NO.	ENCUMBRANCE TYPE	DOCUMENT NO.	BENEFICIARY	PURPOSE
6	Easement	G289136	City of Cockburn	Drainage
7	Easement	G004044	City of Cockburn	Drainage
7	Easement	G289135	City of Cockburn	Drainage
7	Easement	G394840	City of Cockburn	Drainage
7	Easement	G523659	City of Cockburn	Drainage
7	Easement	G523660	City of Cockburn	Drainage
7	Easement	N/A	Water Authority of WA	Water and Sewerage
7	Easement	N/A	Gas Corporation	Gas Supply
7	Easement	N/A	Public	Right of Footway (PAW)
512 and 509	Easement	N/A	Lot 509	Right of Carriageway
139	Easement	B368209	State Energy Commission	Right of access for the purposes of erecting and maintaining towers, poles, wires and other necessary apparatus
139	Easement	G004043	City of Cockburn	Drainage
139	Easement	I296686	City of Cockburn	Drainage and Access
509	Easement	N/A	Water Corporation	Sewerage

Table 3: Encumbrances

2.4 SITE HISTORY

The subject site has had a varied history of zonings and amendments, with the most recent use of the site being a golf course estate. The golf course was officially closed by the previous owners in March 2020, prior to the current proponents/landowners acquiring the site.

The central portion of the subject site was developed as a golf course in the early 1960s. The northern and southern extensions of the golf course were later cleared and developed during different periods in the early 1990s, alongside the residential development of the area between the golf course and the Kwinana Freeway, comprising the Glen Iris Golf Course Estate.

Various scheme amendments were progressed in the 1990s to rationalise existing commercial, hotel, private recreation and light industrial zonings within the site and its surrounds, to facilitate the development of the golf course, restaurant/clubhouse and associated residential estate. Rezoning proposals were also progressed during this period to increase residential densities in some areas from R12.5/15 to R20, R30 and R40.

Since closure of the golf course, the site has remained generally vacant and unused.

1. REGIONAL LOCATION

2. LOCAL LOCATION

3. SITE PLAN

3 PLANNING FRAMEWORK

3.1 ZONING AND RESERVATIONS

3.1.1 METROPOLITAN REGION SCHEME

The subject site and surrounds are zoned 'Urban' under the provisions of the Metropolitan Region Scheme ('MRS').

Refer **Figure 4** – Metropolitan Region Scheme Zoning.

3.1.2 CITY OF COCKBURN LOCAL PLANNING SCHEME NO. 3

3.1.2.1. EXISTING ZONING

The portion of the subject site comprising Lot 512 (2.7945 hectares) is zoned 'Residential' under the provisions of the City of Cockburn Town Planning Scheme No. 3 ('TPS3') and is assigned a residential density coding of R40 on the Scheme Maps. The balance of the site is zoned 'Special Use'.

The purpose of the Residential zone is as follows:

i) *To provide for a range of housing and a choice of residential densities to meet the needs of the community.*

ii) *To facilitate and encourage high quality design, built form and streetscapes throughout residential areas.*

iii) *To provide for a range of non-residential uses, which are compatible with and complementary to residential development.*

The purpose of the Special Use zone is as follows:

To provide for uses which have unique development requirements that cannot be easily accommodated by the objectives of any of the other zones included in the Scheme.

Lots 3, 6, 7 and 139 are located within Special Use Zone 1 ('SU1') under TPS 3, and Lot 509 is located within Special Use Zone 6 ('SU6').

The provisions applying to each Special Use zone are set out below:

NO.	DESCRIPTION OF LAND	SPECIAL USE	CONDITIONS
SU1 (49.59ha)	Berrigan Drive, Jandakot, the Glen Iris Golf Course Estate	Golf Course Estate, Private Recreation, Hotel, Convention Centre and associated uses - means land used and designed for a golf course, integrated with residential development and associated commercial and community facilities.	Structure Plan adopted to guide Subdivision, land use and Development - Glen Iris Golf Course Estate.
SU6 (1.3477ha)	Dean Road, Jandakot, the Glen Iris Golf Course Estate Commercial Area	Private Recreation, Hotel, Convention Centre and Associated Uses.	Structure Plan adopted to guide Subdivision, land use and Development - Glen Iris Golf Course Estate.

Table 4: TPS 3 Special Use Zones

The subject site is also included within Development Contribution Areas 13 (DCA 13) and 15 (DCA 15) under TPS 3.

Refer **Figure 5** – Existing City of Cockburn Town Planning Scheme No. 3 Zoning.

3.1.2.2. PROPOSED ZONING

A request to amend TPS 3 to rezone the site to 'Development' has been lodged concurrently with this Structure Plan. The rezoning of the land to 'Development' under TPS 3 will facilitate the integrated and cohesive development of the site for residential purposes.

The objective of the Development zone is –

To provide for future residential, industrial or commercial development to be guided by a comprehensive Structure Plan prepared under the Scheme.

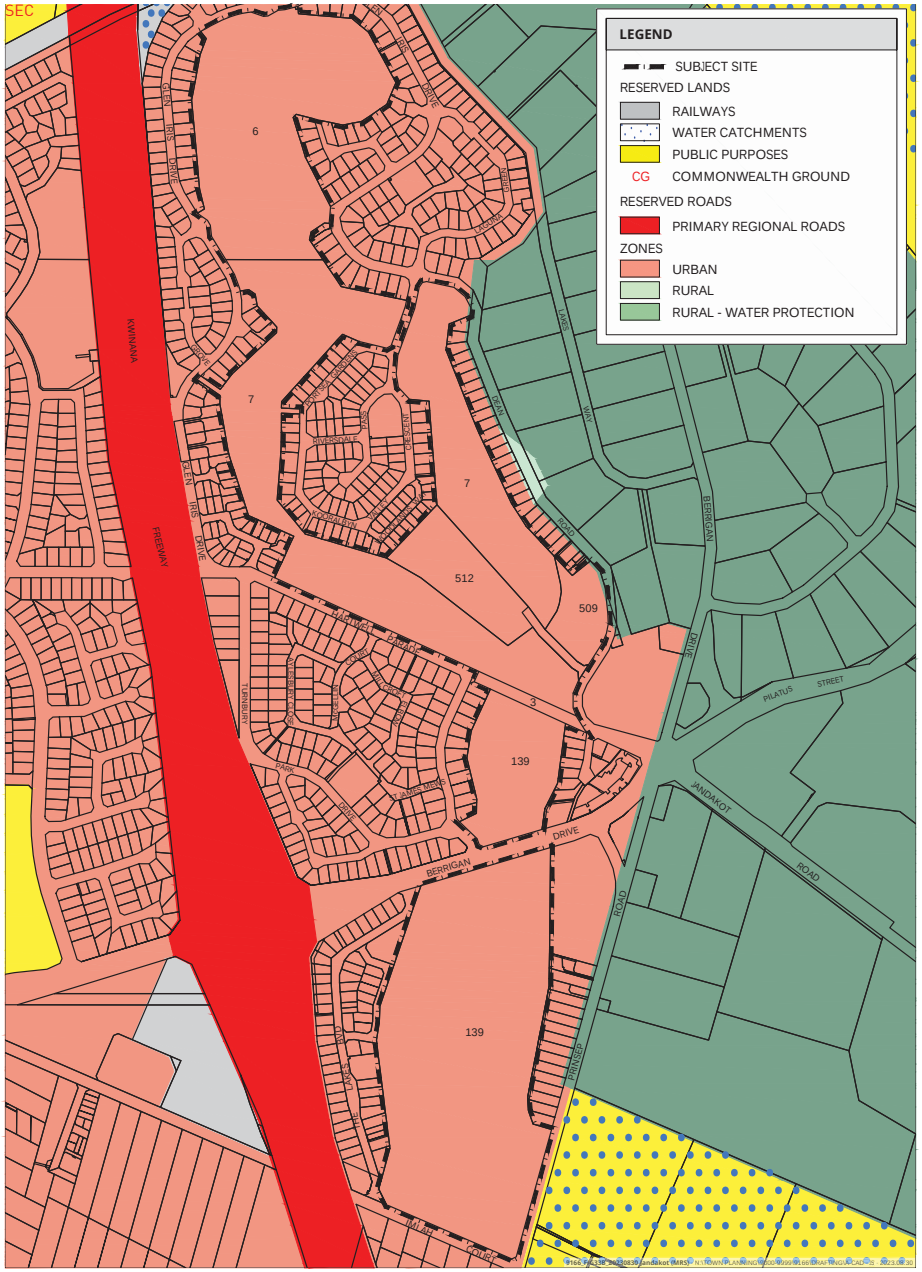
This Structure Plan has therefore been prepared in accordance with the objectives of the 'Development' zone.

Refer **Figure 6** – Proposed City of Cockburn Town Planning Scheme No. 3 Zoning.

3.1.3 Zoning History

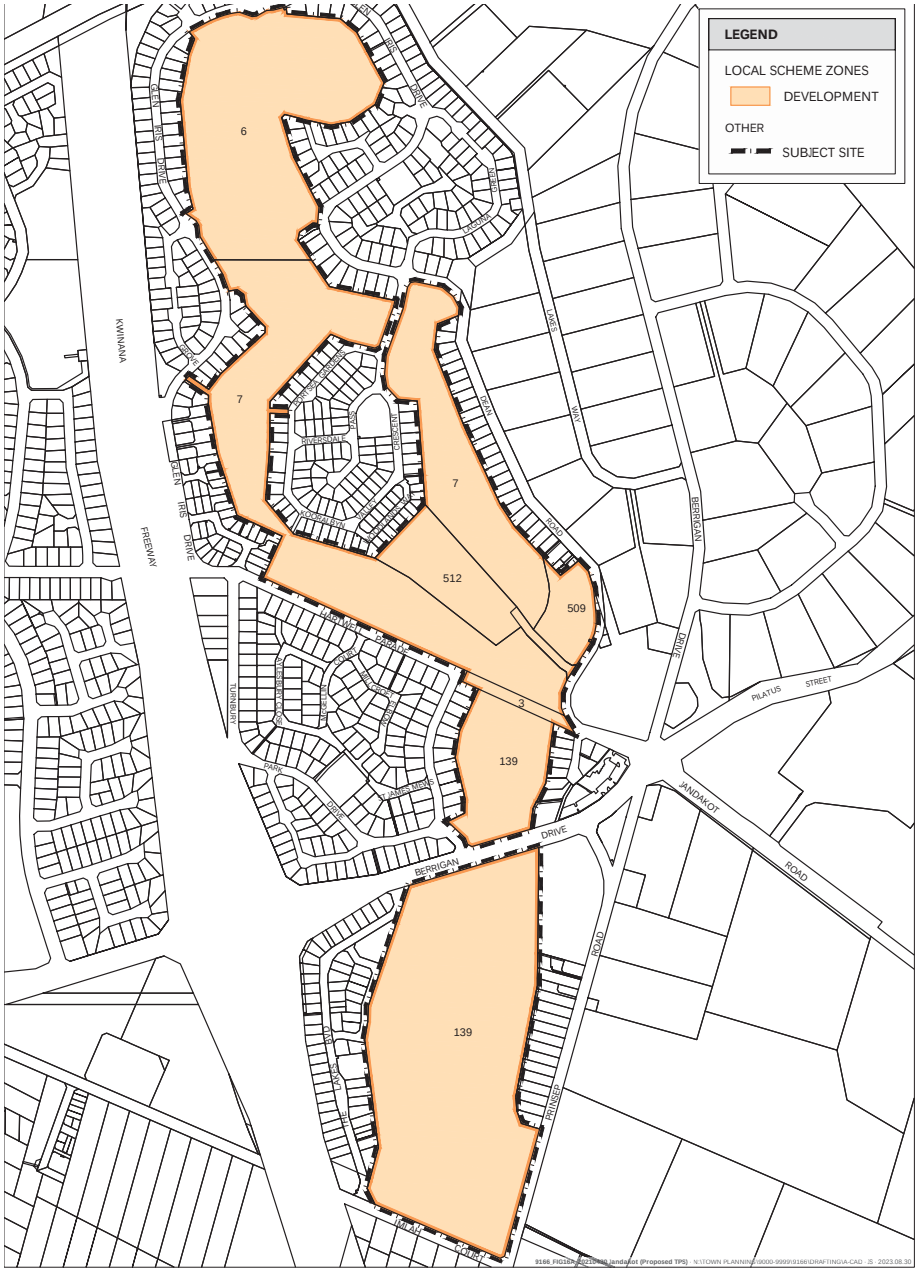
The subject site has had a varied history of zonings and amendments, which effectively facilitated the staged evolution of the site to an integrated golf course and residential estate.

The site has previously been zoned for commercial, hotel, private recreation and light industrial uses, which are understood to have been rationalised in the 1990s through various local scheme amendments. Rezoning proposals were also progressed during this period to increase residential densities in some surrounding areas from R12.5/15 to R20, R30 and R40. The previous zoning and land uses have been facilitated through Amendment numbers 64, 82, 119 and 168 to former District Planning Scheme No.2.



4. METROPOLITAN REGION SCHEME ZONING

5. EXISTING CITY OF COCKBURN TOWN PLANNING SCHEME NO. 3 ZONING



6. PROPOSED CITY OF COCKBURN TOWN PLANNING SCHEME NO. 3 ZONING

3.2 REGIONAL PLANNING STRATEGIES

3.2.1 PERTH AND PEEL @ 3.5 MILLION AND SOUTH METROPOLITAN PEEL SUB-REGIONAL PLANNING FRAMEWORK

Perth and Peel @ 3.5 Million seeks to meet the dwelling targets identified under *Directions 2031 and Beyond* ('Directions 2031') and the *State Planning Strategy 2050*. The infill dwelling target for the City of Cockburn is 14,680 new dwellings by 2050.

The suite of documents associated with *Perth and Peel @ 3.5 million* includes four Sub-Regional Planning Frameworks for the Central, North-West, North-East and South Metropolitan Peel sub-regions. The four Sub-Regional Planning Frameworks detail where future homes and employment should be located, and where important environmental assets should be avoided and protected.

The subject site is located within the *South Metropolitan Peel Sub-Regional Planning Framework* (the 'Framework'). The Framework represents a whole of State Government approach to managing the future urban form within the sub-region, and identifies sufficient land to meet the increased demand for residential dwellings. Within the Framework, the City is expected to require an additional 30,120 dwellings by 2050, of which 14,680 dwellings are expected to be delivered through infill.

Both *Perth and Peel @ 3.5 Million* and the *South Metropolitan Peel Sub-Regional Framework* identify the subject site as 'Urban', consistent with the site's zoning under the MRS.

3.2.2 JANDAKOT AIRPORT MASTER PLAN (2014) AND DRAFT (2021)

The Jandakot Airport Master Plan ('Airport Master Plan') was endorsed in 2014 to guide the development of Jandakot Airport over a 20-year period. It sets out the strategic direction for the efficient and economic development of the airport and considers a range of issues relating to both aviation and non-aviation matters.

A draft Master Plan was prepared in 2020, and is currently being advertised for public comment. Once finalised and endorsed, the draft Master Plan will replace the current 2014 Plan.

The subject site is not located within the boundaries of Jandakot Airport but is indirectly affected through off-site impacts associated with aircraft noise. The Airport Master Plan uses the Australian Noise Exposure Forecast ('ANEF') system to illustrate noise contours in and around the Airport, plotted at 20, 25, 30, 35 and 40 ANEF units. Part of the subject site is located within the 20 to 25 ANEF contour zone. The zoning, development and subdivision considerations relevant to land within this contour zone are addressed under the WAPC's *State Planning Policy No. 5.3 – Jandakot Airport* and are discussed in Section 3.4.6 of this report.

3.3 LOCAL PLANNING STRATEGIES

3.3.1 CITY OF COCKBURN LOCAL PLANNING STRATEGY (1999)

The City of Cockburn Local Planning Strategy ('Planning Strategy') sets out the long term planning direction for the City, covering a 10-15 year timeframe. It contains an 'Ultimate Strategic District Plan,' which provides a guide as to the ultimate land use pattern for the district, and a context for planning and development under both the MRS and TPS 3. The subject site is identified as 'Urban' on the Ultimate Strategic District Plan, consistent with its zoning under the MRS. The proposed Structure Plan is consistent with the site's designation under the Ultimate Strategic District Plan.

The Planning Strategy does not specifically consider the subject site in isolation but rather deals more broadly with a range of district-wide issues relating to matters such as housing, employment, shopping and transport.

In relation to housing, the Planning Strategy notes the opportunity for infill development within the City is limited due to the small size of existing lots and observes, as a consequence, these areas are likely to be redeveloped on a lot-by-lot basis. The Planning Strategy observes this has a subsequent effect on the timeframe for delivery of infill development.

Unlike these 'typical' infill opportunity sites, the subject site is held under a single ownership and comprises a significant land area (in terms of traditional infill sites). It is also largely cleared and generally unconstrained from an environmental perspective. As such, the subject site is not constrained by existing built form, small lot sizes, and fragmented land ownership. In this regard, the subject site provides a unique opportunity for infill development.

3.3.2 CITY OF COCKBURN DRAFT LOCAL PLANNING STRATEGY (2020)

The City has prepared a draft Local Planning Strategy ('draft Planning Strategy') to replace the current Planning Strategy and inform the preparation of a new Local Planning Scheme. The draft Planning Strategy was endorsed by Council at its meeting on 8 October 2020, and is currently with the WAPC awaiting consent to advertise.

The draft Planning Strategy sets out a vision for the City *"to create a sustainable, healthy, connected and prosperous Cockburn community"*. In achieving this vision, the draft Strategy follows five key themes of Environment, Urban Growth and Housing, Economy and Employment, Infrastructure, and Governance. Strategies and actions are provided for each theme.

The proposed Structure Plan has been considered in relation to the strategies and actions contained in the draft Planning Strategy. Having regard to the five key themes of the draft Planning Strategy, the proposed Structure Plan satisfies the following key strategies and actions:

- Focus development intensity in areas that are well-connected to infrastructure to best meet the needs of Cockburn's community, whilst protecting and enhancing the City's natural setting and environmental values, including ecological corridors (Urban Growth and Housing);
- Promote employment self-sufficiency for Cockburn's residents, and encourage new development and employment opportunities within proximity to centres and in areas accessible to where people live (Economy and Employment);
- Create a high quality and liveable urban environment that supports a thriving City that attracts more people to live, work and invest (Economy and Employment);
- Support and promote a transition to sustainable transport mode choices, and improve the efficiency of the City's movement network through integrated transport planning (Infrastructure);
- Prioritise co-location of services, facilities, housing and jobs to reduce trip distances, travel times and reliance on private motor vehicles (Economy and Employment);
- An evidence-based approach to land use planning and decision-making that responds to the local planning framework and considers community benefit (Governance); and
- Appropriate flexibility in the planning framework to respond to changes over time while ensuring the intent of this Strategy and the community's needs are considered (Governance).

The draft Planning Strategy identifies the site as 'Residential - Garden Character Area'. This designation is provided across most of the existing residential areas within the City and recognises the form of development in the existing portions of Glen Iris. The 'Residential - Garden Character Area' is characterised by elements such as open front setbacks; dwellings set amongst landscaping and open space; and dwellings with a form, scale, bulk, style and roof line that generally does not detract from the open, landscape character.

The proposed Structure Plan is consistent with the site's designation under the draft Planning Strategy as it proposes (via a Structure Plan) a form of development that is consistent with the key elements of the Garden Character Area.

In relation to urban infill, the draft Planning Strategy notes urban infill in the form of development of larger sites presents greater opportunities to integrate with the surrounding area; manage appropriate interfaces (streetscape and adjoining properties); rationalise access points and crossovers; and design for increases in traffic and parking that may be generated. Larger infill sites can also provide for a more coordinated outcome, as they allow for greater design flexibility.

The subject site presents a unique opportunity for infill development as it is a large, unused and predominantly cleared area, that is not constrained in the 'typical' manner by existing developed lots and fragmented land ownership (noting the site is held under a single ownership). In this regard, the proposed Structure Plan achieves a quality urban infill outcome consistent with the strategies and actions contained within the draft Planning Strategy.

3.3.3 CITY OF COCKBURN LOCAL COMMERCIAL AND ACTIVITY CENTRES STRATEGY (2012)

An existing commercial area is located on Berrigan Drive, immediately east of the subject site, and provides a variety of retail/shop, restaurant and medical land uses. The commercial area is identified in the City of Cockburn's *Local Commercial and Activities Centres Strategy* ('Commercial Strategy') as a 'Local Centre' with a retail-shop floorspace of approximately 2,146 m^2. Local Centres are defined in the Commercial Strategy as those that *"provide for daily and some weekly household shopping needs, and a very small range of other convenience services"*.

Opportunities for expansion of the Local Centre have been considered as part of the structure planning process and a Retail Needs Assessment has been undertaken by Taktics4. The Retail Needs Assessment indicates a small supermarket-based centre presents the most suitable opportunity for the site, having regard to the number of additional dwellings proposed through the redevelopment and the impacts on existing supermarket-based centres in the surrounding area.

The Structure Plan therefore proposes a Local Centre within the site on Lot 139, with frontage to Berrigan Drive. The location of the Local Centre provides an opportunity to integrate with the existing commercial area also located on Berrigan Drive. The Local Centre is proposed to be approximately 7,000m^2 (site area), with a retail floorspace allocation of approximately 2,500m^2. The Centre would likely comprise a supermarket of 1,500m^2 retail floorspace, and 5 -10 shops, food and beverage tenancies with a combined floorspace of approximately 1,000m^2.

The inclusion of the Local Centre land use is considered to be complimentary to the existing shops and uses on Berrigan Drive.

The expansion of the existing Local Centre is consistent with the Commercial Strategy principles which include:

- supporting the maturation of centres (Principle 3);
- optimising access to and within centres (Principle 5); and
- matching use with purpose (Principle 6).

The identification of a Local Centre within the proposed Structure Plan also respects the hierarchy of activity centres within the City, and is based on robust evidence and considered assessment, in line with the Commercial Strategy principles.

The findings and recommendations of the Retail Needs Assessment are discussed further in Section 5.8 of this report and copy of the Assessment is included in **Appendix 13**.

3.3.4 AGE FRIENDLY STRATEGY (2016)

The City of Cockburn's 'Age Friendly Strategy' was adopted in 2016 and identified many older residents within the City had spent most of their lives in the area and wished to continue to live in Cockburn.

The Age Friendly Strategy identifies Jandakot as a suburb with a high concentration of people over the age of 55 years (30% of the population), which is expected to rise by 2025 (to 38% of the population). The Age Friendly Strategy notes the provision of improved services and accommodation for older people in this area will become critically important and observes the provision of appropriate housing options is a key necessity.

The proposed Structure Plan will facilitate the development of additional undeveloped land suitable for residential purposes, that is of sufficient size to ensure it is developed in a comprehensively planned and coordinated manner. This will ensure the site provides for a diversity of housing needs and takes advantage of its proximity to the existing public transport network and established community facilities and services. The future development of the site provides opportunities for the provision of housing that is more appropriately suited to the occupiers needs. In this regard, the proposed Structure Plan is consistent with the recommendations and strategies contained within the Age Friendly Strategy, including ageing-in-place housing.

3.3.5 HOUSING AFFORDABILITY AND DIVERSITY STRATEGY (2018)

The City of Cockburn adopted its Housing Affordability and Diversity Strategy ('Housing Strategy') in 2018. The Housing Strategy builds upon the findings and recommendations contained within an earlier Strategy adopted in 2014. The key objectives of the Housing Strategy are:

- To provide households with access to housing appropriate to their needs in terms of size, physical attributes and location;
- To provide housing that is affordable to households of varying financial capacity;
- To provide a variety of housing types in locations with good accessibility to public transport, and essential services; and
- To promote affordable living, taking into consideration the total cost of living in a dwelling, including energy and water consumption, the price of transport to access employment and essential services, and other daily needs impacted by location.

The proposed Structure Plan responds to the objectives of the Housing Strategy by:

- Providing greater choice through lot and dwelling diversity, thereby increasing the number of affordable entry points into the housing market;
- Designating areas of medium density (R30) in strategic locations, to accommodate smaller houses with lower living/running costs and provide opportunities for existing residents to downsize, whilst remaining in the local area (ie. facilitating ageing-in-place);
- Providing additional housing in an area that is accessible to the existing public transport network (eg. Perth – Mandurah Railway Line and future METRONET Thornlie link), thereby reducing travel costs;
- Providing additional housing in proximity to existing employment areas, essential facilities, services and social activities (eg. Jandakot Airport, Cockburn Central District Centre);
- Developing unused land that is not significantly constrained by noise or bushfire risks and which may otherwise necessitate more expensive construction costs;
- Improving access to essential services through the expansion of the existing Local Centre on Berrigan Drive.
- Maximising north-south/ east-west lot orientation to reduce heating and cooling costs; and
- Promoting tree retention through design considerations such as road layout and public open space configuration, reducing the 'heat island' effect and subsequently reducing heating and cooling costs.

In this regard, the proposed Structure Plan is consistent with the objectives and recommended actions contained in the Housing Strategy.

3.3.6 URBAN FOREST PLAN (2018)

The City of Cockburn's Urban Forest Plan sets out a vision for the future management and expansion of the City's urban forest and directs the management of streetscapes and public open space to improve liveability and wellbeing.

The proposed Structure Plan satisfies the objectives and provisions of the Urban Forest Plan by:

- Providing approximately 17.94% of the gross subdivisible area as credited public open space (with a total 25% of green space, including the non-credited landscaped interfaces, the Western Power easement and conservation area), well in excess of the minimum 10% requirement under Liveable Neighbourhoods;
- Designing areas of public open space around the retention of trees – that is, locating areas of public open space to maximise the retention of existing trees;
- Retaining over 500 existing mature trees and planting over 1000 additional new trees;

- Undertaking a targeted tree survey as part of the Environmental Assessment Report to identify the location, species and quality of existing vegetation on site, informing design outcomes;
- Widened road reserve widths to accommodate street trees and other vegetation through the provision of a landscaped interface to existing residential development;
- Developing an unused parcel of land that has previously been cleared to facilitate its former use as a golf course, thereby reducing the need for additional clearing; and
- Satisfying the provisions of the City's *Local Planning Policy No. 5.1 'Subdivision and Development – Street Trees'* by providing street trees at a rate of one tree per lot.

The structure planning process will respond to the objectives and provisions of the Urban Forest Plan and in doing so, ensure development is undertaken in a coordinated and considered manner.

3.3.7 STRATEGIC COMMUNITY PLAN (2020)

The City of Cockburn Strategic Community Plan ('Community Plan') was adopted in 2020 and sets out the City's vision and outlines how the vision will be achieved. The Community Plan has five (5) broad strategic themes covering the Local Economy; Environmental Responsibility; Community, Lifestyle and Security; City Growth and Moving Around; and Listening and Leading. For each theme, the Community Plan identifies a list of *Priorities* and *Focus Areas*, based on feedback provided through consultation with the community.

The proposed Structure Plan has been considered in relation to the Community Plan and satisfies the following Priorities and Focus Areas:

- **Economic, Social and Environmental Responsibility**
  - Improved sustainability by utilising an unused parcel of land and providing additional dwellings in an area close to public transport (eg. Perth – Mandurah Railway line and future METRONET Thornlie link) and employment opportunities (eg. Jandakot Airport and Cockburn Central Secondary Centre);
  - Creation of new open spaces and parks accessible to everyone;
  - Increasing the urban tree canopy through additional street planting, landscaping of public open space and tree retention;
  - Upgrading parks and local infrastructure (such as roads and intersections);
  - Improved environmental outcomes, given a significant reduction in groundwater use and fertilizer application when compared to the former use as a golf course; and
  - 70% reduction of the 325 million litres of groundwater previously extracted to water the greens and fairways of the golf course.
- **Community, Lifestyle and Security**
  - Improved security and community safety through adherence with Crime Prevention through Environmental Design Principles; and
  - Enhanced open space network and opportunities for exercise options leading to improved health and wellbeing.
- **City Growth**
  - Revitalisation of an existing residential area; and
  - Managing an increase in population and housing density against the need to retain a desirable living environment. This is achieved through a careful design response that recognises the area's existing character.
- **Moving Around the City**
  - Road safety through improvement to the local road network, including construction of new intersections; and
  - Improved public transport options, including creating the opportunity for better connected and more frequent bus services.
- **Listening and Leading**
  - Community engagement and consultation-lead design response.

By redeveloping an unused parcel of land in a comprehensively planned and coordinated manner, the proposed Structure Plan will assist in delivering key Priorities and Focus Areas identified in the Community Plan.

3.3.8 COMMUNITY, SPORT AND RECREATION FACILITIES PLAN (2018)

The City of Cockburn adopted its *Community Sport and Recreation Facilities Plan 2018-2033* ('CSRFP') in 2018 to provide strategic direction and guidance on the provision of community, sport and recreation facilities across the City. The CSRFP also identifies current and planned sporting and recreational facilities that service each of the localities within its jurisdiction, based on current and future population growth. The CSRFP recommends 10% of every development be set aside as public open space, with 4.2% allocated to sporting grounds and 3.8% allocated to parks and recreational purposes.

The CSRFP recognises however, this level of provision is not going to be achievable on all occasions due to issues such as the size of the area available or the significant features of the area needing to be retained.

The Structure Plan provides for approximately 17.94% of the gross subdivisible area as credited public open space, with a total of approximately 25% being allocated as 'green space', distributed across 19 parks and an interconnected landscaped pedestrian network, catering to a range of recreational opportunities.

The public open space network has been designed around tree retention (with the proposed retention of some 500 mature trees across the site), and working with the existing topography and drainage flows across the site (including existing storage areas from surrounding residential development), as well as integration with the existing surrounding public open space and road network.

Further, the irregular linear configuration of the site, and being an infill development, does not necessarily provide the optimal attributes for the provision of large expanses of playing fields and sporting grounds. The public open space strategy does, however, consider the inclusion of a playing field through reimagining the existing Prinsep Park on the corner of Berrigan Drive and Prinsep Road. With some modifications and more discussion around confirming the oval's content and use levels, this may be achievable subject to further detailed design. This location is also considered to be ideal for the provision of a hard-court facility, as part of an active space for teens, as requested by the City of Cockburn.

The provision of playing fields at Prinsep Park will require a process of evaluation by the City that will include the assessment of a number of factors associated with the creation and use of the reserve. Should the City wish to pursue the use of Prinsep Park in such a manner, a separate process led by the City would need to be undertaken. The staging of implementation of development within the subject site has however been adjusted to provide sufficient flexibility to accommodate the playing fields should the Council resolve to pursue this option.

Developer Contributions will also be paid for the proposed development in accordance with the endorsed Development Contribution Plans for DCAs 13 and 15, involving the delivery of community facilities such as sporting grounds and playing fields. However noting, funds collected under DCAs 13 and 15 may only be used for the funding of specific infrastructure items listed in those schemes.

3.4 STATE PLANNING POLICIES

3.4.1 LIVEABLE NEIGHBOURHOODS

Liveable Neighbourhoods represents the Western Australian Planning Commission's ('WAPC') primary policy to guide the design and assessment of residential structure plans and subdivision. The underlying objective of Liveable Neighbourhoods is to create safe, sustainable and attractive neighbourhoods with a strong site responsive identity that reduce dependency on private vehicles, and are more energy and land efficient. As such, Liveable Neighbourhoods seeks to promote an urban structure based on walkable, mixed-use neighbourhoods with interconnected street patterns. It functions by drawing together key policy aspects into a single 'integrated planning and assessment policy' to provide for a performance-based approach to planning assessment. These aspects include:

- Community;
- Movement;
- Lot Layout;
- Urban Water Management;
- Public Open Space; and
- Schools.

Liveable Neighbourhoods identifies a series of objectives and requirements for structure plans that, when met, demonstrate compliance with the overall outcomes sought by Liveable Neighbourhoods. These objectives and requirements relate to items such as road layout, relationship of housing to open space and schools, school location/distribution, public open space layout and location, and housing densities.

Working with the site constraints, the Structure Plan has been prepared to satisfy the various objectives and requirements of Liveable Neighbourhoods to ensure more detailed proposals at subdivision stage are also capable of satisfying the relevant criteria.

3.4.2 STATE PLANNING POLICY 2.3 – JANDAKOT GROUNDWATER PROTECTION

Part of the site is currently classified as a Priority 3 Groundwater Protection Area, and is therefore subject to the principles and policy measures contained within the WAPC's *State Planning Policy 2.3 – Jandakot Groundwater Protection* ('SPP 2.3'). SPP 2.3 aims to protect the Jandakot Groundwater Protection Area from development and land uses that may potentially have a detrimental impact on the water resource.

The Department of Water (2016) *Land Use Compatibility Tables for Public Drinking Water Source Areas Water Quality Protection Note No 25*, details urban residential as an acceptable land use within a Priority 3 area. The site's location within the Jandakot Groundwater Protection Area therefore does not preclude residential development, although some specific land use and development restrictions/exclusions (such as a sewer pump station or a petrol station) may apply.

A Local Water Management Strategy ('LWMS') has been prepared in support of the proposed Structure Plan to examine the site's hydrological conditions and recommends a strategy for managing existing and future stormwater on-site. The LWMS demonstrates the site can be developed for urban (residential) purposes in accordance with the objectives of SPP 2.3 and without compromising the SPP's Groundwater Protection Principles.

Refer **Appendix 10** – Local Water Management Strategy.

3.4.3 STATE PLANNING POLICY 3 – URBAN GROWTH AND SETTLEMENT

State Planning Policy 3 – Urban Growth and Settlement ('SPP 3') sets out the principles and considerations which apply to planning for urban growth and settlement in WA. SPP 3 recognises:

> *The orderly planning of urban growth and settlement should be facilitated by structure plans, which should take into account the strategic and physical context of the locality, provide for the development of safe, convenient and attractive neighbourhoods which meet the diverse needs of the community, and facilitate logical and timely provision of infrastructure and services. Structure plans may consist of a hierarchy of plans ranging from broad district structure plans to more detailed plans for neighbourhoods and precincts.*
>
> *Proposals for future urban growth will be determined having regard to*
>
> - *the State Planning Strategy, relevant statements of planning policy and regional and subregional strategies in the State Planning Framework;*
> - *population projections provided by the Department for Planning and Infrastructure;*
> - *land release plans published by the Commission; and*
> - *local planning strategies prepared by local government and endorsed by the Commission.*

The proposed Structure Plan is consistent with the abovementioned objectives for future urban growth. Consideration of the strategic and physical context of the subject site is discussed further within this document and more detailed design provisions are to be addressed and considered at the subdivision stage.

3.4.4 STATE PLANNING POLICY 3.7 – PLANNING IN BUSHFIRE PRONE AREAS

State Planning Policy 3.7 – Planning in Bushfire Prone Areas ('SPP 3.7') seeks to guide the implementation of effective risk-based land use planning and development to preserve life and reduce the impact of bushfire on property and infrastructure. Part of the site (along the periphery) is identified by the Department of Fire and Emergency Services ('DFES') Map of Bush Fire Prone Areas as being 'bushfire prone' with the mapped bushfire risk coming from the adjacent areas of remnant vegetation.

Due to the subject site being identified as 'bushfire prone", the principles and objectives of SPP 3.7 need to be considered as part of the structure planning process. A Bushfire Management Plan ('BMP') has therefore been prepared by Ecological Australia in support of the proposed Structure Plan.

Refer **Appendix 5** – Bushfire Management Plan.

3.4.5 STATE PLANNING POLICY 4.2 – ACTIVITY CENTRES FOR PERTH AND PEEL

State Planning Policy 4.2 – Activity Centres for Perth and Peel ('SPP 4.2') sets out the broad planning requirements for the planning and development of new activity centres and the redevelopment and renewal of existing centres in Perth and Peel. An existing commercial centre is located on Berrigan Drive, immediately east of the subject site. The centre is defined as a 'Local Centre' under the provisions of the City of Cockburn's *Local Commercial and Activities Centres Strategy*.

Opportunities for expansion of the Local Centre have been considered as part of the structure planning process and a Retail Needs Assessment has been undertaken by Taktics 4. The Assessment indicates a small supermarket-based centre presents the most suitable opportunity for the site having regard to the number of additional dwellings proposed through the redevelopment and the impacts on existing supermarket-based centres in the surrounding area.

The Structure Plan therefore proposes a Local Centre within the site on Lot 139, with frontage to Berrigan Drive. The Local Centre is proposed to be approximately 7,000m², with a retail floorspace allocation of approximately 2,500m². The Centre would likely comprise a supermarket of 1,500m² retail floorspace, and 5 -10 shops, food and beverage uses with a combined floorspace of approximately 1,000m².

The Structure Plan provides for residential uses associated with the expansion of the Local Centre within a medium density walkable catchment. In this context, consideration has been given to the objectives of SPP 4.2 to provide for integrated urban development which provides for the daily and some weekly household shopping needs, and a small range of other convenience services.

The findings and recommendations of the Retail Needs Assessment are discussed further in Section 5.8 of this report and copy of the Assessment is included in **Appendix 13**.

3.4.6 STATE PLANNING POLICY 5.3 – LAND USE PLANNING IN THE VICINITY OF JANDAKOT AIRPORT

The subject site is located approximately 1.5 kilometres west of Jandakot Airport and accordingly, the provisions of *State Planning Policy 5.3 – Jandakot Airport Vicinity* ('SPP 5.3') are a relevant consideration in the structure planning process. SPP 5.3 recognises the strategic importance of Jandakot Airport, both as an element of transport infrastructure and as a local economic contributor. Its objectives are to protect Jandakot Airport from encroachment by incompatible land use and development, whilst also minimising the impact of airport operations on existing and future communities, with particular reference to aircraft noise.

SPP 5.3 is predicated upon the Australian Noise Exposure Forecast ('ANEF') system which is used to guide zoning, land use and development proposals. The *Jandakot Airport Ultimate Capacity ANEF Chart 2019* ('ANEF Chart') illustrates noise contours in and around the Airport, plotted at 20, 25, 30, 35 and 40 ANEF units. The contour plot is the calculated total noise energy at that given point on the ground on an annual average day. The higher the ANEF value, the greater the expected exposure to aircraft noise in that area. The ANEF contours contained in the ANEF Chart are calculated on the theoretical maximum movement capacity of the airfield and in this regard, represent maximum noise exposure levels.

The southern portion of the site, comprising part of Lots 3, 7, 512, 509 and 139, is identified on the ANEF Chart as being located between the 20 ANEF and 25 ANEF contours. The balance of the site is located below the 20 ANEF contour.

SPP 5.3 provides guidance on zoning, land use, residential density, subdivision, and development within each of the various ANEF contours based on *AS2021 – Building Site Acceptability Based on ANEF Zone*. Within the 20 to 25 ANEF zone, residential uses are deemed 'Conditionally Acceptable', meaning consideration should be given to the suitability of such uses within this noise exposure zone. Where land is zoned for residential purposes, SPP 5.3 recommends a maximum dwelling density of R20, except where:

- land is identified as appropriate for more intensive development through strategic planning instruments such as a regional or sub-regional structure plan;
- a higher density coding is desirable to facilitate redevelopment or infill development of an existing residential area; and
- it can be demonstrated the public benefits of higher density coding outweigh the negative impacts of exposing additional residents to aircraft noise.

The Structure Plan proposes residential uses within the 20 to 25 ANEF contour zone, predominantly at a density of R20 with some (limited) R30 in strategic locations where an increase in density is desirable. This includes areas of high amenity such as adjoining public open space; areas well serviced by, or connected to, the existing public transport network and strategic Transport connections such as the Kwinana Freeway; and areas located in proximity to the existing (and proposed expanded) Local Centre along Berrigan Drive.

Within the 20 to 25 ANEF contour, subdivision and development may be approved provided it is consistent with the zoning and density coding provided under the applicable local planning scheme. There are no restrictions on zoning, density or development within areas below the 20 ANEF contour.

The Structure Plan considers the objectives and policy measures of SPP 5.3 and responds appropriately by:

- Designating the land for residential land uses, consistent with its 'Urban' zoning under the MRS, and 'Urban' designation under *Perth and Peel @ 3.5 Million and the South Metropolitan Peel Sub-Regional Framework*;
- Limiting the density of residential development to predominantly R20;
- Designating R30 and R40 density development only in strategic locations where a higher density coding is desirable;

- Avoiding the designation of land for more sensitive land uses such as educational establishments, child-care premises and nursing homes;
- Assessing potential noise impacts through an Acoustic Assessment of the site and surrounds; and
- Identifying mitigation strategies to address aircraft noise and including these strategies in future Local Development Plans to be prepared for the site.

It is also relevant to note the adjoining area, which also falls within the 20 to 25 ANEF contour zone, has been developed for residential purposes ranging in density from R20 to R40.

An Acoustic Assessment has been undertaken in support of the proposed Structure Plan to examine the potential noise impacts from Jandakot Airport in further detail and recommend appropriate noise mitigation measures where required. These measures will be implemented through Local Development Plans and/or conditions of subdivision approval.

The Acoustic Assessment is contained at **Appendix 6** of this report and demonstrates compliance with SPP 5.3.

3.4.7 STATE PLANNING POLICY 5.4 – ROAD AND RAIL NOISE

The Kwinana Freeway (Primary Regional Road), Berrigan Drive, the Perth to Mandurah Railway Line, the Thornlie to Cockburn passenger rail line and the Yangebup Freight Rail Line are located in proximity to the site and accordingly, the provisions of *State Planning Policy 5.4 - Road and Rail Noise* ('SPP 5.4') are a relevant consideration. The general objectives of SPP 5.4 are to ensure people are protected from unreasonable levels of transport noise, and to ensure new development is compatible with existing transport corridors and freight operations.

An Acoustic Assessment has been undertaken in support of the proposed Structure Plan to examine the potential noise impacts from road traffic (Kwinana Freeway) and rail traffic (Perth to Mandurah Line and Yangebup Freight Rail Line) and recommend appropriate noise mitigation measures where required. These measures will be implemented through Local Development Plans and/or conditions of subdivision approval.

The Acoustic Assessment demonstrates the potential road and rail noise levels at the site are not at a sufficient level to require acoustic amelioration, but recommends notification be placed on the Titles of lots in proximity to the road and rail line. A copy of the Acoustic Assessment is contained at **Appendix 6** of this report.

3.5 LOCAL PLANNING POLICIES

The following City of Cockburn Local Planning Policies are to be addressed and considered through the subdivision and detailed design stages:

- Local Planning Policy No. 1.1 – Residential Design Codes Alternative Deemed to Comply Provisions;
- Local Planning Policy No. 1.2 – Residential Design Guidelines;
- Local Planning Policy 1.12 – Noise Attenuation;
- Local Planning Policy No. 1.16 – Single House Standards for Medium Density Housing in the Development Zone; (Note – the WAPC is in the process of preparing Medium Density Design Codes. Subject to the outcome of this process, LPP 1.16 may be revoked or amended.)
- Local Planning Policy No. 5.1 – Public Open Space;
- Local Planning Policy No. 5.2 – Incorporating Natural Areas in Public Open Space and/or Drainage Areas;
- Local Planning Policy No. 5.4 – Location of High Voltage Overhead Power Lines & Microwave Towers;
- Local Planning Policy 5.5 – Local Development Plans;
- Local Planning Policy 5.7 – Uniform Fencing;
- Local Planning Policy No. 5.15 – Access Street Road Reserve Pavement Standards;
- Local Planning Policy No. 5.18 – Subdivision and Development - Street Trees; and
- Local Planning Policy No. 5.19 – Structure Plans and Telecommunications Infrastructure.

4 SITE CONDITIONS AND CONSTRAINTS

The following provides a summary of the environmental conditions and constraints relating to the subject site. For further detailed information, refer to the Environmental Assessment Report ('EAR') contained at **Appendix 4**.

4.1 BIODIVERSITY AND NATURAL AREA ASSETS

4.1.1 FLORA AND VEGETATION

4.1.1.1. PLANT COMMUNITIES AND CONDITION

A Reconnaissance Flora and Vegetation Survey was undertaken to support the preparation of the EAR. The Survey recorded four (4) native plant communities present on the site.

Plant community ***EmB***, which is described as *"woodland to open woodland"*, was found to comprise the most intact native vegetation within the site, covering approximately 4% of the site. Some patches were mapped as being in 'very good – good' condition while others were mapped as being in 'good' and 'good – degraded' condition.

Plant community ***TdSt***, which is described as *"closed sedgelands"*, covers less than 1% of the site and was identified as being in 'good – degraded' condition as it comprises a combination of native and non-native species that only exist on the site due to the presence of the artificial lakes.

The two remaining plant communities ***Planted Trees and Shrubs*** (25% coverage) and ***Turf and Bare Ground*** (66% coverage) were mapped as being in 'completely degraded' condition, as they were dominated by non-native species or present only as bare non-vegetated areas on the site.

The remainder of the site supports multiple artificial lakes, buildings and hardstand that formed part of the former golf course. These areas were not assigned a condition category. As outlined in the EAR/EAMS reports, the golf course was historically established and expanded through the extensive clearing of native vegetation, and its replacement with irrigated turf and planted amenity tree species, some of which are native plant species. There were some small patches of native vegetation retained and some remnant scattered trees, which have continued to exist within the largely modified golf course environment.

The former golf course use required the application of fertilisers and considerable irrigation which created and maintained the modified and highly artificial environment. While this was critical to maintaining the turf, it also exacerbated the proliferation of invasive weeds within the patches of native vegetation which contributed to its degradation over time, which can be seen at the current time and is evidenced in the recent flora and vegetation survey. The patches of native vegetation were not being managed to retain natural values during the operation of the golf course.

Since the golf course has been decommissioned, with the associated decommissioning of the irrigation network and the cessation of fertiliser applications, the site may appear to have degraded. This primarily relates to the condition of the turf, which will appear to 'green up' and 'brown off' in response to the local seasonal climatic conditions. The established trees will not rely on the irrigation given their roots will have extended to the local groundwater table, and the native vegetation is naturally adapted to the local climatic conditions, hence it does not require irrigation.

The redevelopment of the golf course provides the opportunity to transfer parts of the golf course to public open space, which will ensure that areas intended for public amenity and use will be established and maintained appropriately, and areas of retained vegetation can be managed separately to enhance and maintain natural values. The Developer will play a key role in this to establish all areas prior to vesting of these areas to the City.

4.1.1.2. WEEDS

Mapping of weed species undertaken as part of the EAR revealed weed cover across the subject site is widespread, with moderate - high coverage across the site, particularly in the areas subject to historical disturbance. The areas within the site classified as turf and bare ground are also consistent with widespread weed cover.

No species listed as a declared pest pursuant to *Biosecurity and Agriculture Management Act 2007* or *Weeds of National Significance* were recorded within the site. Furthermore, no signs of Phytophthora dieback were observed within the site.

4.1.1.3. THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

No threatened or priority flora species ('TEC') were recorded within the subject site as part of the Reconnaissance Flora and Vegetation Survey undertaken for the site. Furthermore, there were no locally or regionally significant flora species recorded.

The Reconnaissance Flora and Vegetation Survey also noted the structure and composition of plant community ***EmB*** indicates it has the *potential* to represent Commonwealth listed TEC 'Banksia Woodland of the Swan Coastal Plain' (BWTEC), and the state listed PEC 'banksia dominated woodlands of the Swan Coastal Plain IBRA region'. However, due to the small size of the vegetation patches, it does not satisfy the criteria to be considered a TEC.

Notwithstanding, intensive targeted searches were undertaken in August and early September 2021 across the ***EmB*** vegetation, confirming none of the identified threatened or priority flora species were recorded. The absence of the larger perennial species such as *Jacksonia gracillima*, *Verticordia lindleyi* subsp. *lindleyi* and *Andersonia gracilis* was relatively easy to confirm. However, due to their size and seasonal lifeform, smaller annual or geophytic species such as *Drakaea elastica*, *Thelymitra variegata* and *Caladenia huegelii* can be more difficult to detect.

The targeted searches in August and September 2021 are considered sufficient to conclude that *Drakaea elastica* and *Thelymitra variegata* do not occur. The searches were conducted during the main growing and flowering period for these species and it is unlikely they would come to be recorded later in the season.

August and early September lie within the active growing period and the beginning of the flowering period of *Caladenia huegelii* and so the leaf and potentially the flower of *Caladenia huegelii* would be expected to be visible at this time, if present. Suitable habitat in the site was intensively searched and no evidence to indicate that *C. huegelii* occurs, such as flowering individuals or sterile orchid leaves, was recorded. Therefore, it was considered very unlikely that *Caladenia huegelii* would occur within the site. Nevertheless, further targeted flora and vegetation surveys were undertaken on the 7th and the 28th of October 2021. These surveys confirmed that no locally or regionally significant flora species (including *C.huegelii*) are present within the site.

No Bush Forever sites occur within the subject site or immediate surrounds. Furthermore, no *Environmentally Sensitive Areas* prescribed under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* are present within or in proximity to the site.

The City of Cockburn 'Towards a Green Network' and 'Natural Area Management Strategy' documents identify two local ecological linkages/corridors. One of the linkages primarily comprises the rural residential land to the east of Dean Road with a very small portion of the linkage entering the subject site. The second linkage aligns with the Western Power easement located along the southern edge of the site adjacent to Imlah Court. The extent to which the site contributes to these linkages is limited by the lack of native remnant vegetation within the site, but is proposed to be retained as open space in any event.

4.1.2 FAUNA

A Level 1 Fauna Survey and targeted Black Cockatoo Habitat Assessment were carried out by Emerge Associates to determine the fauna values associated with the subject site.

Five fauna habitats were recorded on the site. The majority of the site supports turf, bare ground and infrastructure, which provides low habitat values for native fauna. The native woodland habitat provides the highest relative value but, as this habitat extends over a small portion of the site (4%) and occurs as scattered patches, the importance of this habitat to native fauna is limited. The remainder of the site supports planted trees and shrubs, which provide varying habitat values depending on plant species and density.

11 black cockatoo habitat trees were recorded on the site, however none were determined to be suitable for breeding due to the absence of suitable hallows. Approximately 4.9 hectares of Carnaby's Black Cockatoo and Forest Red-tailed Black Cockatoo foraging habitat exists on the site, and extensive areas of foraging habitat for both species occur adjacent to the site and in the wider area.

15 native, two introduced and two conservation significant fauna species were recorded at the site. The conservation significant species recorded were:

- Carnaby's black cockatoo listed as 'endangered' under the EPBC Act; and
- Quenda, listed as Priority 4 at the state level.

In addition, 45 further species of conservation significance have potential to occur on the site. The majority of these are birds which may only use the site intermittently if at all, including forest red-tailed black cockatoo which are 'likely' to occur due to potential habitat present at the site.

Given the fragmented nature of existing native vegetation within the site, it is considered unlikely the site would contain any habitat critical to the survival of any terrestrial fauna species or any species of conservation significance. Where possible, trees will be retained as part of construction, with tree retention opportunities identified as part of the detailed design phase. It is currently anticipated up to 8 of the 11 Black Cockatoo breeding habitat trees could be retained on site in public open space and road reserve, subject to detailed engineering design. Where trees are to be retained, these will be detailed within the Construction and Environment Management Plan ('CEMP').

The site contains foraging habitat for Black Cockatoos, which are listed as *Matters of National Environmental Significance* ('MNES') under the *Environmental Protection and Biodiversity Conservation Act* ('EPBCA'). Construction work undertaken following the approval of subdivision or development applications has the potential to impact this foraging habitat, and therefore impact the MNES. However, based on the ecological survey work undertaken and the preliminary subdivision layout designs prepared for the site, it is considered these potential impacts would not be significant. Therefore, a referral to the Department of Climate Change, Energy, the Environment and Water ('DCCEEW') for a determination as to whether the proposed redevelopment of the site constitutes a 'controlled action' requiring an EPBC Act approval is not currently required, given only potentially significant impacts trigger the referral process.

Once the detailed designs have been progressed to subdivision and/or development application stage, there will be sufficient certainty to confirm the extent of any impact to the Black Cockatoo species. Using this design information, a self-assessment in accordance with DCCEEW's *Matters of National Environmental Significance Significant Impact Guidelines* will be undertaken to determine if the confirmed impact extent raises any issues that will alter the current view that any impact to the Black Cockatoo species will not be significant. While there is currently no expectation this view will be altered, it is recognised that if the self-assessment raised sufficient doubt, a referral might be required to obtain regulatory certainty.

In addition to the above, a Fauna Relocation Management Plan will be required as a condition of subdivision approval, to be prepared and implemented by the Proponent, in relation to the local Quenda population.

4.1.3 WETLANDS

The Department of Biodiversity Conservation and Attractions '(DBCA') Wetland Mapping does not identify any wetlands within the subject site.

4.2 LANDFORM AND SOILS

4.2.1 TOPOGRAPHY

The topography of the subject site ranges from approximately 25 metres Australian Height Datum ('AHD') in the southern portion of the site up to approximately 40 metres AHD in the northern portion of the site.

4.2.2 GEOLOGY

The subject site is located on the Swan Coastal Plain, which is the geomorphic unit characterising much of the Perth Metropolitan Area.

Regional soil association mapping indicates the subject site is within the Bassendean soil association, which is described as *"sand plains with low dunes and occasional swamps, iron or humus podzols and areas of complex steep dunes"*. This site geology was confirmed by field surveys undertaken by Emerge Associates.

Desktop research and field surveys did not identify any restricted landforms or unique geological features present at the subject site.

4.2.3 ACID SULPHATE SOILS

The Department of Water and Environmental Regulation ('DWER') Acid Sulphate Soils ('ASS') Mapping identifies the subject site as having a 'moderate to low' risk of ASS occurring within 3 metres of natural soil surface, but 'high to moderate' risk of ASS beyond 3 metres of the natural soil surface.

As there is appropriate separation to groundwater, and the regional ASS mapping indicates there is 'moderate to low' risk of encountering ASS within 3 metres of the natural soil surface, ASS is not considered to pose a significant constraint to the proposed urban development of the site. Notwithstanding, any management measures required to address any potential risk from ASS will be further explored prior to subdivision and will be subject to more detailed engineering and environmental advice at that time.

4.2.4 CONTAMINATION

The Department of Water and Environmental Regulation's ('DWER') Contaminated Sites Database does not list the subject site as being a known or suspected contaminated site.

4.3 GROUNDWATER AND SURFACE WATER

4.3.1 GROUNDWATER

The DWER *Water Register* indicates the site is underlain by a multi-layered aquifer system comprised of the following resources:

- Perth – Superficial Swan (unconfined).
- Perth – Leederville (confined).
- Perth – Yarragadee North (confined).

The DWER *Water Information Reporting Tool* indicates the current water table in the northern part of the site is 18 metres below surface level, with the base of the aquifer 59 metres below surface level. In the southern part of the site, the water table is 4 metres below surface level with the base of the aquifer 47 metres below surface level.

It is unlikely that provision of appropriate separation distance between surface levels and groundwater will require further consideration within the site. Groundwater and surface water runoff will be managed in accordance with the endorsed *Better Urban Water Management Framework* ('BUWMF') and will aid the Local Water Management Strategy for the site.

4.3.2 SURFACE WATER

There are no natural surface water bodies present within the subject site.

The site does not have a connection to any arterial drainage scheme, and all stormwater that is generated on site is infiltrated. Currently the site provides stormwater storage and infiltration areas for adjacent developed areas which drain into the site, including 18 bubble-up pit outlets.

There were a number of open water bodies within the site, associated with the previous golf course use. The majority of these water bodies were lined and ornamental, with one in the south of the site being an excavation into the regional groundwater table. The water bodies have been rationalised since the golf course has ceased operating, however some of the water bodies in the area north of Berrigan Drive also serve an existing drainage function.

Surface water runoff will be managed in accordance with the Better Urban Water Management framework, which includes maintenance of the post-development environment in accordance with the pre-development environment. This will ensure the proposed urban development does not impact on surrounding environmental values.

4.3.3 PUBLIC DRINKING WATER SOURCE AREAS

Parts of the subject site are located within a Priority 3 (P3) Public Drinking Water Supply Area ('PDWSA'), being the '*Jandakot Underground Water Pollution Control Area*' (UWPCA). A review of the Department of Water's *Land Use Compatibility Tables for Public Drinking Water Source Areas* indicates land zoned for urban purposes is an acceptable use within a P3 PDWSA.

Three Water Corporation Jandakot Mound production bores are located adjacent to the eastern boundary of the site. Water Corporation bores have a 300 metre radius wellhead protection zone (WPZ) in PDWSA Priority 2 and Priority 3 areas. All three bores have WPZs that extend into the Structure Plan area. A fourth Water Corporation bore is located within the site near the old clubhouse on Lot 509. This bore is no longer in use, however a WPZ still exists.

Advice from DWER indicates urban development within WPZ areas is permitted, consistent with an underlying Priority 3 classification, although some restrictions and exclusions may apply, such as locating a sewer pump station or petrol station in these areas.

4.4 BUSHFIRE MANAGEMENT

Portions of the subject site are identified on the Department of Fire and Emergency Services ('DFES') mapping as being bushfire prone. Therefore, as required by State Planning Policy 3.7: Planning in Bushfire Areas (SPP 3.7), a Bushfire Management Plan has been prepared for the site in support of this Structure Plan, with a copy provided at **Appendix 5**. The Bushfire Management Plan has been prepared in accordance with the requirements set out under the Guidelines for Planning in Bushfire Prone Areas (the Guidelines).

An assessment of the classified vegetation and effective slope within 150 metres of the site was undertaken on the basis of the following assumptions, in accordance with the indicative subdivision concept plan prepared for the site (refer **Figure 5**):

- Majority of the site has been excluded from classification on the basis the land is either cleared or is proposed for residential development, or is proposed to be landscaped with low threat vegetation in the form of streetscapes, public open space, planted drainage basins and screen planting;
- Two pockets of retained Banksia scrub in the northern and southern portions of the site have been classified; and
- The current extent of classified vegetation within the Western Power easement in the south of the site has been retained, however may be modified to low threat vegetation as part of the development of the site.

Classified vegetation across the site includes 'Class C Shrubland', 'Class D Scrub' and 'Class G Grassland', with an effective slope classification of 'all upslopes and flat land (0 degrees)'.

Vegetation is primarily proposed to be retained (and managed) on site in public open space and streetscapes, and within two areas of retained Banksia scrub, with the balance of vegetation intended to be cleared to facilitate development of the proposed residential lots. Therefore, the post-development vegetation is not considered a significant bushfire risk, with any hazards readily managed through a staged clearing process, adequate separation of future built assets from classified vegetation (both external and internal [e.g. retained vegetation] to the subject site), and ongoing fuel management that can be undertaken in and around individual development stages.

The indicative Bushfire Attack Level (BAL) assessment (Figure 10 and Figure 11 of the BMP) highlights the development will not result in a BAL rating of BAL-FZ or BAL-40, except for portions of one residential and one group housing cell adjacent to retained Banksia Class D Scrub and/or the Western Power easement. The indicative lot layout will be finalised at subdivision stage and will be designed so that all residential or group housing lots are subject to a BAL rating of BAL-29 or below. The internal road structure will be developed to allow separation from proposed residential lots and bushfire hazard interface, where appropriate.

On this basis, the Bushfire Management Plan considers the bushfire hazards within and adjacent to the subject site, and the associated bushfire risk readily manageable through standard management responses. On implementation of the proposed management measures, the subject site will be able to be developed with a manageable level of bushfire risk, while maintaining full compliance with the acceptable solutions outlined in the Guidelines.

A further Bushfire Attack Level assessment and contour plan will be required to be submitted with any subsequent subdivision applications.

Refer **Appendix 5** – Bushfire Management Plan.

4.5 HERITAGE

4.5.1 ABORIGINAL HERITAGE

A search of the Department of Planning, Lands and Heritage Aboriginal Heritage Inquiry System identified no registered sites within the Structure Plan area or immediate surrounds.

4.5.2 EUROPEAN HERITAGE

A search of the Heritage Council of Western Australian's Register of Heritage Places identified no sites of State heritage significance within the subject site or immediate surrounds.

A search of the City of Cockburn's Municipal Heritage Inventory identified no sites of local historic significance within the subject site or immediate surrounds.

4.6 CONTEXT AND OTHER LAND USE CONSTRAINTS AND OPPORTUNITIES

4.6.1 EXISTING RESIDENTIAL DEVELOPMENT

There is existing development surrounding the subject site, with several residential lots and existing roads directly adjoining the site. This existing development was established through the 1990's as part of the Glen Iris Golf Course Estate. Whilst the golf course has now closed, there is an established community expectation of a 'green' outlook for those lots directly abutting the site, being the former golf course.

Given the established existing community expectations for the site, careful consideration of the design outcomes have been required to manage the perceived and potential amenity impacts of the development of the site. In this respect, the Structure Plan includes a mix of public open space, landscaped interface treatments and existing road reserves to act as a 'buffer' between the existing and proposed residential development.

The proposed retention of approximately 500 existing mature trees and the planting of some 1000 new trees across the site will also assist in managing the interface with the existing residential development, and maintaining the existing character of the area.

Further, it is proposed that existing rear fences (excluding retaining walls) will be upgraded where suitable and necessary to manage level differences and any impact of development works. This is proposed to be undertaken in consultation with the individual affected adjoining landowners, at the subdivision stage. Where lots adjoin public open space or road reserves (including landscape interface areas), uniform fencing is expected. Consideration for direct access from existing lots to areas of public open space will also be explored through detailed design. Such elements will be managed through Local Development Plans.

4.6.2 WESTERN POWER HIGH VOLTAGE POWER LINE EASEMENT

There is an existing Western Power high voltage power line easement traversing the site along its southern boundary. The easement is approximately 40 metres wide.

Whilst Western Power policy requirements limit land use and construction within the easement, it is anticipated the easement will be landscaped and will provide for the storage of some local drainage. The Structure Plan also proposes a road through the easement, providing a connection from the site to Imlah Court.

All construction and landscaping undertaken within the easement will be designed in accordance with Western Power requirements, and will be subject to all relevant approvals.

The Western Power easement area has been excluded for the purposes of calculating public open space contributions. Notwithstanding, the area provides an ecological linkage/corridor as identified in the City's 'Towards Green Network' and 'Natural Area Management Strategy', and will therefore be created as a public open space reserve, to be transferred and managed by the City.

4.6.3 EXISTING DRAINAGE

The site currently provides stormwater storage and infiltration areas for the existing surrounding development. There are currently 18 bubble up pit outlets that drain into the site from the existing surrounding development, discharging into 15 separate drainage areas. These drainage areas range from wet basins to shallow informal depressions to fenced, steep sided, deep sumps. The existing drainage infrastructure is largely protected through easements on Title.

Post development, the site will be required to continue to provide stormwater storage for the external catchment. Therefore, the design of the site has been required to consider and allow for the retention of existing outlets and storage areas. Some modification and relocation may be possible, subject to detailed engineering design.

To provide for design efficiency, the stormwater management approach for the site has considered the integration of the site's internal drainage requirements with the existing storage areas.

The design of the proposed development provides the opportunity for a range of Water Sensitive Urban Design outcomes, including at source infiltration. This provides for a better environmental outcome than the current drainage regime on site, which primarily comprises sumps, as well as providing for a higher amenity outcome for residents.

Refer **Appendix 10** – Local Water Management Strategy for further detail.

4.6.4 ACOUSTIC ASSESSMENT

The subject site is situated within proximity to the Kwinana Freeway, Berrigan Drive, the Perth-Mandurah Passenger Railway Line (within the Kwinana Freeway Reserve), the future Thornlie to Cockburn Passenger Railway Line, the Yangebup Freight Rail Line, and the Jandakot Airport. An Acoustic Assessment has therefore been undertaken for the site in accordance with the requirements set out under *State Planning Policy 5.4: Road and Rail Noise* (SPP 5.4) and *State Planning Policy 5.3: Land Use Planning in the Vicinity of the Jandakot Airport* (SPP 5.3) and in accordance with the *City of Cockburn Local Planning Policy 1.12 Noise Attenuation* (LPP 1.12). Refer **Appendix 6**.

Road Noise

Concept planning proposes residential and commercial development in proximity to Berrigan Drive and the Kwinana Freeway. Therefore, noise levels for the future road traffic are such, that at some of the lot façades, the noise could exceed the 55 dB(A) noise target. Therefore, amelioration in the form of Quiet House Design is required. These areas have been identified in the Acoustic Assessment and general "deemed to satisfy packages" as per the SPP 5.4 guidelines applied. Detailed design for these requirements can be applied at subdivision staging once further information is available. A noise wall is also required for lots backing onto Berrigan Drive.

Further, the lots exceeding the target noise levels in this area would require a notification on Title advising of the Kwinana Freeway and Berrigan Drive noise impact.

Kwinana Freeway and Perth-Mandurah Railway Line

The Acoustic Assessment identifies two areas which exceed the 55 dB(A) noise target based on the future Kwinana Freeway traffic flows, however this is marginal and not at a sufficient level to require acoustic amelioration within the site. Notwithstanding, as noise levels exceed the noise target, the residential lots in this area would require Notifications on Title, advising of the potential noise impact.

Future METRONET Thornlie-Cockburn Link

As there are existing residential premises located adjacent to the proposed rail line, development of the future rail line operations needs to consider these highly noise sensitive premises.

Review of the preliminary design noise levels, as provided in the *Thornnlie-Cockburn Link Noise and Vibration Assessment Report Number 675.10409.00100-R01* indicates noise levels to these existing residential premises will be designed such that the target noise levels (as per SPP 5.4) will be met. Therefore, noise modelling of the future proposed rail would not be required for this development as the infrastructure provided will meet the requirements of SPP 5.4 for existing residential premises closer to the rail line.

Yangebup Freight Rail Line

Due to the existing topography of the Freight Line (situated in a cutting) and the existing noise wall and residential development between the rail line and the Structure Plan area, the noise levels for the worst-case future scenario of one train per hour have been assessed as being below the night time noise target criteria. On this basis, there are no acoustic requirements for the subject site resulting from the Yangebup Freight Rail Line.

Jandakot Airport

Based on guidance from SPP 5.3, the majority of the northern section of the Structure Plan area is acceptable for residential development.

Areas within the Structure Plan area situated within the ANEF 20 to 25 contour are also acceptable for residential development, however subject to conditions. These conditions require internal noise levels (for aircraft noise events) to meet the criteria detailed in AS2021. This is particularly relevant due to a number of factors, including the type of aircraft using the airport, the activities undertaken at the airport and the Structure Plan area's positioning, almost entirely beneath the approach/ departure splays of the two main runways. The enclosed Acoustic Assessment (Refer **Appendix 6**) identifies the affected lots.

All residential lots within the Structure Plan area will be subject to a Notification on Title, in accordance with *State Planning Policy 5.3: Land Use Planning in the Vicinity of Jandakot Airport*. An example of a notification is provided below:

> *"This lot is situated in the vicinity of Jandakot Airport, and is currently affected, or may in the future, be affected by aircraft noise. Noise exposure levels are likely to increase in the future as a result of increases in numbers of aircraft using the airport, changes in aircraft type or other operational changes. Further information about aircraft noise, including development restrictions and noise insulation requirements for noise-affected properties, are available on request from the relevant local government offices."*

Further, development will also be required to comply with the *City of Cockburn Local Planning Policy 1.12 – Noise Attenuation* ('LPP 1.12'). This includes the recommended minimum glazing standard and other noise mitigation measures.

Industrial Noise

Land located south of Imlah Court, south of the Structure Plan Area, comprises existing industrial development. The attached Acoustic Assessment considers the impact of industrial related noise on the future residential development within the southern portion of the development, and recommends the following noise amelioration measures be implemented to achieve compliance with the *Environmental Protection (Noise) Regulations 1997*:

- Noise Wall (1.8 metre high, solid, masonry barrier to Prinsep Road);
- Upgrade Building Design (As per the requirements for ANEF 20/25 dwellings set out within SPP 5.3); and
- 50 metre setback to industrial development, achieved via road and buffer.

Through implementation of the above, noise levels can be managed, regardless of compliance with the regulatory criteria. Refer **Appendix 6** – Acoustic Assessment.

4.6.5 TREE RETENTION

One of the key design considerations for the site has been premised on the retention of existing mature trees and vegetation. The Structure Plan proposes to retain some 500 existing mature trees across the site, through public open space distribution and configuration, and streetscape considerations. The retained trees on site comprise a range of species, including both local and introduced.

Two small areas of existing Banksia bushland are also proposed to be retained within the site, as well as the potential to retain 8 of the 11 Black Cockatoo habitat trees surveyed on site, subject to detailed engineering design

In addition to the trees proposed to be retained on site, it is intended that some 1,000 new trees will be planted. These will comprise trees of local character, preferably being endemic and native to the site. This will provide for local ecosystems as habitat for a range of endemic fauna.

The retention and planting of a substantial number of mature trees and vegetation across the site not only has key environmental benefits, but also seeks to provide a strong sense of place and character, and soften the landscape within an existing residential area, meeting established community expectations for the site.

4.6.6 EXISTING ROADS

The site is dissected by Berrigan Drive, which runs east west through the site, connecting Jandakot Road to the Kwinana Freeway. Berrigan Drive is classified as a District Distributor A road under Main Roads WA's *Functional Road Hierarchy* and has a posted speed limit of 70km/hr.

Traffic volumes along Berrigan Drive have continued to grow at a consistent and relatively high rate over the past 5 years to 2021, resulting in very poor and worsening levels of service and diminishing safety for existing residents in the surrounding area.

The Structure Plan proposes one crossing of Berrigan Drive, by the proposed Neighbourhood Connector, to provide for connectivity between the northern and southern portions of the site. This intersection is proposed to be managed by a new signalised intersection, accommodating the additional traffic generated by the proposed development, and improving access for existing residents. Refer Transport Impact Assessment at **Appendix 9** for further detail.

The Structure Plan also proposes modifications to The Lakes Boulevard, making it a left-in, left-out intersection, as well as closing the intersection of Turnbury Park Drive with Berrigan Drive.

The Structure Plan seeks to minimise residential development fronting Berrigan Drive, through the provision of public open space and the strategic location of the proposed Local Centre. Where residential development is proposed, no direct access will be permitted from Berrigan Drive, with interface treatments managed through a Local Development Plan.

There are also a number of existing local access roads surrounding and adjoining the boundary of the site. These are proposed to be retained through the development of the site and have been considered as part of the overall design response.

4.6.7 JANDAKOT AIRPORT AIRSPACE

The airspace over the Jandakot Airport is protected under both the Airports Act 1996 and Airports (Protection of Airspace) Regulations 1996, with Jandakot Airport being one of the two leased Federal airports in Western Australia. In this regard, activities which would result in an intrusion of protected airspace are subject to the approval of the Airport operator. Controlled activities include (but are not limited to):

- Permanent structures, such as buildings, which intrude into the protected airspace;
- Temporary structures, such as cranes, which intrude into the protected airspace; and
- Any activities causing intrusions into the protected through glare from artificial light or reflected sunlight, air turbulence from stacks or vents, smoke, dust, steam or other gasses or particulate matter.

According to the Commonwealth Department of Infrastructure, Transport, Regional Development, Communications and the Arts, local governments within the vicinity of an airport's protected airspace are required to review all building and development applications received for any potential intrusions into protected airspace. Proposals are forwarded to the airport operator for comment and would require separate approval by the airport operator.

5 LAND USE AND SUBDIVISION REQUIREMENTS

5.1 LAND USE

The Structure Plan sets out land use, residential densities, public open space, public and private transport provision, environmental considerations, hydrological and servicing requirements.

The Structure Plan comprises residential development with density codes ranging from R20 to R40. The Structure Plan also comprises areas of public open space and a local centre.

The following describes the design response underpinning the Structure Plan and addresses the relevant elements of Liveable Neighbourhoods. Please also refer to the Land Use Summary Table provided within the Executive Summary on Page IV of this report.

The Structure Plan layout has been carefully considered within the site's location. The proposed Structure Plan contributes a residential infill development opportunity within an existing contained residential area. It is well located adjoining Berrigan Drive to the north and south, which provides connections to major transport infrastructure. The site maintains an interface (buffer) with existing residential dwellings, within its surrounding residential area and associated movement network.

Refer **Plan 1** – Structure Plan.

Refer **Figure 7** – Indicative Subdivision Concept.

7. INDICATIVE SUBDIVISION CONCEPT

5.2 DESIGN RATIONALE

The subject site is situated on 53.74 hectares of vacant land within an existing residential locality of approximately 130 hectares. The existing residential locality is inherently confined by surrounding land uses, including the Rural Residential land to the east, Kwinana Freeway to the west, freight rail to the north and industrial land uses to the south. The site provides an opportunity for a residential infill development integrated with, and building upon, the existing residential area. The future development of the site will enhance the sense of community within the locality, whilst providing housing opportunities within proximity to major services and infrastructure.

The design rationale has been informed through an extensive community engagement process undertaken with representatives from the Glen Iris Project Reference Group. The outcomes of the community engagement are outlined in the Community Engagement Report provided at **Appendix 1** and summarised at Section 1.2 of this report.

Through the community engagement process, the following priority areas for consideration were identified:

- Traffic and Access;
- Future Housing;
- Open Space and Environment;
- Interface with existing residences; and
- Local Amenities.

The above elements have been considered within the Structure Plan to provide for a site responsive design that integrates with, and is in keeping with, the characteristics of the existing residential area. The increase in the residential population provides the impetus for improved community facilities (public open space) and services.

The layout includes and repeats design elements currently found in Glen Iris to assist with the integration of the new development with the existing residential area. These design elements include:

- Meandering road layout;
- Interconnected pedestrian network;
- Substantial areas of open space;
- Direct lot interface with open space;
- Combination of linear open space and traditional open space;
- Cul-de-sacs connected with PAWs;
- Dispersed Group Housing / Strata development;
- 4-Packs subdivision layout, ensuring retention of existing streetscape; and
- Integration of commercial development with the existing Local Centre.

The design considerations have been addressed through the following sections.

5.2.1 TRAFFIC AND ACCESS

The proposed movement network has been designed to integrate with the existing road network, to improve traffic flows for the existing residents, whilst accommodating traffic generated by the future subdivision within the site. Connections to the existing road network have been integrated at all possible and logical access locations to provide for a legible and considered distribution of traffic.

The vehicle movement network has been designed in consultation with the project traffic engineers to encourage all additional vehicle traffic generated by the proposed development to utilise the proposed internal subdivision roads, and to be directed primarily to Berrigan Drive. Through consultation with representatives from the City, it is understood there is a desire to create a road link between Dean Road and Lakes Way. Although there are two potential existing accessways that may assist in addressing this request, they are outside the Structure Plan area and may not be ideally located. Other than these accessways, the land between Dean Road and Lakes Way is held in private ownership making the provision of a new road problematic in this area.

It is however noted the 'Resource' zoned area east of Dean Road has been identified by the WAPC as part of the Jandakot/Treeby Planning Investigation Area. The future land use for this area will be finalised as part of the review of the South Metropolitan Peel Sub-Regional Planning Framework which is intended to be finalised during 2021. There is the potential for a new road connection to be provided in this area through a future Structure Planning and subdivision process should the urbanisation of the land be supported.

It should be noted that the proposed development of the subject land does not generate the need for a road connection between Dean Road and Lakes Way. The Structure Plan proposes the addition of new roads to the existing movement network which will assist in alleviating existing traffic congestion by providing improved connectivity and legibility to the existing residents. The existing intersections with Berrigan Drive have been reconfigured, with the proposed closure of Turnbury Park Drive at its intersection with Berrigan Drive, and the reconfiguration of The Links Boulevard to a left in- left-out arrangement, will redirect traffic through the estate to a proposed signalised priority-controlled intersection with Berrigan Drive. The proposed location of the traffic signals will provide for a centrally located priority access to the proposed residential areas north and south of Berrigan Drive. This will provide for a landmark entry to the estate, which interconnects the estate north and south.

5.2.2 FUTURE HOUSING

The proposed development will provide for diversity in housing choice that will compliment the local area. Whilst the proposed development will comprise predominately single residential lots, which are in keeping with the existing residential area, it will also provide for group housing sites, which will present the opportunity for downsizing and aging in place. This will be achieved through the inclusion of townhouses on medium density lots and group housing sites with an interface to public open space, which will contribute to the visual appeal and passive surveillance of the area.

The quality of the built form outcome will be managed through Local Development Plans and Design Guidelines.

5.2.2.1. LOT TYPOLOGIES

The development is intended to provide for a seamless integration with the surrounding residential area. The proposed urban layout carries the same design philosophy of the existing residential development with direct lot frontage to areas of open space and natural appeal.

Based on indicative concept planning, the proposed average lot size for the low density (R20) land is approximately 596m², comprising single residential dwellings. This density is consistent with the R20 residential density that is currently allocated to the Special Use zoned areas.

The medium density (R30) lots will achieve an average lot size of 300m² in accordance with R-Codes requirements, comprising a mix of rear-loaded terrace product and grouped housing sites. The proposed R30 medium density coding is lower than the R40 coding that currently applies to Lot 512, however the R30 coded areas are disbursed across the site rather than being concentrated in one part of the site. The anticipated average lot sizes are commensurate to the existing surrounding residential lots, and provide for a diversity in housing product.

Two R40 grouped housing sites are located generally centrally within the development, within proximity to the Local Centre. These have been strategically located in areas that benefit from high amenity and access, and do not detract from the existing amenity of the surrounding development (i.e., the existing residents).

5.2.2.2. GROUPED HOUSING SITES

Medium density grouped housing sites have been included within the proposed development to provide for increased diversity in housing choice. Nine grouped housing sites have been identified in locations which provide for the amenity suitable to support increased density, including public open space and the proposed Local Centre. The proposed sites have been configured to allow for the development of townhouses in groups ranging from approximately 7 dwellings to 20 dwellings, each with internal access and proximity to open space.

5.2.2.3. BATTLEAXE LOT CONFIGURATION

Lots in a '4-Pack' battleaxe configuration have been included in strategic locations. This lot typology assists in extending the diversity in housing choice in suitable locations and is in keeping with the lot design context of the existing residential area.

This design response has been considered to be the preferred outcome along the southern portion of Dean Road where a sweeping left-hand bend, heading north poses a danger to vehicular access to lots with crossovers to Dean Road.

Whilst alleviating the potential traffic issue, it provides vehicular access to the 4-Pack lots from within the estate, contributing to safe traffic movements for the existing and future residents. This design also allows for the retention of a number of existing mature trees and protects the natural interface with the existing park on the eastern side of Dean Road.

5.2.3 LOCAL AMENITIES

The location of the Structure Plan area adjoining Berrigan Drive to the north and south, and adjacent the existing Glen Iris Local Centre, provides an opportunity for the expansion of the Local Centre to provide for improved community facilities and convenience. The proposed Local Centre expansion allows for a range of uses which may include a small supermarket, café/retail outlets, as well as community services which complement the existing provisions, such as additional medical facilities.

A Retail Needs Assessment has been undertaken for the site, which indicates that with an increase in the residential population, a range of retail uses may be supported in this area, including a supermarket, with an anticipated overall retail floorspace of approximately 2,500m² (additional to the existing commercial facilities on Berrigan Drive), which would provide for future and existing resident needs. This provides an opportunity to integrate with, and expand on, the existing centre on Berrigan Drive.

Connections for reciprocal access and car parking will be explored at the detailed design phase of the Local Centre.

5.2.4 OPEN SPACE AND ENVIRONMENT

The irregular cadastral boundaries of the site boundary, its undulating topography and mature trees, provide a challenging spatial configuration for incorporating rectilinear residential lots. Conversely, it provides the opportunity for an urban layout with serendipitous areas of open space, linked through interconnected linear 'green corridors'.

Public open space has been strategically located to provide for both active and passive recreation opportunities within areas identified as suitable for tree retention and landscape protection, that are also within proximity to proposed and existing residents. The open space areas are intended to extend and enhance the recreational opportunities within the broader precinct.

5.2.4.1. PEDESTRIAN LINKS

The urban layout supports a pedestrian environment which integrates the existing residential areas with the proposed development, with an interconnected path network allowing for pedestrian movement with minimal intrusion from the vehicular traffic. The philosophy for pedestrian and cycle movement has incorporated an approach whereby where possible, the paths are located within 'green' open spaces creating a series of defined 'loops'. This will allow for safe pedestrian movement throughout the estate to the proposed Local Centre and public open space areas.

5.2.4.2. TREE RETENTION

The preservation of mature trees is broadly acknowledged to be a significant benefit in many aspects and has significantly influenced the urban design of the Structure Plan. It is recognised the preservation of trees will require the retention of the natural ground level where trees are to be retained. This will be further considered through the detailed engineering design and bulk earthworks.

Future applications for subdivision approval over the site should to be supported by a plan that demonstrates the maximum retention of mature trees within public open space, landscape buffers and road reserves (refer Part 1, Provision 4.3 of this Structure Plan). Such plans should include the results of the tree survey, together with engineering detail of the proposed roads showing cut to fill requirements and civil servicing.

5.2.5 INTERFACE

The interface with existing residential lots has been considered extensively through the community engagement process, which identified a preference for a 'green buffer' adjoining existing lot boundaries, running parallel to roads and future residential development. This has been balanced in the context of ensuring passive surveillance and the community safety for public spaces.

The Structure Plan provides the opportunity for an interface with adjoining residential lots, which includes a widened road reserve with retained trees and an enhanced landscape environment, preserving the predominately natural aspect from the rear of existing residential lots.

A widened road reserve of 20 metres, which includes a landscaped buffer of approximately 10 metres from the existing lot boundary to the kerb edge of the road carriageway is proposed in several locations. The proposed residential dwellings will provide for surveillance and activation of the street. An indicative cross section example is provided within the supporting Landscape Strategy (refer Appendix 7).

This interface treatment will maintain a rear outlook for the existing dwellings across a retained natural landscape, providing a natural transition from the existing residential lots to the proposed development.

5.2.5.1. HISTORIC RESTRICTIVE COVENANTS

There are 23 existing Restrictive Covenants on surrounding lots, relating to fencing and building controls, seeking to manage the interface between the residential lots and the then golf course. However, the six primary parcels that make up the Structure Plan area are not benefited or burdened by the Restrictive Covenants registered on those surrounding lots. This can be reviewed on each Certificate of Title.

Given the above, the City of Cockburn or the owner of the former golf course landholding (Structure Plan area) are not party to any of the restrictions provided by the Restrictive Covenants, and are not able to enforce, nor have any authority to extinguish the existing Covenants.

Of the 23 Restricted Covenants currently registered on surrounding land, 11 have passed their expiry date and are no longer enforceable, but exist on the affected Certificate of Titles. The remaining 12 Restrictive Covenants are current. Formal applications to the Commissioner for Titles under the Transfer of Land Act 1893 will be required by those landowners in order to remove or amend the existing Restrictive Covenants on Title.

The affected lots are detailed as follows:

Restrictive Covenant Doc	Lots Affected	Date Of Expiry
F797541	Lots 113-119, 133 on DP85005	31/12/2005
F367260	Lots 26-37,109-112,134-138,141-156,173-176 on DP19383	31/12/2003
F509100	Lots 20-25,177-183 on DP19594	31/12/2003
F545052	Lots 57, 88-108,120-126 on DP19595	No stated expiry/ current
F551607	Lots 11-61 on DP19792	No stated expiry/ current
F679902	Lots 2-12 on DP19980	31/12/2004
F676273	Lots 13-19,55, 157-172 on DP19991	31/12/2004
F681610	Lots 74-86,92-118,131-133 on DP20059 & Lots 62-72,87-91 on DP87008	No stated expiry/ current
F760088	Lots 1, 55-62 on DP20049	31/12/2004
F752442	Lots 119-130,134-171 on DP20339	No stated expiry/ current
F368011	Lots 127-132 on DP87736	31/12/2003
G382162	Lots 38-87 on DP20283	31/12/2006
G091958	Lots 197-202, 223-225 on DP89977 & Lots 173-196, 211-222 on DP21041	No stated expiry/ current
G174554	Lots 601-609 on DP89211	No stated expiry/ current
G216597	Lots 203-210, 226-251 on DP21401	No stated expiry/ current
G414022	Lots 252-272 on DP21741	No stated expiry/ current
G523668	Lots 358-376,436-472,513 on DP22060	No stated expiry/ current
G853514	Lots 377-385,421-435 on DP95575 & Lots 386-396,400-406 on DP22743	No stated expiry/ current
H385316	Lots 199-215 on DP23022	31/12/2003
H170591	Lots 184-196 on DP23231	31/12/2003
H3969779	Lots 614-640 on DP24073	No stated expiry/ current
H528552	Lots 801-826, 829-839 on DP24462	No stated expiry/ current
H963361	Lots 301-358 on DP28871	30/06/2015

5.3 SUSTAINABILITY COMMITMENTS

The Structure Plan has been designed to address and incorporate key principles and practices that define sustainable urban development.

The development of the site constitutes urban infill, addressing the Perth and Peel @ 3.5 Million objectives of consolidating urban growth, as well as the City of Cockburn's planning strategies addressing environmental integrity and social community benefit, such as housing choice, liveability, connection to activity centres and services, transport options, and access to public spaces and employment.

Integral to this, the proponent is committed to implementing key sustainability initiatives aligned with the UDIA EnviroDevelopment standards. Active Sustainability has undertaken a detailed analysis of the proposed development to inform the Structure Plan and determine project initiatives. A copy of the 'Sustainability Initiatives' prepared by Active Sustainability is contained in **Appendix 11**. The results of this analysis indicate the development is well placed to address the EnviroDevelopment certification requirements in all six categories, being Ecosystems, Community, Waste, Materials, Energy and Water. Further assessment will be undertaken as detailed design and development progresses.

The following table summarises the preliminary sustainability analysis undertaken for the proposed Structure Plan.

ENVIRODEVELOPMENT CATEGORY	KEY PROJECT SUSTAINABILITY INITIATIVES
Ecosystems	- Water Sensitive Urban Design to manage surface water quality to support ecological health, including a major reduction in the existing long-term groundwater draw, and significant reduction in the use of fertilisers, herbicides and pesticides; - Retention of over 500 existing mature trees, relocation of some, and planting of local natives species in new parks and the landscaped interface adjoining existing residences, including the planting of some 1,000 new trees; - Protection and/or relocation of native fauna during construction; - Creation of possible fauna habitat opportunities within open space and retention of trees suitable for avian fauna; and - Significant public open spaces - 17.94% of the gross subdivisible area- and a total green space of 25% of the gross subdivisible area in park and bushland corridors, designed to manage fire risk.
Community	- Detailed consultation with existing residents to ensure new areas are strongly integrated with the existing community; - Delivery of a range of housing types and densities to allow greater diversity of residents, including down-sizing for retirees (ageing in place), singles, couples and families; - Creating a community hub (local centre) as a connection point for interaction of future and existing residents; - The public open space and movement network has been designed to encourage a safe environment, and encourage positive interaction between residents and other local people using the area; - All dwellings will be within 150 metres of local parks and green spaces; - Public spaces will be designed to provide for multiple uses with safety, comfort and security for community members, including children, the elderly and disabled people, providing shade, seating and quality amenities; and - Pathways for both walking and cycling that are safe, attractive and well-lit, connecting residential areas with public spaces and local facilities.
Water	- Reduction in water use though waterwise landscaping and gardens, water efficient fixtures and appliances; - Rainwater harvesting and reuse OR Greywater reuse on larger lots; and - Landscape guidelines will be provided to residents to assist in making informed choices around design, aesthetics, plants species selection and productive gardens.

ENVIRODEVELOPMENT CATEGORY	KEY PROJECT SUSTAINABILITY INITIATIVES
Energy	- Street and lot orientation designed to provide best practice solar access opportunities, as well as ensure buildings and outdoor spaces have solar amenity; - Building design guidelines will be prepared, informing purchasers about energy efficiency and comfort, addressing the following elements: › climate responsive, solar passive design for homes, › renewable energy systems and investigations into a community micro-grid battery storage system for all lots, and potentially including existing adjoining lots, and › efficient fixtures and appliances. - Use of efficient LED and solar lighting for street lighting and public spaces.
Waste	- All development works are to be guided by a Waste Management Plan during civil works and building construction, targeting > 80% recycling; and - Building design guidelines to be prepared, informing purchasers about the waste hierarchy of reduce, reuse and recycle.
Materials	- All civil works and landscape design to incorporate materials with recycled content, reused, and replacement materials; such as for construction of roads and pathways, landscape features, reuse of timber as both nature play elements and in mulch and possible selected public art elements.

5.4 PUBLIC OPEN SPACE

The Structure Plan provides a framework for the hierarchy and location of public open space areas across the site, considering the requirements for vegetation and tree retention, pedestrian connectivity, residential interface, topography, and drainage. Parkland across the Structure Plan area has been designed to provide a strong interconnected network of open space and pedestrian access ways, also providing links to existing areas of open space within the surrounding residential areas.

The findings of the Arboricultural Assessment contained in Appendix F of the Environmental Assessment and Management Strategy (which is contained in Appendix 4 of this document) influenced decisions with respect to tree retention and the Structure Plan layout. A plan depicting the trees proposed to be retained is provided at Figure 7 of the Environmental Assessment and Management Strategy. It should be noted that only trees with a trunk diameter of 30 centimetres (measured at breast height) have been mapped. It should also be noted that trees of a smaller trunk diameter that are contained within proposed open space areas, are also proposed to be retained.

The symbol used in Figure 7 of the Environmental Assessment and Management Strategy does not denote the canopy extent, drip or root protection zone of each tree. Additionally, in some cases where a group of closely positioned trees was found these were recorded as a single location. Each recorded tree (or group of trees) has been tagged, photographed and assessed, with the details published in the Arboricultural Assessment.

Detailed subdivision design will provide further refinement of the Structure Plan public open space framework, defining the configuration, uses and treatment within each public open space area in addition to further refinement of tree retention in consultation with the City.

The Structure Plan provides for approximately 8.80 hectares of public open space, being approximately 17.94% of the gross subdivisible area , and comprising approximately 15.79% unrestricted open space, 1.02% restricted open space (drainage), and 1.13% dedicated drainage (first 15mm). The open space is distributed across 19 parks, ranging in size from approximately 700m² to 1 hectare.

The Structure Plan also provides an additional 2.05 hectares of land as a dedicated landscaped pedestrian network and 0.99 hectares of landscaped Western Power easement (to be reserved as public open space), connecting the areas of public open space and providing an interface to the existing residential development surrounding the site. There is also an area of approximately 0.42 hectares identified in the north of the site for conservation purposes. Whilst not credited toward public open space, these areas provide an important amenity and recreational function. Combining the credited public open space and landscape interface/ pedestrian network and conservation areas, the Structure Plan provides a total of 12.26 hectares (being approximately 22.8% of the total site or 25% of the gross subdivisible area) as reserved green space for passive and active recreational purposes.

All lots within the Structure Plan area are situated within 150 metres of an area of public open space, either within the Structure Plan area or existing within the site surrounds.

Refer **Figure 8** – Public Open Space Schedule and **Figure 9** – Public Open Space Plan.

Glen Iris Estate, Jandakot – Public Open Space Schedule

Lot 3 Dean Road on Diagram 30047, Lot 6 on Diagram 91027, Lot 7 on Plan 21402, Lot 512 on Diagram 94292, Lot 139 on Plan 18946, and Lot 509 (No. 76 Dean Road) on Diagram 91028, Jandakot

14.05.2024				
Site Area (Local Structure Plan Boundary)				53.74
Deductions				
Western Power Easement (excl. Road Reserve)		0.99		
Proposed Local Centre		0.72		
Streetscapes / Landscaped Pedestrian Network		2.05		
Dedicated Drainage (1:1yr ARI / First 15mm)		0.55		
Conservation (within POS 2)		0.42		
Total			4.73	
Gross Subdivisible Area				**49.01**
POS @10%				4.90
Public Open Space Contribution				
May comprise:				
Min 80% unrestricted POS			3.92	
Min 20% restricted use POS			0.98	
Total Required POS				**4.90**

POS Reference Number (area within LSP boundary only)		**1:1yr / First 15mm Drainage (m²)** *Deduction from Net Area*	**Unrestricted POS area (m²)**	**Credited Restricted POS area (m²)**
1	1297	105	616	576
2 (less conservation area)	3808	542	2954	312
3	8253	0	8253	0
4	2543	212	2201	130
5	7224	928	5775	521
6	1329	229	898	202
7	3201	92	3024	85
8	5458	88	4652	718
9	4953	0	4953	0
10	3004	91	2839	74
11	5760	606	4595	559
12	8732	804	7659	269
13	1857	494	1117	246
14	5704	676	4285	743
15	3186	187	2875	124
16	9280	125	9088	67
17	5652	137	5406	109
18	1432	0	1308	124
19	5282	219	4899	164
Total	**87953**	**5535**	**77395**	**5023**
	8.80	**0.55**	**7.74**	**0.50**
Percentage of gross subdivisible area		**1.13%**	**15.79%**	**1.02%**

Notes:

1. *This Public Open Space Schedule is based on the Public Open Space Plan prepared by Rowe Group (Plan ID: 9166-FIG18l_20231213).*
2. *This Public Open Space Schedule is based on the drainage assumptions as per the Local Water Management Strategy prepared by Hyd2O dated 16 September 2021 (Ref: H20002AV3).*
3. *Restricted Open Space credit based on 5 yr/ 20% drainage area less the 1yr / 15mm area. Therefore, Restricted Open Space actual land area equals Restricted open space credited area plus the 15mm area.*
4. *Restricted Open Space actual 'on the ground' land area equals Restricted open space credited area plus the 1 yr / 15mm area.*
5. *The Landscape interface and Western Power easement also comprises areas of dedicated 1yr/ 15mm drainage. To avoid double counting deductions, these areas have not been included in the 15mm drainage calcs.*
6. *The Landscape interface and Western Power easement also include areas of 20% and 1% AEP drainage.*

8. PUBLIC OPEN SPACE SCHEDULE

9. PUBLIC OPEN SPACE PLAN

5.4.1 LANDSCAPE AND PUBLIC OPEN SPACE STRATEGY

A Landscape and Public Open Space Strategy has been developed for the site by Emerge Associates, depicting the anticipated use and intent of each of the public open space areas, as well as the key principles underpinning the design. Please Refer **Appendix 7**.

The overall landscape design strategy has been built around the following objectives:

- To reflect and respond to the key existing landscape elements and character of the site, in order to maintain visual continuity between existing and new precincts wherever reasonably possible. This includes built form and landscape treatments within streetscapes and open space;
- To provide a safe external environment for the quiet enjoyment of the residents, guests and the general public;
- To best cater for the lifestyle needs and aesthetic desires of the existing residential community within the bounds of the capacity of the development to do so;
- To best cater for the lifestyle needs and expected desires of the new future residential community, in reference to their anticipated demographics;
- To provide integrated public access that links with the existing residential, street and path network, with a strong sense of movement opportunity, options and legibility as part of a broader open space green link strategy;
- To retain mature trees wherever reasonable and practical to do so within the bounds of the project's delivery and approval requirements;
- To provide a more environmentally sustainable outcome than the prior land use (golf course), inclusive of the use of sustainable design practices applied to new works;
- To consider Black Cockatoo foraging and roosting habitat retention and creation through various methods, including vegetation retention and replanting;
- To clearly define various landscape design typologies as applicable to all areas of open space, to assist in the provision of facilities and legibility;
- To manage fire risk in a creative and aesthetic manner, while meeting required standards and obligations;
- To respond to the local colour palette with either matching or complimentary colours and textures, with the aim of minimising visual impacts and blending where possible; and
- To utilise generally well-established trees within the development, comprising:
    - 100 litre stock for street trees; and
    - 45 litre to 500 litre native tree stock within areas of public open space and landscape interface areas, to support endemic wildlife habitat.

Noting this is intended to be a general guide, as the optimal size of trees will vary depending upon the agreed species, availability at the time, and a range of other factors to be discussed with the City of Cockburn at detailed design stage.

5.4.1.1. PUBLIC OPEN SPACE TYPOLOGIES

Broadly, the public open space areas proposed across the site will consist of set landscape and use typologies. These typologies have been determined by a number of factors including size of the open space, grades and levels, the amount and location of gravity surface runoff, tree retention ability, habitat retention and creation, and usable, safe walkable linkages.

The four open space typologies proposed across the site include:

- **Focal Open Space:**

  The proposed design consists of four larger open space areas suitable for community gathering and informal active recreation. These four parks are distributed generally evenly throughout the site. These parks cater for a range of informal active recreation uses and a mix of passive recreation uses. These larger areas of open space have the ability to cater for tree retention and larger areas of surface runoff drainage storage and management.

- **Access Open Space:**

  The proposed design consists of a series of access open space areas. These open space areas are characterised by providing a strong open space link between other open space typologies. In doing so, these open spaces provide a critical role in the creation of a continuous green link option for pedestrian and cycle movement around the site. The linear nature of these open space links allows for the retention of vegetation, while the width of these open spaces enables the inclusion of series of public facilities accessible for existing and new residents.

- **Pocket Park Open Space:**

  The proposed layout includes a number of smaller open space areas set within the residential zone. These smaller open space areas are located to provide a range of localised incidental benefits, including visual softening among the residential zone, walkability, rest and respite via shade and seating, and in some cases specific associated needs such as low point drainage management and existing landmark specimen tree retention.

- **Buffer and Linking Open Space:**

  The proposal consists of a series of linear open space links. The nature of these open space areas ranges from road reserves with a widened verge to one side, to narrow buffers suitable to cater for a linking path and low planting between existing and proposed residential development, and landscaped pedestrian access ways. The internal function of these spaces is to act as a landscaped pedestrian access link.

The proposed open space typologies have been distributed across the site to provide a range of experiences and also a range of facilities within both vehicular and walking proximity to all existing and future residents of Glen Iris and Jandakot generally.

5.4.1.2. COMMUNITY FACILITIES

The Structure Plan proposes to build on existing community facilities, whilst catering for new residents via a range of new publicly accessible facilities. The extensive community consultation process and discussions with the City of Cockburn Technical Officers have identified a number of desirable public facilities including:

- **Informal larger play areas** disbursed through the focal parks to cater for informal recreation activities, such as informal touch football, ball games, unstructured training, frisbee, kite flying, dog exercise and the like;
- **Defined personal training areas.** It is envisaged areas be set aside for small gatherings of residents and visitors to allow for use/hiring for personal training and bootcamp type events. This is intended to cater for a variety of local age groups and skill levels. The landscape design can provide definition to these areas via small level changes and path and wall layouts;
- **Playground facilities** – it is noted the need for a major regional facility is already catered for externally to the site. It is proposed a mid-order play facility be located within the site to cater for the expected increase in local use and change in demographics;
- **Smaller play elements generally associated with nature play** items located in discrete locations along the green links, as part of a broader play trail running through the proposed development. This caters for smaller local precincts and also acts as a combined whole, with each nature play area having a different type of play offering;
- **Shelter structures with picnic settings** to select locations where residents are encouraged to stop and stay for a while. These are generally associated with play elements and view axis lines from adjacent roads;
- **Electric BBQs** are proposed to select locations as part of a social gathering and mixing initiatives, catering for smaller family groups and family scaled events;
- **Fitness elements** are proposed as part of the broader green link design approach. This is in response to community feedback gained from the community consultation process;
- **Walking trails** are proposed to occur through the green link network and are to be denoted via signage and colour coded elements to identify trails of various lengths and difficulty to suit a variety of users (such as 1km, 3km, 5km, 7km). It is envisaged these trails will form a key tool in encouraging greater social interaction between existing and new residents;
- **Cycle trails** are proposed to meander through the proposed development, primarily on a path network, with suitable signage. In some locations this may also occur partly onto the road system where low vehicle flow is to occur;
- **Dog walking trails and facilities** are proposed to be included generally in alignment with the pedestrian walking trails. These may include rest points in shade, taps and fixed dog bowls and discrete areas containing dog agility elements as part of a broader walking network;
- A **hard surface ball court** is proposed to provide an active focus for teens. The final location of these facilities will be subject to detail design to mitigate noise impacts to adjacent residents, but also to maintain clear and open view lines for passive surveillance;
- **Embayment carparking** is proposed adjacent to the larger areas of open space and along certain streets. The car bays will cater for local visitors and a variety of social events and informal activities;
- **Street furniture** is proposed in defined locations for the comfort of open space users. This will include seating, table settings, drink fountains, select bollards and the like;
- **Public art** is proposed to occur either as a larger landmark elements on key view lines or as smaller discrete art elements to be discovered as part of the green link approach, perhaps set into paving or on to low walls and the like; and
- A **3-phase power outlet** is proposed for the larger open community gathering grass space to cater for possible periodic larger scaled community events.

In addition to the above, the Structure Plan includes an additional community facility (formal playing field) to address the unanticipated increased demand (partly) generated by development of the former golf course. To deliver this, the Structure Plan considers the inclusion of a formal playing field through reimagining the existing Prinsep Park on the corner of Berrigan Drive and Prinsep Road.

The Structure Plan area is within Developer Contribution Areas (DCA) 13 and 15 and as such developer contribution funds will be collected by the City for the Regional, Sub-regional (East) and selected Local items (Banjup Playing Field and Banjup Community Centre) and the 'neighbourhood-level' playing fields and pavilion identified for a site within Lot 705 Armadale Road by the City's Community, Sport and Recreation Facilities Plan. These DCA's would not have factored in the contribution funds generated by the development of the Structure Plan area and, in this sense, the development of the land will increase the overall availability of funds to fulfil the delivery of community facilities such as sporting grounds and playing fields. It is however noted that the existing arrangements embodied in the DCA's will not facilitate the ability for the DCA funds to be used in the context of the establishment of potential playing fields at Prinsep Park.

Refer Section 5.4.2 of this report for further information relating to the Prinsep Park proposal.

5.4.1.3. PRINSEP PARK

The Structure Plan proposes a significant surplus of Public Open Space however the recreational opportunities provided are predominantly passive or low level active in nature. This type of Public Open Space has been provided in response to Community feedback as it is conducive with the retention of trees, the creation of shaded and connected walking trails, and is consistent with the existing character of the locality. More intensive active recreation, specifically in the form of formalised team sport, is catered for at a Regional and Sub-regional level. However, this provision was assessed prior to the proposed residential redevelopment of the former Glen Iris golf course.

The Structure Plan area is within Development Contribution Area 13, which is a community infrastructure DCA covering most of the City of Cockburn and requiring a financial contribution towards selected items including the Banjup Playing Field and Banjup Community Centre. The Structure Plan area is also within Development Contribution Area 15, which is another community infrastructure DCA. It covers Treeby and Jandakot only and was prepared to fund the 'neighbourhood-level' playing fields and pavilion identified by the City's Community, Sport and Recreation Facilities Plan (2017-2031). This facility will be provided within the 'District Open Space' at Lots 705 and 707 Armadale Road, Treeby, which is scheduled for delivery between 2024 and 2027. Contributions under both community infrastructure DCAs will be payable on a per-lot basis at the time of subdivision clearance.

Notwithstanding the existing and planned sporting facilities, the City has advised there is an existing shortage of consolidated open space areas suitable for use as active formalised team sports areas to support the additional demand created by this development. As such, the Structure Plan proposes enlarging and improving the use of the existing local reserve at the intersection of Prinsep Road and Berrigan Drive, creating a future community asset. To facilitate this, the Structure Plan provides approximately 9,280m² of additional public open space adjacent to the existing Prinsep Park reserve, to create a new consolidated active recreation park of approximately 31,285m² in area.

In investigating the potential for the upgrade of the Prinsep Park reserve, the City requested a concept be prepared to explore whether sufficient space is available to accommodate the following:

- AFL (multi-use) size oval – prefer 165m long by 135m wide (plus 5 min run-off);
- Clubroom – 525m² ;
- Small playground area (can include provision of multi-use hard court;
- Car Parking – 35-40 bays; and
- Two-bay cricket nets.

A Concept Plan depicting the potential Prinsep Park sporting facility has therefore been prepared and is contained in Figure 10. As is evident from the Concept Plan, there is insufficient area to accommodate a full size (senior) AFL ground, however, a full size (junior) AFL ground of 135m x 110m can be accommodated, together with parking, club rooms and playground facilities. It should be noted the Concept Plan is indicative only and will be subject to further design refinement at subdivision stage.

Implementation of the Prinsep Park sporting facility would require the removal of an amount of existing vegetation. The Concept Plan seeks to retain as much of the existing vegetation as possible, particularly where it can act as a buffer for existing homes adjoining Prinsep Park; however, it is unavoidable that some vegetation in the area occupied by the proposed oval would need to be removed. A Flora and Vegetation assessment has been undertaken to determine the environmental values of the vegetation. A copy of the assessment is contained in **Appendix 8**.

5.4.1.4. CPTED AND PASSIVE SURVEILLANCE

The detailed design of public open space and streetscapes will take into consideration various Crime Prevention Through Environmental Design ('CPTED') principles. Noting the extent of open space and the connected nature of the path system, passive surveillance over the open space areas is a key part of the developments safety and security approach. The design of the open space landscape treatments, combined with orientation of the open space to roads, paths, and new and existing residential development enables passive surveillance of public spaces.

The height of rear boundary fencing, and possible semi-permeable detailing enables interaction. This can be managed through the application of Local Development Plans. In addition, the use of level changes, where required, allows for some overlooking of public spaces. The location of trees, furnishings, and play elements will be arranged to not impede views to smaller open space areas.

Shrub planting will typically be lower shrubs and groundcovers to minimise the ability for hiding. The location of key facilities will be set on key view lines from adjacent streets, inclusive of car headlights illuminating various elements. The use of lighting will also be carefully considered through detailed design.

5.4.1.5. TREE RETENTION

A key element of the Structure Plan and public open space design has been around the objective of maximising tree retention across the site.

It is proposed in the order of 500 existing mature trees will be retained across the site, and more than 1,000 new trees will be planted as part of public open space and streetscape development. This is in addition to the trees to be retained within existing streetscapes in and around the surrounds of the site.

Two areas of existing Banksia bushland are also proposed to be retained within the site, one in the north and one in the south of the site.

Whilst the retained trees on site comprise a range of species, including both local and introduced, the trees proposed to be planted across the site will comprise those of local character, preferably being endemic and native to the site. This will provide local ecosystems as habitat for a range of endemic fauna. Native trees are also typically lower maintenance than introduced species.

The tree and plant species proposed for the site will also comprise a series of attractive and contrasting foliage, colour and form to enable design-based planting, and displaying the diversity of the local environment. A selection of species will also ideally enable seasonal flowering to occur all year round, as well as being of suitable form to promote shade and provide screening where required.

Planting will consist of a mix of mature stock for specific uses and high-profile location purposes, and smaller nursery hardened off stock for mass planting purposes.

5.4.1.6. LANDSCAPE RESPONSE TO BUSHFIRE MANAGEMENT

As detailed in Section 4.4 of this report, portions of the site are identified on the Department of Fire and Emergency Services mapping as being bushfire prone. As a result, development of the site is to be undertaken in accordance with the requirements set out under an approved Bushfire Management Plan, in accordance with SPP 3.7 and the associated Guidelines.

An assessment of the classified vegetation and effective slope within 150 metres of the site was undertaken, in accordance with the indicative subdivision concept plan prepared for the site (refer Figure 7). Based on that assessment, a fire setback zone occurs around parts of the site's boundary where it abuts a bushfire threat. In addition, two small areas of existing Banksia bushland are proposed to be retained within the site. As a result, the landscape design will respond to the relevant Bushfire Attack Level contours in these two smaller defined locations, and will employ the use of compliant fire management techniques to meet fire management obligations.

For those areas requiring a bushfire management response, as identified in the Bushfire Management Plan provided at **Appendix 5**, the landscape response will include, but not be limited to the following:

- Use of endemic plants and native species identified by the Department of Fire and Emergency Services (DFES) as being low fire fuel species;
- Selection, arrangement and spacing of shrub planting to meet low fire risk principles and requirements;
- Selection, arrangement and spacing of trees to meet low fire risk principles and requirements;
- Use of non-combustible and low-combustible landscape materials within the fire setback zone, including hard paving, gravels as paths and mulches in select areas, limited organic material, rocks and boulders;
- Provision of access for fire and emergency vehicles;
- Incorporation of a fire setback zone management and maintenance approach, inclusive of removal of necessary vegetative fuel and debris at standard required intervals; and
- Proposed inclusion of irrigation to fire zones for use in advance of fire emergency.

10. PRINSEP PARK CONCEPT PLAN

5.5 RESIDENTIAL

5.5.1 DENSITY

The Sub-Regional Planning Framework defines an infill target of 14,680 dwellings (32,300 people) for the City of Cockburn, with a minimum average target of 15 dwellings per gross hectare of urban zoned land. Likewise, Liveable Neighbourhoods specifies a target of 15 dwellings per gross urban hectare and an average of 22 dwellings per residential site hectare, however noting that an R20 density code is typically equivalent to a density of 13 dwellings per residential hectare.

An indicative subdivision layout has been prepared for the site, identifying a yield of approximately 550 dwellings. Therefore, based on the indicative subdivision concept, the Structure Plan achieves a density of approximately 19.69 dwellings per residential site hectare and approximately 10.29 dwellings per gross urban hectare.

Whilst the subject site does not achieve the minimum density targets set out under the Planning Framework, the proposed densities are considered appropriate for the site in the context of the site's location and the existing surrounding residential development.

The Structure Plan is situated within an established residential area, with typical lot sizes in the order of 500m^2 – 700m^2, primarily developed to an R20 density code (with areas of R40 dispersed throughout). The densities proposed by the Structure Plan are generally consistent with the surrounding residential development, in keeping with the existing urban fabric and expectations of the community. The Structure Plan proposes a base density code of R20 (consistent with the existing residential density applied to most of the land), with areas of R30 dispersed throughout to provide for a diversity in housing product. The R30 coded land is generally located in areas of higher amenity, typically with direct frontage to public open space and in proximity to the proposed Local Centre.

Based on indicative concept planning, the proposed average lot size for the low density (R20) land is approximately 596m^2, comprising single residential dwellings. The medium density (R30) lots will achieve a minimum average lot size of 300m^2 in accordance with R-Codes requirements, comprising a mix of rear-loaded terrace product and grouped housing sites. The anticipated average lot sizes are commensurate to the existing surrounding residential lots.

Further, approximately 22.8% of the total site (25% of the gross subdivisible area) is proposed to be reserved for green space (including the retention of approximately 500 mature trees), either as public open space, conservation or as part of the landscaped pedestrian network. While this provides for a high level of amenity for the Structure Plan and surrounds, it reduces the developable area and somewhat restricts the ability to achieve minimum density targets. The lot sizes and the extent of open space proposed within the Structure Plan are a direct reflection of, and response to, the community feedback provided through the consultation process.

In addition, whilst the Structure Plan seeks to facilitate a consolidated urban form (as required by the Planning Framework) and contribute to infill targets, it is not located within close proximity to a METRONET precinct or existing public transport node, nor is it located within an existing or planned activity centre. The closest existing passenger rail station and activity centre is located at Cockburn Central, approximately 1.5 kilometres from the site. Typically, such areas will deliver most of the density required to achieve infill dwelling targets. Therefore, the densities anticipated for the Structure Plan are appropriate and justified in the context of Liveable Neighbourhoods and the Sub-Regional Planning Framework.

For reference, an Indicative Subdivision Concept is provided at **Figure 7**. This is provided for explanatory purposes only, and is subject to review and detailed design at the subdivision stage.

5.5.2 LOCAL DEVELOPMENT PLANS

To provide for appropriate and site responsive built form outcomes, a Local Development Plan is required, as a condition of subdivision approval, for any lots with one or more of the following attributes:

- Lots with an area less than 260m²;
- Lots with an irregular configuration;
- Lots where specific vehicle access and egress control is required;
- Lots abutting public open space, a pedestrian access way or an area of landscape interface;
- Lots zoned 'Local Centre';
- Lots with particular site constraints (e.g. steeply sloping land);
- Lots directly abutting existing residential development;
- Lots that require quiet house design for noise attenuation through deemed-to-comply noise attenuation packages, and/or lots requiring specialist acoustic requirements, as identified in an approved Noise Management Plan; and/or
- Any lots requiring variations to the Residential Design Codes to achieve specific built form and streetscape outcomes.

Local Development Plans are to address, as a minimum, the following:

- Dwelling orientation and management of dual frontage lots;
- Type of fencing;
- Location of carports/ garages and vehicular access;
- Surveillance;
- Setback variations;
- Solar orientation;
- Access and interface management between private lots and public open space; and
- Requirements for dwelling construction compliant with an approved Bushfire Management Plan and Noise Management Plan.

In preparing Local Development Plans, the design responses between the existing and proposed residential development will need to be considered to ensure an appropriate transition, however noting the design objectives of the proposed development in comparison to the existing urban fabric, which was largely developed through the 1990s, and the need to create a distinct character and sense of place.

The transition between the existing and proposed residential development will be primarily managed through the use of public open space, landscaped interface treatments and road design, creating a 'buffer' between the old and new residential areas.

It is anticipated that where a Local Development Plan(s) is required, in accordance with the abovementioned criteria, a condition of subdivision approval will be imposed by the WAPC requiring the preparation and approval of a Local Development Plan.

5.6 MOVEMENT NETWORKS

5.6.1 EXISTING ROAD NETWORK

The subject site is bound by Dean Road, Glen Iris Drive and Prinsep Road to the east, The Lakes Boulevard, The Fairway, Hartwell Parade and Glen Iris Drive to the west and Imlah Court to the south. These roads are all classified as 'Access Roads' under Main Roads WA's *Functional Road Hierarchy*, and are subject to the default 50km/h built up speed limit.

These roads have typical local street typologies with pavement widths ranging from 6.5 metres to 7.2 metres. The majority of these streets have footpaths on one verge and do not support frequent on street parking.

Vehicular access to and from the site is only possible via Berrigan Drive with full movement priority-controlled intersections at The Lakes Boulevard, Turnbury Park Drive and Prinsep Road, as well as a four-way signal-controlled intersection at Dean Road/Jandakot Road/Berrigan Drive.

Berrigan Drive runs east-west between the northern and southern portions of the site, connecting Jandakot Road to the Kwinana Freeway. It is classified as a 'District Distributor A' road under Main Roads WA's *Functional Road Hierarchy*, and has a posted speed limit of 70km/hr. Berrigan Drive also forms part of the Restricted Access Vehicle Network up to and including Category 4 vehicles, which can be represented by a 27.5m B-Double road train.

Traffic volumes along Berrigan Drive have continued to grow at a consistent and relatively high rate over the past 5 years to 2021, resulting in very poor and worsening levels of service and diminishing safety for existing residents in the surrounding area.

Prinsep Road runs north-south along the eastern boundary of the southern portion of the site, forming a connection between Berrigan Drive and Verde Drive. It is classified as a Local Distributor under Main Roads WA's *Functional Road Hierarchy* and has a posted speed limit of 60km/hr.

Kwinana Freeway is located immediately to the west of the site and **Roe Highway** is located to the north. Given their classification as major roads in the network hierarchy, these roads cannot accommodate any new intersections.

The existing **Thornlie Railway Line**, runs east-west along the north of the site, providing public transport services from Perth to Armadale. The **Perth to Mandurah Railway Line** runs north-south within the Kwinana Freeway reserve. **METRONET** is also connecting the existing rail between Thornlie and Cockburn Railway Stations, north of the site.

5.6.2 PROPOSED ROAD NETWORK

A key design consideration of the proposed road network was to improve the functionality of the existing local network and minimise the increase of traffic on existing roads from the proposed development.

To achieve this, the Structure Plan layout proposes a short section of 'Neighbourhood Connector A' road at the intersection with Berrigan Drive, and adjacent to the proposed Local Centre. Extending from this is a modified 'Neighbourhood Connector B' road running north-south through the site to facilitate future bus access and act as the main spine through the site. The balance of the proposed road network will comprise 'Access Streets (C and D)'.

The proposed Neighbourhood Connector A will be constructed to a reserve width of 20 metres, and the proposed Neighbourhood Connector B and Access Streets will be constructed to a reserve width of between 13.5 – 15 metres. Where roads adjoin existing residential development around the perimeter of the site, reserve widths are proposed to be widened by approximately 9-10 metres to provide for a landscaped interface and tree retention. The cross sections in these areas will vary depending upon the number and elevation of the existing trees that are to be retained and the level difference between the existing residential properties and the new roads. A number of cross section scenarios have been graphically represented in the Transport Impact Assessment contained in **Appendix 9** and in the Landscape Strategy contained in **Appendix 7** of this document, however each specific road will need to be considered separately in consultation with the City at the detailed design stage.

In other areas, the proposed reserve widths are typically narrower than those recommended under *Liveable Neighbourhoods* due to the future residential lots serviced by these roads being relatively large in size and capable of accommodating on-site parking (ie. on-street parking excluded from the cross-section), or where otherwise adjoining public open space and therefore services are not required on both sides of the road.

The proposed Neighbourhood Connectors will have lane widths of between 3.2 – 3.5 metres to allow for the provision of future Public Transport Authority ('PTA') bus services. Typically, Access Streets throughout the site will be well below 1,000 vehicles per day and will be designed with 5.5 – 6.0 metre pavements.

There are two roundabouts proposed internally within the Structure Plan and two existing roundabouts that are proposed to be modified to include a fourth connection. The two proposed roundabouts will both likely need to accommodate PTA buses in the future and will be designed accordingly.

A new signalised intersection is proposed along Berrigan Drive to accommodate the additional traffic generated by the proposed development and improve access for existing residents. A Concept Plan for the intersection has been prepared but will require formal endorsement from Main Roads WA and the City of Cockburn (refer Transport Impact Assessment at **Appendix 9**). This intersection will be funded by the Developer.

Traffic modelling for the proposed intersection has also considered the effects of the proposed Surf Park and concludes there is not any additional impact expected. Further, modelling for the community oval identifies it has a non-competing peak traffic demand and is therefore not expected to have any detrimental impact on the proposed intersections or surrounding road network.

Intersection treatments will be further investigated at the detailed design stage and formalised through the subdivision process.

Refer **Figure 15** – Proposed Vehicle Movement Network.

In addition to the above, the following modifications to the existing local road network will be required:

- The Fairway – requires upgrading to a typical 'Access Street D' classified road, being a 15.4 metre wide reserve. This would be required as a condition of approval for lots with frontage to the Fairway.
- Twin Waters Pass Bridge – the retention of the Twin Waters Pass Bridge should be retained as a key landscape and character feature of the locality.
- The two existing roundabouts proposed to be modified at Bonville Glen / Glen Iris Drive and Turtle Point Cove / Glen Iris Drive, each being modified to provide for a fourth roundabout leg.
- Investigation of a new mini-roundabout at the future four way intersection between Twin Waters Pass and the adjusted Portsea Gardens / new Neighbourhood Connector road.

Any modifications proposed to the existing local road network are to be undertaken at the developer's cost.

Further information relating to traffic is contained in **Appendix 9** – Transport Impact Assessment.

5.6.3 PUBLIC TRANSPORT

The road network geometry in the surrounding residential area is prohibitive to the running of public transport vehicles and, as such, bus services in the area are limited. The 515 service has two stops either side of Berrigan Drive.

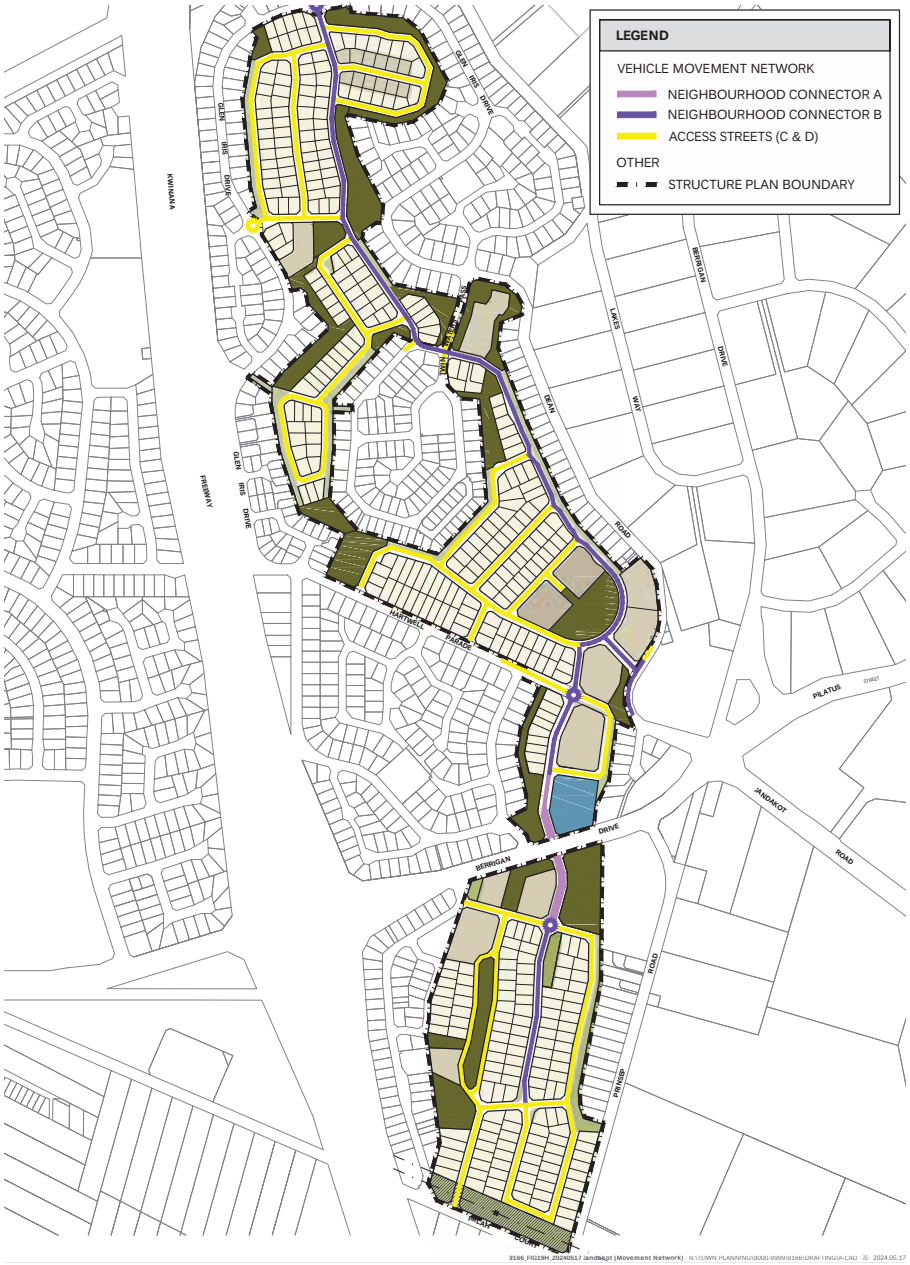
Due to the long north-south configuration of the surrounding residential area, only a limited number of dwellings are located within the 400-metre public transport walkable catchment promoted under *Liveable Neighbourhoods*.

The Cockburn Central Railway Station is accessible by car via the Kwinana Freeway, or cycling along the Principal Shared Path ('PSP') on the western side of the Kwinana Freeway. This trip is approximately 2.2 kilometres from the bus stops on Berrigan Drive, or 3.5 kilometres from the northern-most residencies in the surrounding residential area.

The Cockburn Central Railway Station park and ride facility is an 5-minute drive via Prinsep Road or the Kwinana Freeway.

No new public transport routes in the area have been confirmed by the PTA, however, the Structure Plan has been designed to accommodate a north-south bus network, if required in the future.

As previously noted, METRONET is connecting the passenger rail between Thornlie and Cockburn Railway Stations, north of the site. This will enable residents to travel direct to areas such as Canning Vale, the Cannington Strategic Metropolitan Centre and the Burswood Peninsula, without having to travel via the Perth CBD and switching lines.



11. PROPOSED VEHICLE MOVEMENT NETWORK

5.6.4 PEDESTRIAN AND CYCLE NETWORK

Given the site's previous use as a golf course, there is no formal pedestrian or cycling network within the site itself. In the surrounding residential area, concrete paths typically between 1.5 – 2.0 metres wide are provided on one-side only over much of the local street network. There is also an existing pedestrian underpass under Berrigan Drive, connecting the northern and southern portions of the site. This underpass is proposed to be retained as part of the development of site.

There are no formal cycling facilities within the surrounding residential area, however low traffic volumes and speeds on these streets are conducive to shared on-street cycling. Notwithstanding, the long winding internal road network provides few opportunities to safely overtake.

An existing PSP is located on the western side of the Kwinana Freeway and is accessible from Berrigan Drive. Longer-term, duplication of this PSP and the construction of a further PSP on the eastern side of the Kwinana Freeway is proposed by Main Roads WA. A commuter cycle route is also proposed along Prinsep Road that links in with the new PSP and provides access to Cockburn Central Railway Station.

Footpaths are proposed on at least one side of all internal roads, in accordance with Liveable Neighbourhoods requirements. The Structure Plan layout also promotes active transport through the extensive and connected shared path network (incorporating a dual-use path) meandering the site, through areas of public open space and the landscaped interface. This path network will be connected to the footpath network proposed within the road verges, as well as to the existing surrounding network. This integrated shared path network will provide recreational amenity and improve accessibility throughout the site and surrounds.

All cycling within the Structure Plan area is proposed to be either on-road or on proposed footpaths. Internal traffic volumes are expected to be low enough such that on-road cycling will not pose a high risk to cyclists.

There will also be consideration for bicycle parking within areas of public open space and at the proposed Local Centre. This is to be explored further through the detailed design phase.

5.7 WATER MANAGEMENT

A Local Water Management Strategy (LWMS) has been prepared in support of this Local Structure Plan and is provided at **Appendix 10**.

The LWMS addresses stormwater management of the site, including areas outside the Structure Plan boundary, which currently discharge stormwater within the site. The LWMS provides a comprehensive overall assessment of the existing water management system for the area, and how it will be modified and integrated with the proposed development to improve water sensitive urban design outcomes.

The LWMS provides a total water cycle management approach and has been prepared in accordance with the principles and objectives of the Better Urban Water Management (2008) framework, and in accordance with the requirements of the Department of Water and the City of Cockburn.

In accordance with the processes defined under Better Urban Water Management, an Urban Water Management Plan (UWMP) will be required to be prepared and implemented at the time of subdivision. The UWMP will refine and implement the proposed drainage network/system, as identified under the LWMS.

5.7.1 EXISTING STORMWATER MANAGEMENT

There is no overarching DWER regional or district stormwater strategy covering the site. The site does not have a connection to any arterial drainage scheme and all stormwater generated on site is infiltrated.

The site currently provides stormwater storage and infiltration areas for existing adjacent development. There are currently 18 bubble up pit outlets draining into the site from the existing surrounding development, discharging into 15 separate drainage areas. These drainage areas range from wet basins to shallow informal depressions to fenced steep sided deep sumps.

5.7.2 STORMWATER MANAGEMENT STRATEGY

The stormwater management system will consist of a series of lot soakwells, road drainage pits, piped drainage, overland flows paths, swales, and distributed bioretention and flood storages areas within public open space and road reserves/ landscape interface areas for water quality treatment and major event management.

A key element of the system will be the minimisation of pipe networks and the use of many small scale local catchments to treat and infiltrate stormwater runoff at source.

In some areas, underground storages may be required due to the constraints provided via the level of existing pipe inverts entering the site from external catchments, and the desire to achieve useable public open space outcomes and tree retention.

Where appropriate, additional local scale management measures such as tree pits, pervious paving and rain gardens will be considered during more detailed local planning and engineering design, and appropriately documented in UWMPs.

5.7.2.1. WATER QUALITY MANAGEMENT

The LWMS proposes a treatment train approach to water quality management, which includes non-structural, as well as structural controls:

- Non-Structural Controls include:
  - **Planning:** Public open space and linear green space network, lot product, and subdivision layout;
  - **Maintenan**ce: Regular stormwater system maintenance, including public open space biofilter areas; and
  - **Monitoring:** Post development program and performance review.
- Structural Controls include:
  - **Catchment Scale Infrastructure:** Bioretention areas, swales and storages (above and below ground) in public open space areas and road reserves;
  - **Local Scale Infrastructure:** Soakwells; and
  - **Landscape:** Maintaining existing mature trees and native plantings.

Application of a treatment train approach, using a combination of the non-structural and structural measures, will achieve the design objectives for water quality treatment as detailed in Better Urban Water Management.

5.7.3 GROUNDWATER MANAGEMENT STRATEGY

Based on preliminary earthworks plans prepared for the site, fill is generally not required to achieve adequate separation to regional groundwater, given the proximity of groundwater levels to natural surface over much of the site.

It is anticipated the site will broadly be a cut to fill operation, with minimal imported fill required. No subsoil drainage will be needed.

Final design lot levels and fill specification are a detailed design issue to be addressed during the preparation of detailed engineering design drawings and preparation of the UWMP.

5.7.4 MONITORING

5.7.4.1. PRE-DEVELOPMENT

Baseline surface and groundwater monitoring of existing conditions was undertaken for 18 months, inclusive of two winter periods from June 2020 to December 2021. Monthly groundwater levels and quarterly water quality were recorded, in addition to sampling of existing stormwater quality discharging into the site from City of Cockburn drainage systems. Monitoring results are detailed in Appendix F of the LWMS (refer Appendix 10).

No further pre-development monitoring is required to inform development of the site.

5.7.4.2. POST-DEVELOPMENT

The Department of Water indicates a minimum of 3 years post development monitoring is required, and defines post development as *"from completion of first subdivision to five years after 80 per cent of the development (by land area) has been completed"*.

- Post-development groundwater monitoring is proposed in 9 groundwater monitoring bores, to provide suitable coverage of the site. Locations have been selected based on maintaining existing sampling locations where possible.

The following frequency of monitoring is proposed:

- Monthly groundwater level measurements.
- Quarterly groundwater quality measurements.

Groundwater levels will also be measured in three nearby DWER bores JM45, JM12, and JM², consistent with pre-development monitoring.

Groundwater quality will be monitored quarterly for physical parameters, nutrients and heavy metals.

Stormwater quality sampling of key stormwater infiltration and biofiltration areas within the site, once constructed, will also be undertaken via grab sampling on up to 4 occasions each winter. Sampling parameters will be the same as groundwater monitoring.

The monitoring schedule will be undertaken for a three-year period, consistent with usual DWER requirements. An annual report will be prepared summarising the results of the program, with results compared to pre-development monitoring data.

5.7.5 IMPLEMENTATION

The following table summarises the roles and responsibilities for the implementation of the LWMS:

ACTION	RESPONSIBILITY
Review and approval of LWMS	DWER and City of Cockburn
Completion of predevelopment monitoring/reporting and target establishment	Developer
Preparation of a UWMP for individual development stages	Developer
Review and approval of UWMP	DWER and City of Cockburn
Construction of stormwater system and maintenance post construction until council handover	Developer
Long term stormwater system operation and maintenance	City of Cockburn
Conduct post development monitoring program and annual reporting	Developer
Review of monitoring data and annual reports	DWER and City of Cockburn

Table 5: LWMS Implementation

5.8 EDUCATION FACILITIES

There are no school sites proposed within the Structure Plan area.

Representatives from the Department of Education have advised a new public primary school is not required in this location and it is anticipated the South Lake Primary School would have sufficient capacity to cater for any additional demand. .

Representatives from the Department of Education have also indicated that should the need for a primary school arise in the future, they could potentially consider other options such as the land to the east of the Structure Plan area within the Planning Investigation Area (currently zoned Rural), subject to the progression of planning for that area. A developer contribution towards a potential future public primary school will be requested by the Department at the subdivision stage.

The closest existing school sites to the Structure Plan area are as follows:

- Primary
  - South Lake Primary School (2.1 km);
  - Bibra Lake Primary School (2.2 km); and
  - Treeby (Banjup West) Primary School (opening 2022) (2.6 km).
- Secondary
  - Lakeland Senior High School (1.1 km);
  - Leeming Senior High School (3.5 km);
  - Atwell College (4.2 km); and
  - Willetton Senior High School (5.4 km).

Refer to **Appendix 12** – Correspondence from the Department of Education.

5.9 ACTIVITY CENTRES AND EMPLOYMENT

5.9.1 EXISTING CENTRES

In accordance with *State Planning Policy 4.2: Activity Centres for Perth and Peel* (SPP 4.2), the closest Secondary Centre to the Structure Plan area is the Cockburn Central Activity Centre (approximately 1.5 kilometres to the south). Beside the Perth and Fremantle City Centres (Strategic Metropolitan Centre), Cockburn Central comprises the main regional activity centre within relatively close proximity to the site. It provides a diversity of uses, providing for a range of economic and community services required to service the future population.

The closest District Centre to the site is the Livingston Marketplace in Canning Vale (approximately six kilometres to the east of the site). There are also a number of Neighbourhood and Local Centres accessible from the site, however not within immediate proximity to the site.

There is an existing commercial area located on Berrigan Drive, immediately east of the subject site which provides a variety of retail/shop, restaurant and medical land uses, including medical and dental facilities, a pharmacy, café and hairdresser. The commercial area is identified in the City of Cockburn's *Local Commercial and Activities Centres Strategy* ('Commercial Strategy') as a 'Local Centre' with a retail-shop floorspace of approximately 2,146 m^2. Local Centres are defined in the Commercial Strategy as those that *"provide for daily and some weekly household shopping needs, and a very small range of other convenience services"*.

5.9.2 PROPOSED LOCAL CENTRE

The Structure Plan proposes a Local Centre within the site on Lot 139, with frontage to Berrigan Drive. The Local Centre is proposed to have a land area of approximately 7,000m², with a retail floorspace allocation of approximately 2,500m² net lettable area (subject to detail design) in addition to the existing commercial uses (approximately 300m² net lettable area) along Berrigan Drive. The proposed centre provides an opportunity to integrate with the existing commercial area also located on Berrigan Drive.

The expansion of the existing Local Centre is consistent with the City's Commercial Strategy principles which include:

- supporting the maturation of centres (Principle 3);
- optimising access to and within centres (Principle 5); and
- matching use with purpose (Principle 6).

The identification of a Local Centre within the proposed Structure Plan also respects the hierarchy of activity centres within the City and is based on robust evidence and considered assessment, in line with the Commercial Strategy principles.

A Retail Needs Assessment has been undertaken for the proposed centre, which suggests a small supermarket-based centre is the most suitable opportunity for the site. The centre would likely comprise a supermarket of 1,500m^2 retail floorspace, and 5 -10 shops, food and beverage tenancies with a combined floorspace of approximately 1,000m^2.

Whilst a full line supermarket-based neighbourhood centre could potentially be viable within the Structure Plan area, given the distribution of existing surrounding centres and consumer market characteristics, the Retail Assessment suggests a smaller supermarket-based centre presents the best commercial opportunity for this site.

The nearest small supermarket-based centre is located approximately 3 kilometres from the proposed centre, with no full line supermarket currently operating within 4 kilometres of the site. The proposed centre will therefore provide for the day-to-day food, grocery and convenience goods for the Structure Plan area and surrounds.

It is anticipated the proposed centre would likely to capture sales from not only the Structure Plan area, but also Jandakot, Leeming, South Lake, Cockburn Central and Treeby.

The Retail Needs Assessment conveys an expectation that the proposed centre could be trading and viable prior to 2031.

Refer **Appendix 13** – Retail Needs Assessment.

A Concept Plan has been prepared for the proposed Local Centre, noting the key requirements to be addressed as part of the detailed design (subdivision and development application) phase. The Concept Plan has been provided to demonstrate how the Local Centre site could be developed. The development of the site will be the subject of a separate application and detailed design process, including assessment by the City. The Concept Plan considers key vehicle and pedestrian movements through the site, parking and land use layout, as well as the interface treatments between the commercial and residential precincts.

The Concept Plan depicts a loading/servicing area located at the interface with the existing Commercial area and separated from the adjoining land by staff parking hence minimising any potential impacts on nearby residential uses. Food and beverage tenancies are located to orientate towards open space areas hence facilitating integration with the pedestrian/cycle movement network.

A vehicular and pedestrian/cycle connection between the Local Centre and the existing adjoining Commercial area will facilitate integration and enhancement of the commercial activities to create a hub in this area. It should be noted that whilst a left-in left-out access is depicted direct from Berrigan Drive into the Local Centre site, such an arrangement would need to be carefully considered, justified and assessed at the Local Development Plan and development application stage. It is also noted that negotiation and agreement with the adjoining landowner of the existing centre would be required to achieve the relevant physical changes on both boundaries to facilitate access in accordance with the City of Cockburn's requirements.

A Local Development Plan will be required at the subdivision and/or development application stage, once further detailed design has been undertaken.

Refer **Appendix 14** – Local Centre Concept Plan.

5.9.2.1. LOCAL DEVELOPMENT PLAN

A Local Development Plan will be required, as a condition of subdivision approval, for the proposed Local Centre on Lot 139. The Local Development Plan is to address, as a minimum, the following requirements:

- Vehicle and pedestrian movements and connectivity;
- Access and parking;
- Servicing;
- Interface treatments between the commercial and residential precincts; and
- Landscaping.

5.10 WASTE MANAGEMENT

The structure plan proposes a number of different development forms including single detached housing, grouped housing and commercial uses. Waste collection and management will differ depending upon the nature of the development and site specific design considerations. The following general principles are relevant and are to be considered at the further detailed design stage:

- Laneways are to be designed in a manner that avoids bends obscuring waste truck sightlines or alternate waste collection arrangements such as the use of dedicated bin pads may be considered by the City;
- Road reserve widths shall be adequate to accommodate on-street parking bays abutting POS areas and laneway lots where required;
- All terminating roads (temporary or otherwise) are to include a sufficient area for waste collection vehicles to turn around in forward gear;
- Road design shall ensure that waste trucks do not have to reverse while collecting rubbish;
- Street tree selection and location shall ensure that an unrestricted bin collection space is provided for each lot;
- No bins shall be serviced directly from Berrigan Drive;
- Grouped Housing and other strata-titled properties will require adequate verge space for a communal bin pad (1 bin set/3 dwellings) to be placed and serviced on a straight road frontage unless the City agrees to alternate collection arrangements; and
- Where waste truck access is not possible, any property with insufficient road frontage will require the use of a bin presentation pad (BPP) in front of adjacent properties. These BPPs are to be shown on a Local Development Plan and are to be constructed at the subdivision stage in accordance with the City's specifications.

5.11 INFRASTRUCTURE COORDINATION, SERVICING AND STAGING

The following provides a summary of the infrastructure and servicing requirements for the Structure Plan area. Further information is contained within the Engineering Services Report provided at **Appendix 15**.

5.11.1 SEWER

The site is currently serviced by reticulated sewer, maintained and operated by the Water Corporation.

The site is situated within the Bibra Lake and Jandakot Sewer Districts.

Water Corporation has advised there a number of upgrades required to downstream headworks infrastructure (including collection sewers, pump stations and pressure mains) to facilitate the proposed development. These works will be undertaken by Water Corporation, as the development progresses and new flows come on line.

Reticulation infrastructure downstream of the site will also need to be upgraded as a result of the proposed development. This includes approximately 825 metres of existing DN225 reticulation sewer to be upgraded to DN300. This will be undertaken by the Developer during subdivision works, under a Capital Works arrangement with the Water Corporation (ie. works to be undertaken by the Developer and refunded by Water Corp).

All new wastewater infrastructure installed for the Development will be designed and constructed in accordance with Water Corporations guidelines, including the Developers Manual and Design and Construction Requirements for Gravity Sewer DN150 to SN600 (DS50).

It is noted there are numerous live wastewater lines located within the site, protected by existing easements in favour of the Water Corporation. These have been considered in the indicative concept planning for the site.

5.11.2 WATER

The site is currently serviced by reticulated potable water, owned and operated by the Water Corporation.

The Water Corporation has advised upgrades to the existing network will be required to accommodate the proposed development. This includes upgrades to headworks infrastructure, including distribution mains, and will be undertaken by the Water Corporation as development progresses.

It is expected the site will be connected to the existing DN500 distribution main located in Berrigan Drive, via a DN150 main from both the northern and southern portions of the site.

All water main extensions required for the site will be laid within existing and proposed road reserves, on the correct alignment and in accordance with the Utility Providers Code of Practice and Water Corporation requirements.

5.11.3 ELECTRICITY

There are existing High Voltage (HV) overhead power lines in the east of the site along Prinsep Road, with various sections of underground HV located within the vicinity of the site, servicing the existing residential lots.

There are also existing Low Voltage (LV) underground services surrounding the site.

Western Power forecasting indicates there is between 10 to 15 MVA of capacity available in the existing surrounding network to the service the locality. The proposed development is anticipated to require a power supply of approximately 3500kVA. Therefore, there is currently sufficient capacity in the existing system to service the proposed development.

It is anticipated six sub-station sites (comprising a combination of transformer and switchgear) will be required to service the proposed development.

Western Power owns and operates all electrical supply network assets within the site, and therefore all new electrical supply equipment and cables will need to be installed in accordance with Western Power, WAER (West Australian Electrical Requirements), AS3000 specifications and Standards.

5.11.4 GAS

There are existing ATCO Gas services in the vicinity of the subject site.

ATCO Gas has advised the existing surrounding network has capacity to accommodate the proposed development. The extension of services will be undertaken by the Developer during civil works, at their own cost.

There is also an existing DN150 PVC medium pressure gas main running through the northern portion of the site, through the existing Dean Road reserve. The METRONET Thornlie Cockburn Link project Team are also proposing to install a DN200 steel high pressure gas main through the site along the same alignment as the existing main. This is to replace existing gas mains which currently run through the proposed rail reserves. These mains will also provide opportunity for connection and have been designed to ensure there are no limitations for development in the future.

5.11.5 TELECOMMUNICATIONS

There are existing Telstra and NBN owned pit and pipe networks in the vicinity of the subject site.

The NBN Rollout Map indicates the wider Glen Iris area is covered by the NBN network and is 'service ready'. Existing properties surrounding the site are covered by a fixed line, Fibre To The Node (FTTN) service.

General communication services for the proposed development will consist of the installation of a standard pit and pipe network in accordance with NBN Co guidelines and standards. The current design practice for road reserves, pavement and verge provisions will provide adequate allowance for services in accordance with the agreed Utilities Service Providers handbook. There will be some local land requirements for equipment sites, which will be accommodated at detailed subdivision stage.

NBN advise the site is within their fixed footprint and therefore no additional costs for backhaul will apply to service the proposed development. The Developer will be required to fund the costs of trenching and ducting for the infrastructure, however NBN Co will fund the installation of fibre infrastructure.

5.11.5.1. MOBILE PHONE COVERAGE

Mobile phone coverage in the vicinity of the site is provided by Telstra, Optus and Vodaphone. Based on the coverage maps from these providers there does not appear to be any issues with coverage or capacity in the development area.

Notwithstanding, JDSi contacted the Mobile Black Spot Program Team (managed by the Department of Infrastructure, Transport, Regional Development and Communications) in February 2022, to seek information relating to the proposed development. As at the date of this report no specific feedback has been received.

5.11.6 STAGING

Staging of the Structure Plan area is anticipated to commence from the general intersection of Hartwell Parade and Dean Road, progressively extending to the north and south from this point. The development is likely to be undertaken over 17 stages of approximately 30 to 40 lots each.

It is anticipated full build out will be complete within approximately 5 years of Structure Plan and subdivision approval, depending on sales rates.

Refer **Figure 16** – Indicative Staging Plan.

5.11.7 EARTHWORKS

To complete the bulk earthworks required for the development, the following construction methodology is proposed:

- Protection of vegetation and trees proposed to be retained (fencing);
- Vegetation (where necessary) and turf removal, and grubbing of roots;
- Stripping of topsoil (approx. 100mm thick) for reuse in public open space or non-structural areas of the site;
- Tyne the top 400mm of the surface to expose any uncontrolled fill or waste materials for removal;
- Moisture condition and recompact the tyned surface; and
- Cut to fill operations across the site, including moisture conditioning and compaction to achieve the target density.

5.12 DEVELOPER CONTRIBUTION ARRANGEMENTS

The structure plan area is situated within Development Contribution Area 13 (DCA 13), which is a community infrastructure DCA covering most of the City of Cockburn. The facilities it covers are listed is Table 10 of the City's Town Planning Scheme No.3.

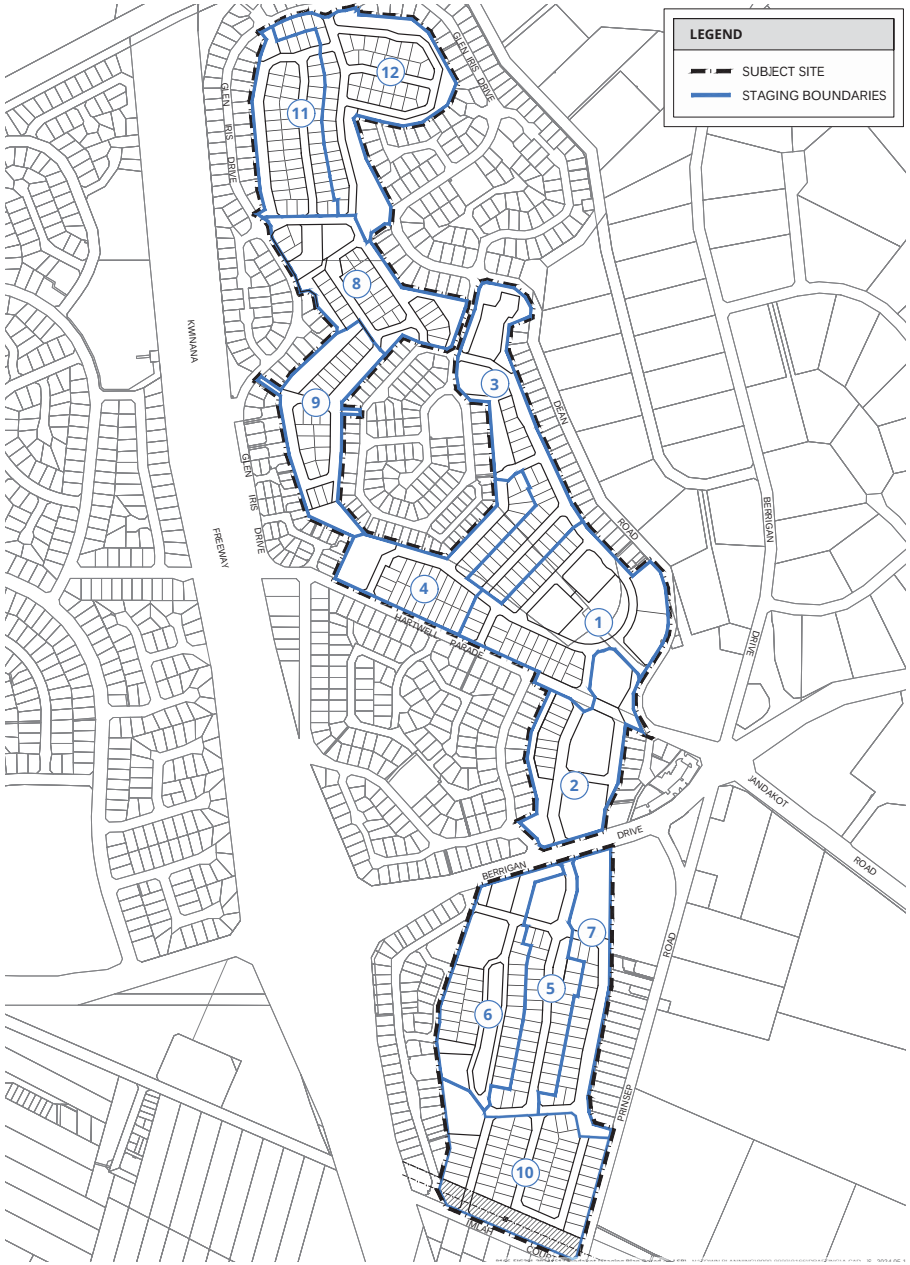
The landowner (developer) is required to make a cost contribution payment (typically as a condition of subdivision approval) based on the number of lots/dwellings they develop in accordance with the contribution rate set by the Developer Contribution Plan. Under the provisions of DCA 13, the developer will be liable to pay a cost contribution towards the Regional, Sub-regional (East) and selected Local items (Banjup Playing Field and Banjup Community Centre).

The structure plan area is also situated within Development Contribution Area 15 (DCA 15), which is another community infrastructure DCA. It covers only Treeby and Jandakot and was prepared to fund the 'neighbourhood-level' playing fields and pavilion identified for a site within Lot 705 Armadale Road by the City's Community, Sport and Recreation Facilities Plan (2017-2031).

This facility will be provided within the 'District Open Space' shown in the Lots 705 and 707 Armadale Road, Treeby Local Structure Plan and is scheduled for delivery between 2024 and 2027.

The contributions payable under both DCA 13 and DCA 15 will be payable on a per-lot basis at the time of subdivision clearance.

Funds collected under DCAs 13 and 15 may only be used for the funding of specific infrastructure items listed in those Schemes.



12. INDICATIVE STAGING PLAN

GLEN IRIS ESTATE

APPENDIX 1
COMMUNITY ENGAGEMENT REPORT

Glen Iris Estate

Community Engagement Summary

Prepared by: Louise Richardson & Associates

May 2021

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1. INTRODUCTION

In April 2020, Eastcourt purchased 53.74ha of land in Jandakot with the intent to submit a proposal to the City of Cockburn for the site to be rezoned to enable residential development.

The land was formerly the Glen Iris Golf Course (originally known as the Lakes Hotel and Golf Links) which was created in the early 1960s and redeveloped with surrounding residential homes in the mid-1990s.

The land purchased by Eastcourt is located in the heart of the Glen Iris Golf Course Estate – a development of some 750 homes created in the 1990s.

Approximately 220 properties within Glen Iris back on to the site of the former golf course.

The proposal to redevelop this land holding as a residential community would be a significant change for existing residents, particularly for those whose properties adjoin the former golf course.

From the outset, Eastcourt was committed to proactive, ongoing communication with the Glen Iris community.

As the new landowner they wanted to understand the concerns and aspirations of residents in relation to the proposed development, and to ensure that those were addressed as far as possible in the design and planning of the new community.

In April 2020 the Glen Iris Estate Project Team (the Project Team) – led by Acumen Development Solutions - commenced a proactive, voluntary 12-month program of engagement with local residents.

This has culminated in a high level concept plan that seeks to address the five key priority areas identified by the community.

2. GOAL, OBJECTIVES and STRATEGIES

2.1 GOAL

To implement a comprehensive community engagement program which provides multiple opportunities for stakeholders to participate in the planning of the proposed Glen Iris Estate.

2.2 OBJECTIVES

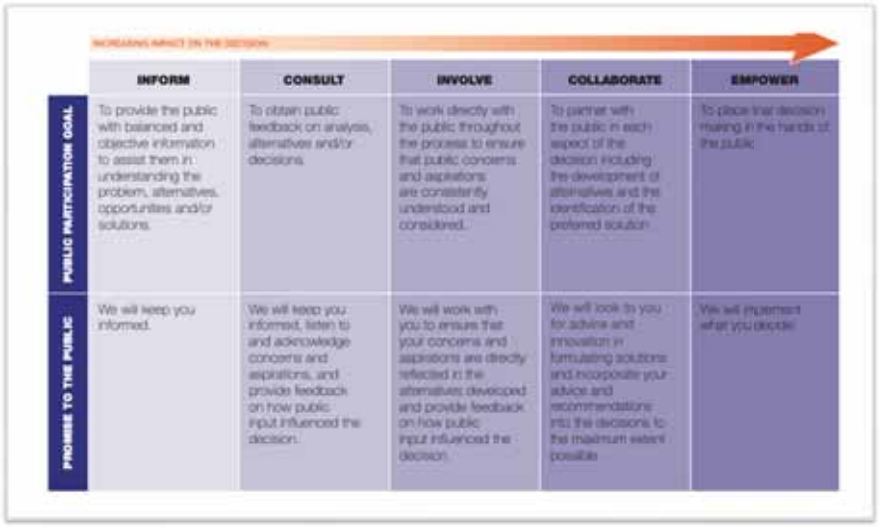
- Achieve a high level of understanding of the proposed Glen Iris Estate concept among all key stakeholders.
- Ensure Glen Iris residents are engaged in the planning of a new residential community at the site of the former Glen Iris Golf Course.
- Achieve a high level of stakeholder satisfaction for the community engagement approach for the Glen Iris Estate Project.

2.3 STRATEGIES

- Appoint an experienced community and stakeholder engagement specialist to the Project Team.
- Align the community engagement approach to the City of Cockburn's Community Engagement Policy which is based on the core values of the International Association for Public Participation (IAP2) Australasia - the peak body for the community and stakeholder engagement sector.
- Optimise opportunities for beneficial stakeholder collaboration, support, endorsement, and involvement through a consultation program built on the best practice IAP2 Public Participation Spectrum.
- Ensure the community engagement program reflects the City of Cockburn's commitment to provide equity in opportunities for people with diverse range of needs and views to participate fully in engagement activities.
- Proactively and consistently provide transparent project information and responses to stakeholder questions and queries.

3. IAP2 FRAMEWORK

Using the IAP2 Public Participation Spectrum as a framework, the Glen Iris Estate community engagement strategy was designed to **Inform**, **Consult** and **Involve** the local community in the development of a high level concept plan.



	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution	To place final decision making in the hands of the public.
PROMISE TO THE PUBLIC	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

The program was staged to alternate between engagement and feedback - gathering information, ideas and opinions, and then reflecting back to the community how what they shared could be incorporated into the planning of the proposed development.

A key priority was to assist the community in understanding the planning process, and the broad range of studies, investigations and analysis that contribute to the development of a concept design – the 'Inform' level of participation.

4. COMMUNITY ENGAGEMENT TOOLS

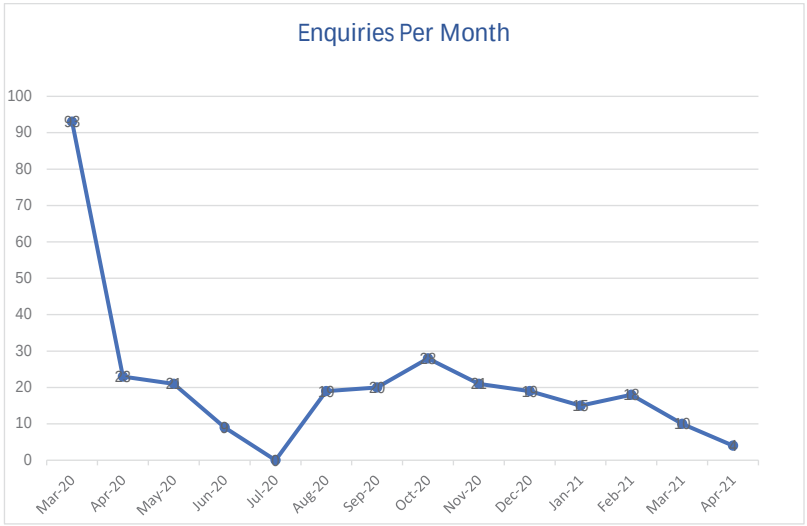
Louise Richardson & Associates worked with a specialist communication advisor and consultants from various planning and development disciplines to deploy a range of community engagement tools.

These were designed to ensure optimum accessibility and two-way communication.

4.1 Project Information Telephone Line and Email Address

A dedicated project information telephone line was established, together with a project email address, both of which linked directly to Community Engagement Manager, Louise Richardson.

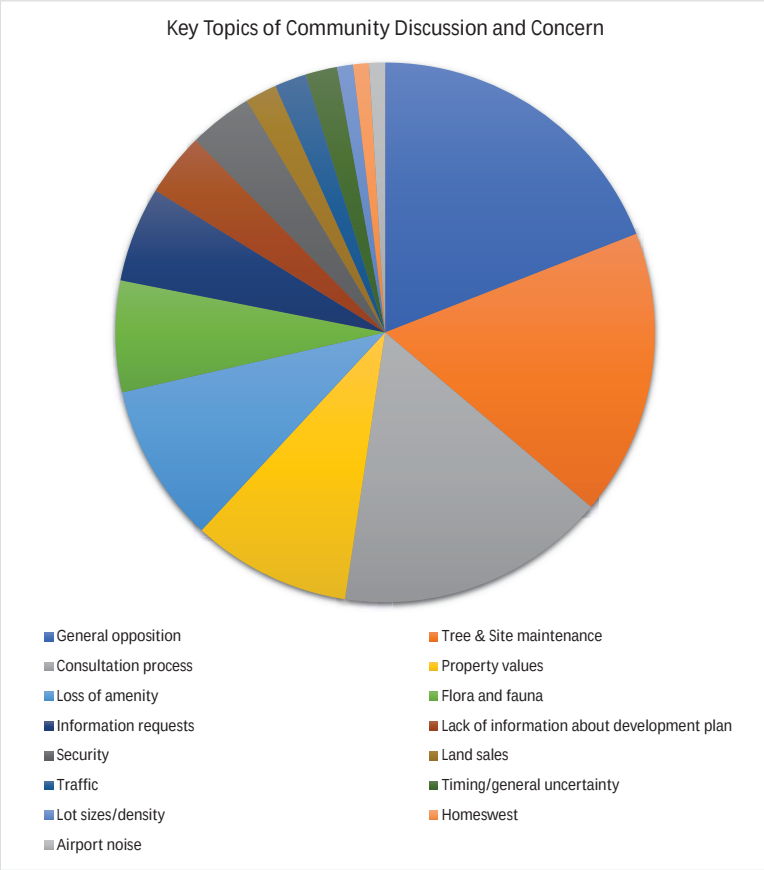
Between March 2020 and April 2021 the Project Team received a total of 290 enquiries from 220 individuals – 63 via telephone and 227 via email.



4.2 Engagement Register

All contact to the project information telephone line and email address, as well as letters sent directly to Eastcourt and Acumen Development Solutions was logged in a comprehensive Engagement Register.

The register was analysed weekly to provide insights into key topics of community discussion and concern and Project Team responses to requests for assistance (e.g. trimming of trees).



See accompanying document titled Glen Iris Estate Engagement Register.

4.3 Online Platform

In line with the Project Team's commitment to best practice, Engagement HQ was adopted as a fundamental engagement tool.

Engagement HQ is an interactive platform designed around the concept of building stronger communities through meaningful engagement and is the choice of leading local government authorities across Australia.

This allowed the development of HaveYourSayGlenIrisEstate.com.au as a central source of project information and communication.

Community members were encouraged to subscribe to the website to receive updates as the project progressed.

4.4 Letters and Project Newsletter

Early in the program and following community feedback about how they would prefer to receive information, letters and newsletters were hand delivered into residents' letterboxes as hard copies, ensuring maximum accessibility.

- **9th March 2020** Community Notice (announcing closure of Glen Iris Golf Course).
- **6th April 2020** Letter announcing land purchase settlement.
- **27th May 2020** Letter announcing residents' survey.
- **21st August 2020** Community Newsletter Edition 1.
- **14th December 2020** Community Newsletter Edition 2.
- **28th April 2021** Letter announcing release of concept plan.

Community Newsletter - Edition 2 - December 2020

GLEN IRIS ESTATE

Reference Group Progresses Consultation

Men's Shed Treasure
See Page 6

Full summaries for each of the workshops are available online at www.HaveYourSayGlenIrisEstate.com.au

See Appendix 1.0 for copies of covering letters sent to residents.

See Appendix 2.0 for digital copies of the Glen Iris Estate Community Newsletter.

4.5 Resident Survey (May - June 2020)

Leading Market Research company, Metrix Consulting, was commissioned to develop and implement a detailed survey of existing Glen Iris residents.

The survey was hand delivered to 780 homes within Glen Iris, and could also be completed online at HaveYourSayGlenIrisEstate.com.au.

See Appendix 3.0 for copy of Glen Iris Community Engagement Survey.

4.6 Advertising

To facilitate maximum awareness of pivotal engagement milestones, paid advertisements were placed in the *Cockburn Gazette* and *Fremantle Gazette*.

Advertisement One: 3rd September 2020 (*Cockburn Gazette* distribution 22,323 and *Fremantle Gazette* distribution 12,896)

Advertisement Two: 29th April 2021 (*Cockburn Gazette* distribution 22,323)

See Appendix 4.0 for full newspaper page with advertisements.

4.7 Electronic Updates

People could register at HaveYourSayGlenIrisEstate.com.au to receive electronic updates from the Project Team.

These updates provide information and feedback on engagement process milestones and onsite activity (e.g. ATCO gas works).

4.8 Briefing Notes and Stakeholder Updates

Briefing notes and stakeholder updates were prepared for the City of Cockburn, the Member for Jandakot (Yaz Mubarakai) and State Parliamentary MLCs for the South Metropolitan Region.

These were designed to ensure government stakeholders remained up to date on all aspects of the project planning and community engagement, and to assist with responding to queries received from members of the public.

See Appendix 5.0 for City of Cockburn Briefing Note.

See Appendix 5.1 for Stakeholder Updates.

4.9 Project Information Sheets

Project Information Sheets were created to provide comprehensive responses to frequently asked questions and requests for further details about topics of significant interest. These were:

- Planning and Design
- Fauna and Flora
- Site Maintenance and Security
- Asbestos Management
- Dilapidation Reports
- Wildlife and Lakes
- Consultation and Planning
- Planning Terms and Definitions

Copies of Project Information Sheets were provided to the City of Cockburn to assist its Technical Officers respond to correspondence and questions from residents and ratepayers.

See Appendix 6.0 for all Project Information Sheets.

4.10 Frequently Asked Questions

Monitoring and analysis of the Engagement Register and queries submitted to the City of Cockburn enabled the Project Team to generate a list of Frequently Asked Questions (FAQs) and responses.

The FAQs were made available on HaveYourSayGlenIrisEstate.com.au and updated regularly in response to community requirements.

- Will site maintenance be undertaken during the consultation and planning phase?
- What about birds and other wildlife at the site?
- What about security at the site?
- Will there be further opportunities for the community to share their ideas and thoughts about the proposed residential development?
- Who has bought the Glen Iris Golf Course site?
- What is planned for the site?
- How can a public golf course be closed?
- How can public open space be taken away from the community?
- How can land zoned for a golf course be developed as residential?
- I took the time to complete a survey and provide feedback to the project team. Will the project team share the survey findings with the community?
- Why would you purchase the land without having pre-approval to develop a residential estate?
- What happens to people who bought a home with 'golf course views'?
- Who is running the Glen Iris Estate project?
- How will you consult with the community?
- How can I get updates of the project?
- How do I speak to someone from the project team?

See Appendix 7.0 for all FAQs.

4.11 Precinct Reference Group

In August 2020 the Project Team invited residents to nominate for Precinct Reference Groups (PRG) with the aim of further engaging Glen Iris community members in discussion about the future development of the site.

Three Precinct Reference Groups covering the North, Central and Southern areas of the site were proposed to allow the Project Team to identify and resolve both big picture issues and location-specific concerns.

This approach was in line with the Project Team's commitment to canvassing a broad range of views and demographics.

Despite promoting the opportunity to participate in the August 2020 Community Newsletter, and advertising in the Fremantle and Cockburn Gazettes, only 26 nominations were received.

Please Note: the number of participants increased to 32 residents as the PRG process progressed.

While the Project Team understood there were members of the Glen Iris community who did not want the site developed, the PRG Terms of Reference focussed discussion on the future of the land, not its former use as a golf course.

A Code of Conduct was also developed and agreed to by all PRG members.

See Appendix 8.0 for Precinct Reference Group Terms of Reference and Code of Conduct.

5. VISIONING WORKSHOPS

The PRG met four times in September, October, and November 2020 and in April 2021 with workshop independently facilitated by Metrix Consulting.

Expert consultants working on planning, traffic, engineering, landscaping, and the environment attended the sessions to participate in the discussions.

The workshops were critical to ensuring the Project Team understood the key concerns of the Glen Iris community and discuss their thoughts on the most suitable ways to address those concerns as part of any future development outcomes.

5.1 Visioning Workshop No 1

Workshop No 1 (Sept 2020) identified five key areas for the community:

- **Traffic and Access** – traffic volumes, connectivity, entries, public transport, and walking/cycling/vehicles
- **Future Housing** – density, lot sizes, housing quality and guidelines, and property values
- **Open Space and Environment** – mature trees and habitat, walking and cycle paths, parks (dog areas, playgrounds, active play), and BBQs and social spaces
- **Interface** – buffers, privacy, greenbelts, retained vegetation, and fencing
- **Local Amenities** – shops, café and a small bar, social precincts, community meeting places, design quality.

5.2 Visioning Workshop No 2

Workshop No 2 (Oct 2020) provided the opportunity for the PRG to further define the key issues and explore potential solutions from the community's perspective. These included thoughts on:

- resolving current traffic issues entering Berrigan Drive,
- pedestrian and cycle connections
- open space buffers and greenbelts between existing and new homes
- retaining the existing streetscapes and mature trees that define Glen Iris
- consideration for retaining the artificial lakes
- providing smaller local open spaces with nature play areas
- walking and cycling trails connecting open spaces
- provision of a community hub for residents – potentially using existing the clubhouse premises

5.3 Visioning Workshop No 3

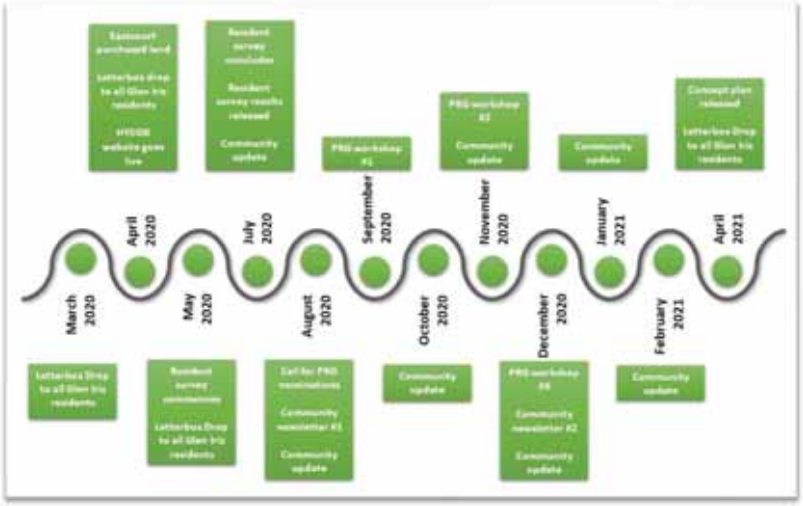
At Workshop No 3 (Nov 2020), participants were given the opportunity to start to draw aspects of the concept development plan with the specialist consultants.

Participants worked in precinct groups to focus on the land's northern, central, and southern areas. These concepts illustrate some of the spatial outcomes considered important by the community.

Summaries of each PRG session were made available to the entire community on HaveYourSayGlenIrisEstate.com.au as part of the Project Team's commitment to a transparent community engagement process.

See Appendix 9.0 for all Visioning Workshop summaries.

6. COMMUNITY ENGAGEMENT PROGRAM



6.1 Phase One: Collection

Phase One was designed to identify the community's key issues and areas of concern.

It was an opportunity for the community to voice its disappointment that the golf course had been closed and the site sold for redevelopment, and to articulate what they value most about where they live.

A Community Notice was hand delivered to all properties within Glen Iris in March 2020, introducing Eastcourt as the new owners of the former golf course site.

Refer to Appendix 3.0 for Glen Iris Community Engagement Survey.

6.2 Phase Two: Feedback

Metrix Consulting prepared a summary of the key findings of the community survey, and this was shared with residents via:

- HaveYourSayGlenIrisEstate.com.au
- EDM update to HaveYourSayGlenIrisEstate.com.au subscribers
- Community Newsletter #1 (hard copy) distributed to every household in the suburb of Jandakot

See Appendix 10.0 for Survey Feedback Summary.

6.3 Phase Three: Visioning

This round of engagement was aimed at developing a vision for the new community – a look and feel, and a sense of what kind of amenity local people would like to see.

As outlined earlier in this report (refer to section 4.11 of this report), a PRG was established and participated in three visioning workshops.

Visioning workshops were held in September 2020, October 2020 and November 2020 (refer to section 5 of this report).

6.4 Phase Four: Feedback

Following each of the three Visioning Workshops, summaries were provided to all PRG members.

Summaries were also made publicly available for download on HaveYourSayGlenIrisEstate.com.au.

Refer to Appendix 9.0 for PRG Visioning Workshop Summaries.

6.5 Phase Five: Concept

6.5.1 PRG Session – 11th May 2021

Presentation of the Glen Iris Estate concept plan was scheduled for 27th April 2021, however due to the reintroduction of COVID-19 restrictions was postponed to 11th May 2021.

It was held at Cockburn Arc from 6pm to 8pm.

Twenty of the 32 PRG members attended along with Project Team consultants from planning, engineering, traffic, landscape and environmental disciplines.

The concept plan presentation session was facilitated by independent market research firm, Metrix Consulting.

Unlike the Visioning Workshops this was an information session to explain the outcomes of the concept plan and its response to five key priority areas identified by the PRG and the community. These were:

- Interface and buffers
- Traffic
- Housing density and quality
- Environment and open space
- Amenities

Metrix Consulting introduced the session and the format in four sections:

- A recap of the outcomes of PRG Visioning Workshop 3 (November 2020) and an explanation of how the three precincts plans created by the PRG participants were compiled into an overall indicative concept plan.
- Presentation of the concept plan and highlighting responses to the five key priority areas by George Hajigabriel of Rowe Group.
- Outline of next steps for the formal planning applications by George Hajigabriel of Rowe Group.
- Q&A opportunity with all Project Team members facilitated by Metrix Consulting.

The Q&A portion of the session was approximately 45 minutes in duration and covered topics including:

- Traffic
- Interface fencing (privacy and security concerns from some residents)
- State and Local government policy regarding density, the number of new houses and the amount of open space
- Timeframes for approvals and development
- Staging of the eventual project
- Explanations of the planning approvals process.

See Appendix 11.0 for the PowerPoint presentation used to explain the concept plan to PRG members at the meeting held on 11th May 2021.

6.5.2 Community Letterbox Drop – 28th April 2021.

A letter announcing finalisation of a Glen Iris Estate concept plan was hand delivered to all residents of Jandakot on 28th April 2021.

Each letter was accompanied by a copy of the master concept plan.

See Appendix 11.0 for copies of the concept plan which was hand delivered to letterboxes across Jandakot.

Refer to Appendix 2.0 for a copy of the covering letter delivered to residents along with the concept plan.

7. APPENDICES

Appendix 1.0 | Copies of initial community notice sent to residents and covering letters sent to residents

COMMUNITY NOTICE TO GLEN IRIS RESIDENTS

Dear Resident,

Glen Iris Golf Course and Glen Iris Bar & Restaurant
We wanted to let you know that the Glen Iris Golf Course and Glen Iris Bar and Restaurant will close on 31 March 2020, and that Eastcourt Property Group has agreed to purchase the land.

With the number of golfers using the course declining over the past decade, Eastcourt is looking forward to creating a new future for the site and integrating the land with the existing Glen Iris community.

The Team
Eastcourt Property Group is a family-owned company with a proud 40 year history of property investment and land development in Western Australia.

The vision for the Glen Iris land is to create a high quality residential estate that retains mature trees and delivers premium housing options, leafy streetscapes and parklands for the whole community.

Acumen Development Solutions are the appointed Project Managers for this development, and we will work with a range of stakeholders including the City of Cockburn and the Glen Iris community to ensure everyone is informed about all aspects of the project as it evolves.

What are the Future Plans?
We understand you will be keen to know what is planned, but it's too early in the process to have a definite concept in mind at this stage. Consulting with you – the surrounding homeowners and residents - and delivering a project that creates a proud legacy for Jandakot, is our priority.

Initial enquiries about the future of the site can be directed to Community Engagement Manager, Louise Richardson, via louise@glenirisestate.com.au or by phoning (08) 6115 6365 between 9am and 5pm, Monday to Friday.

We look forward to keeping you up to date on the project as we move forward.

Regards
Jarrod Rendell
Project Director

Dear Resident

Register your details - 'Have Your Say Glen Iris Estate'

The purchase of the land formerly operated as the Glen Iris Golf Course has now been finalised. The new owners and the project team are looking forward to engaging with the local community to help shape the vision and outcomes for site.

To do this, we have set up an online engagement and consultation platform www.HaveYourSayGlenIrisEstate.com.au which is the central information and contact point for all engagement and information on the project.

The platform is easy to use and specifically designed for community engagement. It is the same platform the majority of local government authorities use, including the City of Cockburn.

By registering your details on the website you will:

- Be the first to know about opportunities to provide feedback on a wide range of topics for the project;
- Have access to the most up to date information about project planning and timeframes; and
- Ensure your views are heard, documented and considered by the project team.

To register, go to www.haveyoursayglenirisestate.com.au and click on the 'Register for Project Updates' button.

We look forward to hearing your thoughts and ideas as to how we can best fulfil the vision to deliver a high-quality, boutique residential community. Your input will be an important part of the future planning applications that will be prepared and submitted to the Local and State authorities for consideration.

Kind regards

Jarrod Rendell
Project Director

GLEN IRIS ESTATE

27 May 2020

Dear Resident,

Have Your Say Glen Iris Estate - Community Survey

We are pleased to commence consultation for Glen Iris Estate, and we look forward to working with the community through a series of surveys, workshops and discussions over the coming six to nine months.

This process will guide our Project Team in considering all the things that will contribute to creating a vibrant and attractive new residential neighbourhood for Jandakot.

While there is no design concept yet, the Project Team's vision is for a boutique estate with quality homes, public parks, and leafy streets - the kind of community where people feel safe, happy, and connected.

We want this estate to be part of a neighbourhood that genuinely reflects the unique character of Glen Iris. So, we are inviting you to have your say on what elements should be included in the new residential community.

You can do that by participating in our first Have Your Say Glen Iris Estate survey, which is now open. This first survey focuses on helping our team understand who calls Glen Iris home, and the key topics the local community wants to discuss in future surveys and workshops.

You can complete the survey online at www.HaveYourSayGlenIrisEstate.com.au or fill in the questionnaire enclosed with this letter and send it back to us using the stamped envelope provided.

This survey is open until 12 June 2020 and is prepared and managed by leading market research company Metrix Consulting. Your responses, whether submitted electronically or via post, remain entirely confidential.

If you have any queries or would like further details about the survey, please contact Louise@glenirisestate.com.au or call our Community Engagement line on 08 6115 6365

We hope you will contribute your valuable feedback to help Glen Iris Estate a unique and connected place to live.

Yours sincerely

Jarrod Rendell
Project Director
Glen Iris Project Team

GLEN IRIS ESTATE

Dear Resident,

The Glen Iris Estate project team has spent the last year planning a new residential neighbourhood in the heart of Jandakot.

Our vision for the site has always been for a boutique estate created around the hundreds of mature trees that give Glen Iris its distinctive, natural character.

But we also wanted to ensure it delivers the quality homes, parks and green spaces, and lifestyle elements that are important to the existing community.

So, much of the last 12 months was spent listening and talking with local residents and coosidering how we could incorporate their ideas into the estate design to create an asset for everybody who calls Glen Iris home.

Today we are pleased to share our concept plan for the proposed Glen Iris Estate, which will form the basis of our planning applications to the City of Cockburn.

Key features of this walkable, liveable, and well-connected community are:

- Retention of mature trees in parks and green buffers
- 25% of the total site as green spaces providing parks, connected walking and cycling paths, green buffers, and swales.
- Landscaping designed to attract local birds and wildlife
- Between 500 and 600 new homes with guidelines for quality design
- Green buffers between existing and future homes
- Road layouts that limit new traffic on the existing roads
- Proposed new 4-way traffic light intersection on Berrigan Drive to resolve existing traffic congestion
- Opportunity for a small supermarket, café/restaurants, and shops on Berrigan Drive

We hope the copy of the plan enclosed with this letter helps you visualise the concept for Glen Iris Estate.

The next step is for the project team to submit the concept plan and a range of technical reports to the City of Cockburn.

This is the start of the process of seeking Council and State Government approval for the proposed development.

This formal process is run by the City of Cockburn. It includes an opportunity for the community to provide written feedback on the proposal for consideration by the relevant regulatory authorities.

You can find more information and download specific plans which focus on the North, South, and Central precincts in more detail by visiting www.HaveYourSayGlenIrisEstate.com.au

If you have any questions, please contact Louise@glenirisestate.com.au or call the Glen Iris Estate Community Engagement line on 08 6115 6365.

Yours sincerely

Jarrod Rendell
Project Director

Community Newsletter – Edition 1 - August 2020

GLEN IRIS ESTATE

Welcome

Welcome to the first Glen Iris Estate Community Newsletter.

In this edition of the newsletter you will find a summary of your responses to our first Community Engagement Survey as well as insights into some of the key aspects of the new residential community we are planning. Because we want to make sure you have the most up-to-date and reliable information, this edition also tackles some of the rumours surrounding our project.

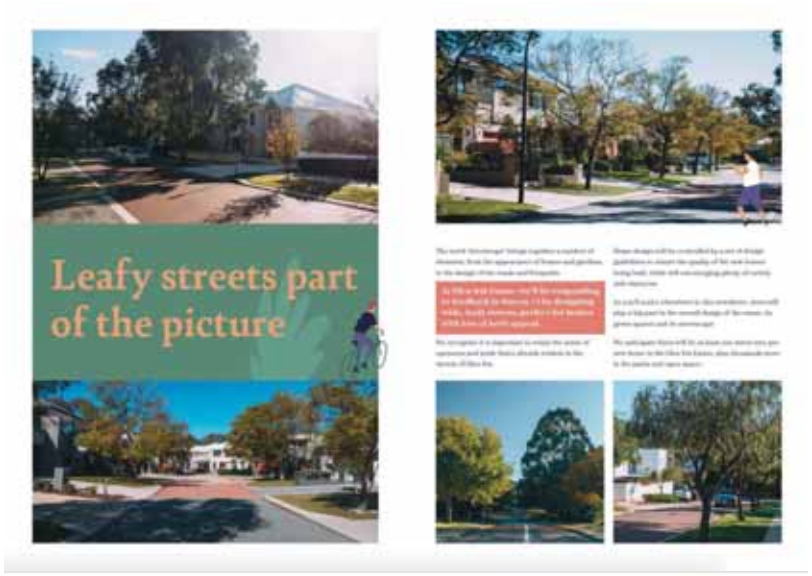
The images you see in this first newsletter are included to give you a sense of the quality and urban character we envisage for Glen Iris Estate. But we hope you will help us build on these initial ideas at our forthcoming community workshops and discussions. You can read more about becoming involved on the back page.

The project team responsible for planning and designing Glen Iris Estate is being led by Acumen Development Solutions and includes highly experienced town planners, landscape architects, engineers, surveyors, traffic experts and environmental consultants.

You can easily get in touch with the project team by emailing Louise@glenirisestate.com.au or calling our community engagement line on 08 6156305.

Staying up to date

For all the latest news and community information visit the Glen Iris Estate project website at **HaveYourSayGlenIrisEstate.com.au** it's also the place to register for updates and to participate in future online surveys and discussions.


Leafy streets part of the picture

Shared spaces to enjoy

What about the flora & fauna?

Traffic impact
Make sure you have your say

Community Newsletter – Edition 2 - December 2020

GLEN IRIS ESTATE

Reference Group Progresses Consultation

Local residents have been exploring ideas for the new Glen Iris Estate.

So far the 32 members of the Precinct Reference Group have spent a total of seven hours workshopping planning considerations for the new residential development.

It is important to the Glen Iris Estate Project Team to get feedback from the local community about what concerns them and what excites them about our proposal as we start planning for rezoning and future development.

So we put the call out in August 2020 for residents to take part in discussion groups for each of the southern, central and northern areas of our project site.

Fewer people responded than we had hoped, so a single Precinct Reference Group was formed with all 32 of the local community members who nominated.

The group has held three workshops since September, with participants having their say on everything from the layout of the development, to traffic and access, and the size and location of public open space.

Key consultants have provided input, including town planners, urban designers, traffic engineers, landscape architects, environmental consultants and civil engineers.

At the first workshop we introduced our project team and the concept of master planning, and invited comment to identify the topics residents wanted to discuss in more detail.

Representatives from our specialist consultants attended the second workshop, providing an opportunity for members of the group to ask more questions, and to raise potential solutions and ideas regarding key topics.

By the third workshop, the group was ready to take the detail to the next level.

Tracing paper was used to mark up plans of the site, addressing key topics such as traffic access, interface buffers public open space and the possibility of a café/shops.

The marked-up site plans will be used to inform an initial draft concept plan.

So what happens next?

The Precinct Reference Group is due to meet again in late February 2021 for a final review of a concept plan based on all the various contributions, including all other community feedback, along with technical reports from our consultants.

Men's Shed Treasure
See Page 4

Full summaries for each of the workshops are available online at
www.HaveYourSayGlenIrisEstate.com.au

What's got Glen Iris talking?

Site maintenance

Water for ducks

From our shed, to the Men's Shed

Stay informed and involved

Glen Iris **Community Engagement Survey**

Have Your Say Glen Iris Estate is a community consultation project designed to inform the planning of a vibrant new residential heart for Glen Iris in Jandakot.

It's a way for you to contribute your views on what's important to locals when it comes to creating a liveable, walkable neighbourhood of quality homes and likeminded people.

Whether it's taking part in surveys and workshops or providing direct feedback via our HaveYourSayGlenIrisEstate.com.au platform, you'll be playing an active role in shaping the Glen Iris community of the future.

This first survey will enable our project team to learn more about the people who call Glen Iris home and the design and planning elements you are keen to discuss over the coming months.

Thank you for your time to take part in this survey regarding the Glen Iris Estate project. Any information you provide will remain completely confidential and will only be used for research purposes.

If you wish to provide a household response, please seek input from everybody you live with before completing the survey. Household members who want to put forward their own views and opinions can visit www.HaveYourSayGlenIrisEstate.com.au and register for their own survey link.

When completing the survey please answer the questions below as accurately as you can by selecting the answers that best reflect your views with an X. There are several opportunities to write in open-ended responses.

Tell us a little about your connection to Glen Iris

Q1 Approximately how long have you lived in Glen Iris?

0 to 5 years ☐ 6 to 10 years ☐ 11 to 15 years ☐ Over 15 years ☐

Q2 Which of following best describes the location of your home in Glen Iris?

Directly adjoining the former golf course, south of Berrigan Drive ☐
Directly adjoining the former golf course, north of Berrigan Drive ☐
In Glen Iris south of Berrigan Drive, but not directly adjoining the former golf course ☐
In Glen Iris north of Berrigan Drive, but not directly adjoining the former golf course ☐

Q3 Which of following best describes your home?

Standalone house ☐ Duplex ☐ Townhouse ☐ Other ☐

Q4 What is the size of your housing lot?

Small - Less than 400m² ☐ Medium – Between 400m² - 800m² ☐ Large – Bigger than 800m² ☐

Let us know your thoughts on Glen Iris

Q5 What do you enjoy most about living in Glen Iris?

Q6 Thinking about other estates in and around Jandakot and the City of Cockburn, how would you say the community of Glen Iris compares?

- ☐ Significantly better than others
- ☐ Slightly better than others
- ☐ About the same as others
- ☐ Slightly worse than others
- ☐ Significantly worse than others
- ☐ Don't Know/Not sure

Q7 Why do you say that? e.g. What's better about Glen Iris or what's missing from Glen Iris?

Please include as much detail as possible

We are keen to understand what you already know about the plan for a new residential estate at Glen Iris

Q8 How would you rate your current knowledge about the proposed development in Glen Iris?

Know nothing about it — Very Knowledgeable — Don't Know/ Not Sure

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐

Q9 What do you know about the proposed residential estate?

Please provide as much detail as possible

Q10 Based on what you know, how do you feel about the proposed residential estate?

Extremely Negative — Extremely Positive — Don't Know/ Not Sure

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐

Glen Iris Public Golf Course and the surrounding housing estate was developed in the 1990's and the community features quality housing and beautiful tree lined streets. The golf course operation was closed in early 2020 and the land is no longer used as a golf course.

While there is no design concept yet for the residential estate, the Project Team's vision is to develop the land in a way that respects the unique attributes of the Glen Iris community by retaining mature trees and delivering premium housing options, leafy streets and parklands for the whole community.

Q11 Based on this information, how supportive or opposed to the creation of a new residential estate in Glen Iris are you?

Extremely Opposed — Extremely Supportive — Don't Know/ Not Sure

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐

Q12 Please provide some reasons for your rating, noting what your supportive of, or ways it might be improved.

Please include as much detail as possible

Q13 What are the key elements the Project Team should be considering as they commence planning for Glen Iris?

We would like to understand your thoughts on aspects of the new residential estate at Glen Iris

Q14 On a scale of 1 to 10, where 1 is not at all important and 10 is extremely important, how do you rate the following aspects when it comes to planning the future residential estates at Glen Iris?

	Not at all important									Extremely Important	Don't Know/ Not Sure
Developement reflects the existing attributes of Glen Iris	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐
Traffic planning and access	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐
New parks accessible to all residents	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐
Ensuring high quality of new homes design	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐
Designing attractive streetscapes	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐
Maintaining vegetation and trees	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐
Treatment of boundaries between existing homes and new development	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐
New social facilities (e.g. local shops, cafes and community space)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐
New active recreation facilities (e.g. playgrounds, fitness circuit, walking trails, BBQs and shelters)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐

Over the coming months the project team will be seeking ideas and feedback on a range of elements to be considered when planning and designing a new residential community. Surveys and workshops will be used to focus consultation discussions around key themes.

Q15 On a scale of 1 to 10, where 1 is low priority and 10 is high priority, how would you rate the priority of future consultation themes?

	Low priority									High priority	Don't Know/ Not Sure
Parks and trees	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐
House density/Lot sizes	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐
Traffic and Access	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐
Shops, Social and Community Facilities	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐
Streetscapes	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐
Fencing and Interface with Adjoining Homes	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐
House Design/Quality	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐

Q16 If there are additional consultation themes you feel should be considered please let us know.

No specific issues/topics to mention ☐

Q17 Thinking ahead 5 years, where do you envisage yourself living then?

- Outside of the Glen Iris Estate ☐
- Living in the Glen Iris Estate, in my same home ☐
- Living in the Glen Iris Estate, in a smaller sized home/block ☐
- Living in the Glen Iris Estate, in a bigger sized home/block ☐

A few final questions about you

The following questions are optional, however they will help us to build a better understanding of the residents living in the Glen Iris Estate. This will also help us to establish resident groups for future surveys, discussions and working groups on particular topics.

D1 Are you... Male ☐ Female ☐ Prefer not to say ☐

D2 How old are you?

Under 18 ☐ 18-34 ☐ 35-64 ☐ 65-74 ☐ 75+ ☐ Prefer not to say ☐

D3 Which of these best describes your household?

- Young person living at home with parents ☐
- Young single/couple – no children at home ☐
- Single/couple with youngest child under the age of 6 yrs ☐
- Single/couple with youngest child between 6 and 12 yrs ☐
- Single/couple with youngest child 13 yrs+ ☐
- Older single with no children at home ☐
- Older couple with no children at home ☐
- Other (please specify) ☐ _____
- Prefer not to answer ☐

D4 Which of the following best applies to you?

- Own my home (no mortgage) ☐
- Paying off my home (have a mortgage) ☐
- Renting ☐
- Other (e.g. live with parents/ boarding) ☐ _____
- Prefer not to answer ☐

D5 Which of these best describes your current employment situation?

- Working full time ☐
- Working part time/casual ☐
- Unemployed ☐
- Student ☐
- Retired ☐
- Home duties ☐
- Other (please specify) ☐ _____
- Prefer not to answer ☐

D6 Finally, we are looking to potentially conduct further research amongst Glen Iris residents. It could involve you taking part in another online survey, a one-on-one interview, or focus group. Would you be interested in taking part?

- ☐ Yes – please provide your contact details below
- ☐ NO

IF YOU ARE INTERESTED IN TAKING PART IN FUTURE RESEARCH, PLEASE PROVIDE YOUR CONTACT DETAILS BELOW

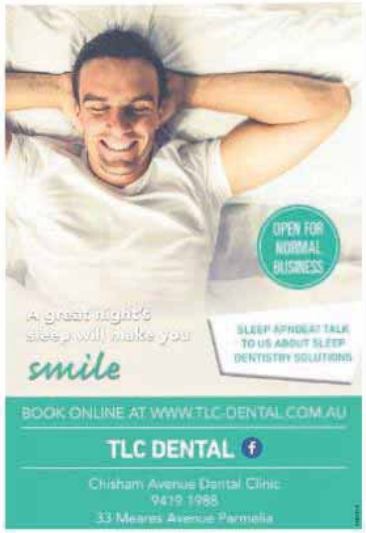
Name: _____

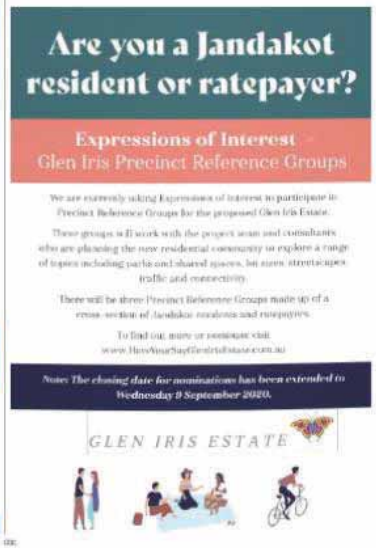
Phone: _____

Email: _____

Thank you for your time completing this survey.

All information you provided will remain completely confidential and only be used for research purposes. This study has been conducted in accordance with the Australian Market and Social Research Society (AMSRS) Code of Professional Behaviour which includes The Privacy Act 1998. If you have any concerns about the legitimacy of this study please contact Surveytime on 1300 364 830.





Small bar wins support

Ben Smith

HIBRA Lake residents are set to have a new local after the City of Cockburn approved a bar across the road from a school, despite an objection from the Department of Education.

Council granted planning approval to Argonauteca (WA) Pty Ltd for a change of use for a Parkway Road shopping centre unit from a restaurant to a small bar.

It will operate from 11am-10pm Wednesdays-Sundays and have a capacity of 70 people, taking over the space previously occupied by Mori Japanese Kitchen.

"The bar will be across the road from Hibra Lake Primary School and on the block next to Hibra Lake Community Centre.

The application was objected to by the Department of Education, which argued the small bar was an inappropriate land use.

Its objection cited WA Planning Commission Draft Operational Policy, which offers guidelines for the planning of schools sites and says small bars were considered undesirable next to school sites, and had real and perceived impacts on health, amenity and safety.

The City report said the operational policy was to guide strategic planning of undeveloped areas and not intended to be used as a statutory control in determining development applications in existing developed areas.

It said the policy did not restrict the local authority from approving uses that were considered undesirable and acknowledged if the site remained classified as a restaurant, alcohol would still be permitted to be served without a meal.

Despite its proximity to the school, the subject site's zoning allows for a small bar and does not require a buffer from other sensitive land uses.

Community consultation suggested strong support for the bar, with the City receiving 78 submissions of support compared to just 13 against.

Dragon Dancers at the 2019 Fremantle Dragon Boat Festival.

Lockdown slays dragon festival again

FREMANTLE'S Dragon Boat Festival could be postponed for the second time this year in the wake of another snap lockdown.

After a wildly successful inaugural event in 2019, last year's festival was cancelled due to COVID-19 and this year's event – which was initially planned for February – was called off when Perth was plunged into a snap lockdown.

It was rescheduled for this Sunday, but organisers were thrown another curveball last Friday.

And despite the lockdown having lifted on Tuesday, as the time of going to print yesterday they were still unsure whether ongoing restrictions would allow the event to proceed.

"I'm hoping it'll go ahead, but right now public and private gatherings are limited to 10 people," festival director Nella Fitzgerald said.

"If it doesn't change, it will have to be postponed, but I don't have enough facts to make that decision at the moment."

Ms Fitzgerald said she would follow the State Government's advice and wait until further announcements were made on the easing of restrictions.

Asked whether she was disappointed, she replied: "I don't see it this way".

"My first duty of care is the health and wellbeing of everyone," Ms Fitzgerald said.

"We will reopen when or needs to be done."

Organisers had expected up to 35,000 people to descend on Fremantle Fishing Boat Harbour.

Ticket pleas

FROM PAGE 1

which will lead to better public behaviour and safer boaters," she said.

The boat involved in the alleged Woodman Point collision stopped and gave assistance before the arrival of Water Police, who are now investigating.

Cockburn Sea Rescue spokesman Brad Nicholas said the incident was the second where a person had been hit by a propeller in Cockburn Sound since Christmas, but believed skipper's ticket reforms were not "necessarily" needed.

Department of Transport waterways safety management director Chris Mather said it could prompt changes.

"DoT reviews all serious boating incidents in WA and adjusts programs where appropriate, which may include amending the Recreational Skipper's Ticket workbook and assessment processes," he said.

Mr Mather said swimmers and divers being hit by boats was "rare", with five reported collisions in the past 10 years, and other reported incidents as one had occurred, with 118 in 2019, 100 in 2020 and 36 so far this year.

Transport Minister Rita Saffioti said any changes to the skipper's ticket would be left to the department, but findings of the 2019 Recreational Vessel Safety Equipment Review – which included discussion of mandatory lifejackets – would be released later this year.

Glen Iris Estate Concept Plan

The Glen Iris Estate project team has released our vision for the proposed new residential community in the heart of Jandakot.

To view the plan visit HaveYourSayGlenIrisEstate.com.au or contact the community engagement line on 08 6115 6365

GLEN IRIS ESTATE

EASTCOURT PROPERTY GROUP

acumen

CONFIDENTIAL: City of Cockburn Briefing Note
Glen Iris Golf Course
March 2020

Sale of the Glen Iris Golf Course:
Eastcourt Property Group (Eastcourt) has agreed to purchase the 54.9h Glen Iris Golf Course site which straddles Berrigan Drive in Jandakot.

The privately–owned 18-hole course was open to the public. The number of golfers using the course has declined steadily over the past decade.

The golf course and Glen Iris Bar and Restaurant will close on 31 March 2020 with settlement for the sale scheduled for 6 April 2020.

Eastcourt Property Group:
Eastcourt is a family-owned company that has been delivering residential and industrial developments and investing in property in Western Australia for more than 40 years.

It is a recognised and trusted property sector leader.

Future plans for the site:
Eastcourt plans to create a quality residential estate on the site of the Glen Iris Golf Course.

The vision is for a development which retains mature trees and delivers premium housing options, leafy streetscapes and parklands for the whole community. It would be integrated with the existing Glen Iris neighbourhood.

Community Consultation:
Eastcourt will work with the City of Cockburn and the surrounding community to ensure everyone is consulted about the project.

Acumen Development Solutions has been appointed to lead an experienced team of expert consultants to manage the Glen Iris project.

A Community Engagement Manager has been appointed to the project to work with key stakeholders and the local community.

Community consultation will be managed through the nationally recognised Engagement HQ software program which is the community engagement platform used by the City of Cockburn.

Briefing:
Eastcourt and Acumen Development Solutions are seeking an opportunity to brief the City of Cockburn on the purchase of the site and our future development plans.

Contact: Mr Jarrod Rendell
Jarrod@acumends.com.au
0422 234 553

CONFIDENTIAL

Glen Iris Estate Project – January 2021
Stakeholder Update - Community Engagement

Dear Elected Members, CEO and Directors, City of Cockburn,

As we are now a few weeks into the New Year, I wanted to provide you with an update on the Glen Iris Estate Project.

Before preparing and lodging any rezoning and development applications, our Project Team has been actively engaging with Glen Iris residents to better understand their concerns and aspirations for a new residential community.

Key initiatives have included:

- A letter to all residents explaining the project
- Activation of the HaveYourSayGlenIrisEstate website
- Dedicated community engagement telephone line and email address
- Community survey managed by market research company, Metrix Consulting
- Two Community Newsletters (August 2020 and December 2020)
- Email updates to people who have signed up for the HaveYourSayGlenIrisEstate website

Since we started the community engagement in March 2020, we have received a combined total of 217 calls and emails from 98 individual people from the community.

Precinct Reference Group Workshops

In mid-2020, we invited residents to participate in a Precinct Reference Group (PRG) with the aim of further engaging Glen Iris community members in discussion about the future development of the site.

Despite promoting the opportunity to participate in the August 2020 newsletter, and advertising in the Fremantle and Cockburn Gazettes, we were disappointed to only receive 26 nominations.

As the sessions have progressed, we received additional resident nominations increasing the PRG participants to 32 residents. The PRG has so far met three times in September, October, and November 2020.

The PRG sessions have been independently facilitated by Metrix Consulting and managed by Louise Richardson & Associates, the Community Engagement consultant for the project.

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Expert consultants working on town planning, traffic engineering, civil engineering, landscaping, and the environmental matters have attended the workshops to participate in the discussions with the residents.

The Terms of Reference for the PRG are focussed on discussions about the future development of the land and were explicit in not being a forum for discussing the site's former use as a golf course.

The workshops' aim has been for the Project Team to understand the key concerns of the Glen Iris community and discuss their thoughts on the most suitable ways to address those concerns as part of any future development outcomes.

Workshop No 1 (Sept 2020) identified five key areas for the community:

- **Traffic and Access** – traffic volumes, connectivity, entries, public transport, and walking/cycling/vehicles
- **Future Housing** – density, lot sizes, housing quality and guidelines, and property values
- **Open Space and Environment** – mature trees and habitat, walking and cycle paths, parks (dog areas, playgrounds, active play), and BBQs and social spaces
- **Interface** – buffers, privacy, greenbelts, retained vegetation, and fencing
- **Local Amenities** – shops, café and a small bar, social precincts, community meeting places, design quality.

Workshop No 2 (Oct 2020) provided the opportunity for the PRG to further define the key issues and explore potential solutions from the community's perspective. These included thoughts on:

- Finind options to resolve current traffic issues entering Berrigan Drive,
- pedestrian and cycle connections,
- open space buffers and greenbelts between existing and new homes,
- retaining the existing streetscapes and mature trees that define Glen Iris ,
- consideration for retaining the artificial lakes,
- providing smaller local open spaces with nature play areas,
- walking and cycling trails connecting open spaces,
- provision of a community hub for residents – potentially using existing the clubhouse premises.

At Workshop No 3 (Nov 2020), participants were given the opportunity to start to work in groups to draw aspects of the concept development plan with the specialist consultants.

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The participants worked in precinct groups to focus on the land's northern, central, and southern areas. These concepts illustrate some of the spatial outcomes considered important by the community including interface buffers, open space, road connections and local amenities.

Summaries of each PRG session have been made available to the entire community on our engagement website HaveYourSayGlenIrisEstate.com.au as part of our commitment to a transparent community engagement process.

Over the next few months, the Glen Iris Estate Project Team will begin developing a draft concept plan based on the ideas, insights, and information gathered through the PRG workshops and the findings of expert site investigations completed by the specialist consultants.

We will also be having meetings and discussions with key authorities and agencies such as the City of Cockburn, Water Corporation, Department of Education, Main Roads, and Department of Biodiversity, Conservation and Attractions to inform key aspects of the concept plan.

It is envisaged that the PRG will reconvene in late March/early April 2021 to view and discuss the draft concept plan. It will also be shared with stakeholders and the broader community around this time.

We have provided an overview of the PRG process and the next phase of our community engagement program in Edition 2 of the *Glen Iris Estate Community Newsletter*.

A PDF of the newsletter, delivered into all Jandakot letterboxes in mid-December 2020, accompanies this email. It is also available for members of the public to download from HaveYourSayGlenIrisEstate.com.au.

If you would like to discuss any aspect of our engagement process or proposed development, please contact me directly on 0422 234 553.

I wish you all the best for 2021, and I look forward to keeping you updated on Glen Iris Estate.

Yours sincerely

Jarrod Rendell
Project Director

Glen Iris Estate Project – March 2021
Stakeholder Update – Environment and Wildlife

Dear Elected Members, CEO and Directors, City of Cockburn,

Since the purchase of the Glen Iris Estate Project land in April 2020, there has been strong community interest in flora and fauna at the site and it's management.

Therefore I thought I would provide you with an overview of the work we have been doing with our environmental consultants, Emerge Associates (Emerge), over the past ten months.

Wildlife
In June 2020, Emerge completed a Level 1 Fauna Assessment of the land.

This provided our project team with a detailed understanding of the wildlife found across the project site, including the seven man-made lakes built as part of the former golf course.

As a result of the initial assessment, two snake neck turtles living in one of the lakes were relocated by a specialist contractor under licence from the Department of Biodiversity, Conservation and Attractions (DBCA).

Around 45 koi fish across several of the lakes were safely relocated to Woodvale Fish and Lily Farm to be rehomed by the Koi Society of WA.

Lakes
With the site no longer operating as a golf course, the irrigation system was stopped and the ageing equipment dismantled. The golf course was previously extracting around 325 million litres of groundwater annually to water the fairways and greens, along with applications of fertilizers, pesticides and herbicides to maintain the standard of the course.

Without an operating golf course, the Project Team did not believe it was environmentally responsible to be continuing to extract groundwater to maintain the grass across the site.

Once the irrigation system and bores were dismantled, we began slowly draining all of the lakes to ensure the unfenced waterbodies did not pose a drowning risk to the community or become a breeding ground for mosquitoes in the warmer months.

Ducks

Conscious that ducks may have been breeding around these lakes during the 2020 breeding season, we decided not to completely drain all of the lakes until the ducklings could fly.

We are aware that some Glen Iris community members have expressed concern that ducks may have been crossing Dean Road or entering residents' backyard swimming pools as the water levels in the lake lowered.

Emerge have provided advice that the movement of ducks is normal behaviour.

Waterbirds that may have used the lakes are well adapted to moving from wetland to wetland as water levels change (both seasonally and over longer timeframes, such as in response to climatic changes).

Early this year, we began working with leading non-profit wildlife rescue organisation Native Arc to continue our comprehensive monitoring and management of the ducklings at Glen Iris.

In addition to relocating several ducks and ducklings that were regularly entering resident's properties down to Bibra Lake, Native Arc is advising the project team on the draining of the remaining lakes at the project site, before the next breeding season.

This process has begun, and we have been keeping the City of Cockburn updated on all activities.

Quenda

Another issue that some community members have raised is the impact draining the lakes may have on quenda at the site.

Emerge, and a leading university researcher's expert advice is that quenda do not rely on bodies of water for their survival. Their water intake is generally through ingesting plant material containing water, rather than drinking from water sources. Accordingly, they do not need extra water (e.g., via watering stations) as claimed by some members in the local community.

Carnaby's Black Cockatoo

Our environmental monitoring has also focussed on the Carnaby's Black Cockatoos, which have been recorded foraging (feeding) on the project site and may have at times roosted (stayed overnight).

There is no evidence that black cockatoos have nested on the project site.

It is anticipated that a significant portion of the foraging and roosting habitat at Glen Iris will be retained in any future development proposal, limiting the impacts on the Carnaby Black Cockatoos.

Future Management Reports

Any residential development work undertaken in the future will only be conducted following the preparation and approval of an agreed Flora and Fauna Management Plan prepared by our consultants and reviewed by relevant authorities.

Until such time, we will continue to work with the City of Cockburn, Native Arc, Department of Biodiversity, Conservation and Attractions, and the community to achieve the best environmental outcomes at the proposed Glen Iris Estate.

If you have any further queries about wildlife at the site or other environmental aspects of the project, please don't hesitate to contact me on 0422 234 553.

Yours sincerely

Jarrod Rendell
Project Director

GLEN IRIS ESTATE

STAKEHOLDER UPDATE – 21st May 2021

At the City of Cockburn's Ordinary Council Meeting (13/05/21), several questions about Glen Iris Estate were raised by members of the public.

In line with our commitment to thorough and transparent community engagement, we are pleased to provide the following clarifications:

Petition to Upper House of State Parliament

We have always understood that some residents are disappointed that the former golf course closed, and they do not wish any redevelopment at the site.

In July 2020, these community members drove a petition containing 2,400 signatures presented to the Upper House of State Parliament.

However, the petition was shared online, and people across Perth were encouraged to sign, not just the local Jandakot community.

It was also fuelled by a plan that falsely depicted a high-density, low-quality development for Glen Iris Estate placed anonymously in all Glen Iris letterboxes.

The petition was generated before our Project Team had started its thorough community engagement program, which included establishing the Precinct Reference Group and our visioning workshops.

Unfortunately, the Jandakot Residents and Ratepayers Association went to the community shortly after Eastcourt purchased the site in April 2020 and advised them not to engage in community consultation.

We have always been committed to listening to the broadest possible range of stakeholder views and incorporating community aspirations into the plan for Glen Iris Estate.

GLEN IRIS ESTATE

Public transport route to support social housing

The Public Transport Authority (PTA) is the State Government authority responsible for determining public transport routes across Perth.

Roads within the existing Glen Iris neighbourhood are not suitable for buses, so the Glen Iris Estate concept plan incorporates roads designed to accommodate buses should the PTA decide a public transport route is required in the future.

While we recognise social housing as a whole-of-community responsibility, there is no provision for social housing in the Glen Iris Estate concept plan.

Discussions at the Precinct Reference Group (11/05/21) related to providing smaller, easy care blocks of around 300sqm to allow Glen Iris residents to downsize and remain living in the community they love as they get older.

Lakes at Glen Iris Estate

The Glen Iris Estate project site contained seven artificial lakes established as part of the irrigation system for the former golf course in the early 1990s.

The northern lake (near the old, fourth fairway) also captures stormwater drainage from nearby roads.

This lake is approximately 25m above the natural groundwater level and only held water because it was lined with plastic. This liner has now been partially perforated as we manage the draining of these lakes.

Irrigating the former Glen Iris Golf Course required a Department of Water licence allowing 325 million litres of groundwater to be extracted each year.

As the golf course is no longer operating, maintaining this level of groundwater extraction would not be environmentally responsible.

GLEN IRIS ESTATE

Update on the Glen Iris Estate concept plan

Our Glen Iris Estate concept plan was released on 27/04/21.

Copies of the plan were letterbox dropped to all residents in Jandakot, and we also ran an advert in the Cockburn Gazette to encourage people to view a digital copy of the plan at www.HaveYourSayGlenIrisEstate.com.au

Since the release of the plan we have had a total of 21 emails from 19 individual residents. Seven of these outright reject the concept plan, three support the concept plan and 9 were neutral or seeking more information on specific items of the concept plan.

While we understand there is a core group that do not support any redevelopment, we have also had discussions with residents who generally support the plan but have put forward minor changes or fresh ideas.

Our Project Team will continue to engage with all stakeholders to ensure the best possible community outcomes can be delivered at Glen Iris Estate.

If you would like any further information about topics covered in this update, please do not hesitate to contact me on 0422 234 553.

Yours sincerely

Jarrod Rendell
Project Director

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GLEN IRIS ESTATE

Glen Iris Estate Project Information Sheet
Asbestos

Is it true that asbestos is buried on the site?

The Project Team are aware of claims that there is asbestos buried within the project site.

We are taking these claims seriously and can report that investigations to date have found there is no evidence that large quantities of asbestos are buried on the site.

- As part of our preliminary site investigations, we looked at historical aerial photographs to help us build up an understanding of past land uses across the site. The photographs did not indicate any noticeable areas of uncontrolled fill or ground disturbances.
- We have also liaised with the Jandakot Residents and Ratepayers Association (JRRA) regarding the anecdotal claims that asbestos from former buildings on the site was buried on the land. To date, no further information has been provided to the Project Team regarding the claims.
- Geotechnical testing undertaken at the site to date has not found any asbestos containing material (ACM) on the site.

What sort of soil testing has been undertaken?

Geotechnical consultants have conducted soil profiling and water infiltration tests across the site. This involves digging a pit with an excavator or hand auger to reveal the sub-surface conditions.

A total of 55 large soil test pits and eight water infiltration pits were completed across the site, to depths of 2.2m.

The geotechnical investigations revealed soil conditions consistent with the expected profiles in this part of Perth, with deep sandy layers that have high infiltration rates for water.

What happens if you find asbestos during construction?

Should asbestos be discovered on the site during construction works we would work with our environmental consultants and a licenced contractor to safely remove the hazardous material in accordance with the relevant regulations and guidelines.

There is often the potential to find asbestos on development sites across metropolitan Perth, but it can be cleaned up safely, efficiently and effectively by a licenced contractor.

Common options for the removal of asbestos are outlined in the Department of Health's *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia* (2009).

Step 1: Community Engagement

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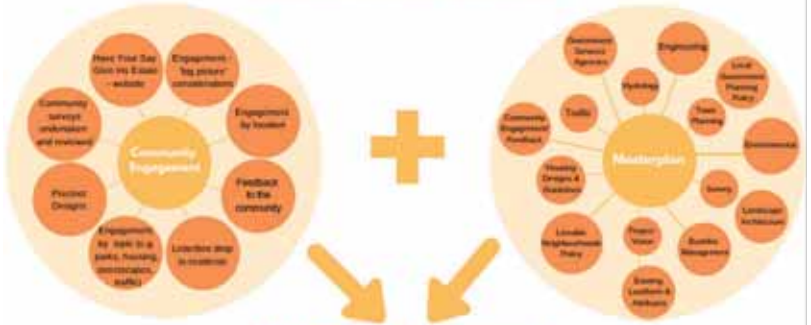

Step 2: Town Planning Scheme (TPS) Amendment

Step 3: Local Structure Planning (LSP)

GLEN IRIS ESTATE

Glen Iris Estate Project Information Sheet
Dilapidation Reports

What is a dilapidation report?

A dilapidation report, also known as a property condition survey, is an accurate survey of the state of a property at a particular point in time. The report records any existing damage and the state of any aspects of the property that are likely to be affected by future construction work.

Dilapidation reports form the basis of any claims of damage caused by construction work. They provide a legal record of a property's condition before construction begins. A follow up report can also be performed once the works have been completed.

The reports typically include a detailed photographic record of the condition of each property prior to any construction works commencing on the adjoining land.

The report is used as a baseline against any claims of damage by a property owner, to the construction contractor, as a result of the works.

In the event of any damage occurring as a result of the development works, the damage would be remedied and paid for by the contractor.

Who is responsible for the reports?

It is the responsibility of the civil contractor undertaking development works to undertake dilapidation reports prior to commencing works near existing homes and buildings.

The requirement is included in the construction contract between the developer and the civil contractor. Civil contractors arrange insurance to cover the cost of repairs in the event of damage to nearby homes as a result of the work they are carrying out.

The project engineers who are overseeing the project will ensure the contractor adopts best industry standards when working on the development.

Will I need a survey done on my property?

Property condition reports will be offered to the owners of properties that are deemed to be in close proximity to the staged works across the Glen Iris Estate project site as development progresses.

With the homeowner's consent, the report will be completed by a specialist consultant appointed by the civil contractor prior to work commencing.

Homeowners will be offered this service by the civil contractor's nominated sub-consultant. You are not obliged to accept the offer but if the offer is not taken up it is very difficult to justify any claims of damage at a later date.

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Exactly which properties will be surveyed will be determined on the advice of the project consultants and civil contractors. As a guide, the industry standard (for example, on State Government infrastructure projects) is to offer surveys to owners of properties within 100m of the active works site. This can vary, depending on the nature of the work being done, the equipment to be used and the conditions of the site.

A copy of the dilapidation report prepared by the contractor can be provided to the homeowner.

What about retaining walls?

Retaining walls are generally built inside the boundary of the property they are supporting (i.e. on the high side of the wall). They will be assessed as part of the property condition report undertaken before any works commence.

Can I organise my own dilapidation report?

As a homeowner you can arrange to have an independent dilapidation survey completed on your home, outbuildings and any other structures on your property.

Should you choose, as the homeowner, to arrange an independent survey this would be at your cost.

Dilapidation surveys commissioned by a homeowner are for the homeowner's information only.

It is highly unlikely that a civil contractor would accept a dilapidation report that they had not commissioned, due to strict insurance and liability requirements.

An independent second opinion would not replace the need for the civil contractor to undertake a dilapidation report on properties adjoining the project site.

Construction works are not expected to commence at Glen Iris Estate for another two years, assuming rezoning and planning approvals are achieved in an orderly timeframe.

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Glen Iris Estate Project Information Sheet
Fauna & Flora

The Glen Iris Project Team are aware that a range of wildlife inhabit the Glen Iris project site, including ducks, parrots, black cockatoos and quenda (a small marsupial). There are also mature trees, natural vegetation and a number of man-made lakes on the project site.

How old is this ecosystem?

Aerial photos from the mid 1990s show that a significant area of bushland was cleared to make way for the former golf course and the existing Glen Iris housing.

Over a period of 25-30 years, the trees and vegetation on the course matured and the irrigation lakes provided habitat for a range of animals and plants.

During this time the golf course annually extracted up to 325 million litres of groundwater for irrigation purposes and required fertilisers, herbicides and pesticides as part of its maintenance.

With the land no longer operating as a golf course, the ongoing water extraction and course irrigation is no longer environmentally sustainable or responsible.

Who are your environmental consultants?

Our Project Team includes highly experienced environmental consultants from Emerge Associates (Emerge) to ensure a best practice approach to complying with all Local, State and Federal regulations.

The team at Emerge have been carefully monitoring and guiding the environmental management of the project site ever since the sale of the land was settled in April 2020.

In June 2020, Emerge completed a Level 1 Fauna Assessment across the project site. The survey provided our team with a detailed understanding of the wildlife to be found across the project site.

As part of our ongoing management and monitoring of the site, we are also obtaining input from other sources, including:

- Native Arc
- RSPCA
- City of Cockburn
- Department of Fisheries
- Department of Biodiversity, Conservation and Attractions
- Department of Water and Environmental Regulation.

What is the impact of draining the lakes?

The seven man-made lakes – built as part of the former golf course in the 1990s – were reliant on the groundwater to hold the water levels. They have started to dry up now that the irrigation system is no longer operating.

Three of the lakes form part of the drainage network, capturing and storing stormwater run-off from surrounding roads.

The Level 1 Fauna Assessment completed by Emerge in June 2020 included a thorough investigation of the seven man-made lakes.

<u>Turtles</u>

As a result of the initial assessment, two snake neck turtles were relocated to an authorised private dam by a specialist under licence from the Department of Biodiversity, Conservation and Attractions. This was considered to be the safest option for the long-term survival of these turtles.

<u>Fish</u>

Around 45 koi fish and carp were safely relocated to Woodvale Fish and Lily Farm to be rehomed by the Koi Society of WA.

Koi and carp are both introduced species that are known to pose threats to native aquatic wildlife and ecosystems in natural waterways.

<u>Ducks and other waterbirds</u>

As the team were aware that ducks were nesting and breeding around the man-made lakes, it was decided to defer completely draining the lakes until the ducklings could fly, normally 12 to 16 weeks after hatching.

The duck breeding season typically runs from July to September.

As the water levels have progressively dropped in the lakes, the Project Team have monitored the ducks and other waterbirds across the site in consultation with leading wildlife rescue, relocation and rehabilitation organisation Native Arc. According to the *Wildcare Helpline Ducks and Ducklings* section of the Department of Biodiversity, Conservation and Attractions website, ducks often nest a considerable distance from wetlands.

Being well adapted to urbanisation, they are often in backyards as they feel secluded and safe. They are attracted to swimming pools because they can clearly see there are no underwater predators.

By their very nature, ducks are mobile animals and cannot be contained within a certain area. For many years, the City of Cockburn has installed warning signs along Dean Road during the spring and summer months advising drivers to look out for ducks and ducklings.

It is important to note that waterbirds that may have used the lakes are well adapted to moving between water sources as water levels change (both seasonally and over longer timeframes, such as in response to climatic changes).

What about other animals and plants?

Quenda

Quenda, also known as southwestern brown bandicoots, are small ground-dwelling marsupials encountered in urban and suburban areas of the southwest of Western Australia.

They are listed as Priority 4 species on the Department of Biodiversity, Conservation and Attractions priority fauna list. Priority 4 species require regular monitoring.

The habitat of the quendas at Glen Iris remains largely the same as it was before the land was transferred to the new owners.

Our environmental experts have confirmed quenda do not need supplementary water (e.g. via watering stations) as their water intake is generally through ingestion of plant material, insects and bugs containing water, rather than actually drinking from water sources.

Before any development work is undertaken, the management of the quendas will be incorporated into a thorough Flora and Fauna Management Plan in line with government requirements.

Relocating quenda is a standard process often undertaken for developments within WA and this option will be explored by Emerge for the Glen Iris project site.

A licence is required from the Department of Biodiversity, Conservation and Attractions for the relocation of quenda.

Carnaby Black Cockatoo

Black cockatoo habitat occurs right across the Perth metropolitan area (Swan Coastal Plain).

They have been recorded foraging (feeding) on the project site and may have at times roosted (stayed overnight), typically in large trees near water.

There is no evidence of black cockatoo breeding ever occurring on the project site.

It is anticipated that a substantial portion of breeding, foraging and roosting habitat at Glen Iris will be retained as part of the future development, thereby limiting the impacts on the Carnaby Black Cockatoos.

Banksia Woodland

Banksia woodland is protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. None of the vegetation in the project site qualifies as a patch of the Commonwealth-listed banksia woodland.

Banksia woodland is also protected as a "priority ecological community" under State approval process. Small areas of State-listed banksia woodland occur on the project site, however they are a form of banksia woodland that is relatively well retained in the local area.

The retention of native vegetation is a consideration in our project design process.

Wildflowers

To the knowledge of the Project Team, it is not true that a rare orchid has been discovered on the project site. Neither is it considered likely to occur given the high disturbance of the site when the golf course and surrounding housing was developed in the mid-1990s. Spring 2021 (flowering season) will be the time when wildflower species can be confirmed.

Stylet Bush Cricket

The project site does not constitute habitat likely to support a rare invertebrate and there is no reasonable basis to suggest that this cricket is present.

Will you retain some of the trees?

Mature trees feature across the project site and we understand the benefits to the community of retaining as many of these as possible.

A detailed site survey is being undertaken to rate and classify every tree to identify those that could be suitable for retaining or relocating as part of the future development.

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GLEN IRIS ESTATE

Glen Iris Estate Project Information Sheet

Site Maintenance and Security

Trees and maintenance

Tree loppers and maintenance contractors visit the Glen Iris Estate site regularly. A range of activities, including pruning, mowing, slashing of weeds and fence repairs, are undertaken to keep the site tidy and safe.

Tree loppers have been pruning trees that are either at risk of dropping large branches onto adjacent properties or have branches that need to be removed.

Much of this work has been done at the request of residents concerned about large trees overhanging their boundary fences.

Dust Suppression

Why is there more dust than usual?

The Project Team are proactively managing dust on the project site, especially given this summer's particularly strong and prolonged easterly winds, which are known to aggravate dust issues.

What is being done about it?

Specific locations where dust appears to be an issue have been mapped by the Project Team, possible causes beyond prevailing winds have been investigated and all reports (by residents to the City of Cockburn) of increased dust have been acted upon.

The City of Cockburn have conducted dust monitoring in several locations adjoining the site and those investigations have not identified any dust readings that exceed the normal levels expected.

Based on the information provided by residents and our liaison with the City of Cockburn, initiatives have been explored to minimise dust emanating from the site.

Where and when possible, we will:

- Require any vehicles that need to be on the site (eg fence maintenance, bush fire inspections, wildlife monitoring) to be driven at a speed of no more than 15km/h.
- Apply hydromulching to dust-generating areas.

- Install dust screen fencing in appropriate areas where hydromulching would not effectively minimise dust.
- Instruct security officers to conduct patrols at the site from external roads where possible. Those elements of the patrols that need to be undertaken inside the fence to be done at the new maximum speed limit of 15k/h.

In addition to these actions, the Project Team will develop a specific Dust Management Plan for any future works at the site as and when required by the City of Cockburn.

We're committed to staying on top of dust and we welcome people alerting us to any potential issues so we can take action quickly.

Residents who notice an increase in dust are encouraged to contact Louise@glenirisestate.com.au or call the Glen Iris Estate Community Engagement line on 08 6115 6365 and a member of the Project Team will be sent to investigate.

Bushfire Management

What's the current situation?

The Glen Iris Estate Project Team includes a bushfire consultant from Eco Logical Australia who has undertaken a bushfire risk assessment for the site.

All grass and weeds were mowed to a height of 50mm as part of the annual seasonal fire management plan agreed with the City of Cockburn in late 2020.

We will be maintaining this level of maintenance during the designated bushfire season, from the beginning of November and until mid-April. The rest of the year we will continue to manage grass within 20m of property boundaries that adjoin the project site.

Other ongoing site maintenance work that supports bushfire management includes tree pruning, branch removal, debris clean-up and the mowing / slashing of grasses.

Are there regular DFES inspections?

The Department of Fire and Emergency Services (DFES) and the City of Cockburn undertake regular inspections of the site with the Project Team.

To date, the site is deemed to be fully compliant with the Fire Control Order Variation with the City of Cockburn. Routine DFES inspections are scheduled every three weeks during the bushfire season.

In January 2021, the Project Team asked DFES to carry out a Risk Assessment, in addition to its routine inspections, to identify if there were any additional works that could be undertaken.

A Bushfire Risk Management Officer from DFES inspected the site and confirmed it was rated a low bushfire risk.

The assessment determined the site was generally very tidy and presented in a maintained standard, with onsite fire hydrants still in service. At the time of inspection, it did not present a significant bushfire risk.

The Project Team continues to work closely with the City of Cockburn on all site maintenance issues.

What about security at the site?

The land is securely fenced, and we have monitored alarms and CCTV in place as well as mobile security patrols. If you notice any suspicious or anti-social behaviour, please report it immediately to the Cockburn Police on 6174 9666.

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GLEN IRIS ESTATE

Glen Iris Estate Project Information Sheet
Planning & Design

It is anticipated that the Glen Iris Estate Concept Plan will be ready to share with the community in the first quarter of 2021.

The Concept Plan will have consideration for the community input from the Precinct Reference Group and other discussions with community members, along with input from the expert consultants we have engaged to conduct detailed site investigations on everything from environmental considerations to traffic management.

Formal planning applications for the Town Planning Scheme Amendment (rezoning) and Local Structure Plan are expected to be lodged with the City of Cockburn in the second quarter of 2021.

For a step-by-step guide to the statutory planning process, which includes opportunities for public submissions, visit https://www.haveyoursayglenirisestate.com.au/fact-sheets/news_feed/fact-sheet-consultation-and-planning

How many homes will there be at the new Glen Iris Estate?

The Project Team have been consistent in stating that we expect between 600-800 homes in the new development at Glen Iris Estate.

Our team is considering the site in its entirety and striving for an equitable balance of development, open space and amenity in accordance with the underlying urban zoning.

Will there be a buffer between the old and the new?

This has been identified in the Precinct Reference Group workshops as a priority for residents whose properties back onto the former golf course. The solution may include a combination of options, such as public open space and widened road reserves with retained trees. It could also include vegetation protection zones in future private land.

Interface and buffer options will be included in the Concept Plan.

There is no guarantee of any specified distance or setback until final planning designs and approvals are undertaken, including considerations and assessments with the City of Cockburn and the Department of Planning, Lands and Heritage.

How much public open space will there be?

The amount of public open space is ultimately a decision for the City of Cockburn and the Department of Planning, Lands and Heritage when they assess the Local Structure Plan proposal.

We do however anticipate that the amount of public open space will be substantially more than the standard 10% of the gross subdividvisable area of any new development required by the Department of Planning, Lands and Heritage.

How does the Department of Planning, Lands and Heritage define and calculate public open space?

Public open space is land within a residential estate that is contributed free of cost by the developer for the creation of parklands.

The developer must contribute a minimum of 10% of the land that can be sub-divided to public open space.

This can comprise a minimum of 8% active and passive recreational purposes where the remaining 2% (of the overall minimum 10% requirement) comprises restricted-use land for areas such as drainage swales and natural wetlands.

For the purposes of calculating public open space requirements, the gross subdivisible area excludes land proposed for non-residential use such as school sites, retail/commercial sites, regional roads, power transmission corridors, and environmental protection policy areas.

What will the landscaping look like?

The mature trees on-site provide a valuable asset to the Glen Iris Estate land and where possible will form an integral part of the future landscaping plans.

It is too early to confirm the exact vegetation to be planted in specific locations, however there is likely to be a variety of trees, shrubs and other plants to supplement the existing mature trees and vegetation, many of which will be retained.

New streets will have street trees and new parks will have new tree plantings.

We anticipate a mix of retained mature trees and new trees in both the street verges and the new parks.

The Project Team are focussed on ensuring as many of the trees as possible are retained.

Are you likely to plant London Plane trees?

Among the many mature trees on the project site there are a few plane trees.

If these are deemed suitable for retaining or relocation then careful consideration will be given to their location. Options might include use in parks and wider verges, away from footpaths, driveways and homes.

Our team is aware that plane trees have the potential to cause issues in the wrong location and we will be working closely with our environmental consultants, landscape designers and the City of Cockburn to ensure all trees, either new, retained or transplanted, are in the appropriate position.

Who will be responsible for looking after the new parks?

The installation of new parks is the responsibility of the developer. The City of Cockburn requires developers to undertake the maintenance of new parks they create for a minimum of two years.

Ongoing maintenance costs will be a consideration for the City of Cockburn when it is assessing how much and what type of public open space is approved for the new development.

The developer is responsible for securing groundwater licences and installing new bores to irrigate the parks.

Bores and licences will eventually transfer to the City of Cockburn.

Mains water is *not* used for the irrigation of parks.

What about parking, footpaths and cycleways?

Adequate street parking, and parking near shared spaces such as retail outlets and parks will be provided, as well as elsewhere as needed.

The estate will be designed to encourage walking and cycling, with good connectivity within the estate and further afield to local facilities, including the freeway cycle path.

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Planning Terms & Definitions

Navigating your way through the WA planning system can be complex and confusing. Here is a brief explanation of some of the phrases, planning schemes and regulatory bodies that you might come across during the engagement process for the former site of the Glen Iris Golf Course.

Town Planning Scheme

Town Planning Schemes, also known as Local Planning Schemes, are made under Part 5 of the Planning and Development Act 2005, which sets out the general objectives of schemes, the matters which may be addressed and the requirements for review.

Where schemes involve the zoning or classification of land, they are required to reflect the Planning and Development (Local Planning Schemes) Regulations 2015. Importantly, there are some sections of the scheme which are 'deemed provisions' which cannot be changed.

Schemes include a variety of zones and accompanying statutory planning provisions which combine to provide for control of land use and development. This combination reflects a set formula of land use possibilities and zoning arrangements, with the intent being that the formula achieves the aims of the Scheme, which itself is derived from the strategic vision of the Local Planning Strategy.

The local planning scheme for the City of Cockburn is known as Town Planning Scheme No.3 (the Scheme) and regulates how land in the City is used and developed.

Source: City of Cockburn

Town Planning Scheme Amendments:

From time to time, it becomes necessary to amend the City's Town Planning Scheme No. 3 (TPS No.3). When a change is proposed or made to TPS No.3, it is referred to as a scheme amendment. These changes can be proposed by landowners, State Government agencies or the City itself. The decision to initiate a scheme amendment is however at the discretion of the City (which has no appeal rights), and once initiated the City becomes responsible for progressing a scheme amendment.
Scheme amendments occur for a variety of different reasons including:

- A change in zoning to accommodate development
- A change in the residential density coding to alter residential density
- A change in the scheme's wording to ensure more effective planning
- To implement the strategic vision of the local planning strategy
- To ensure orderly and proper planning.

Source: City of Cockburn

Local Structure Plan

Structure plans outline the structure and layout of future development areas. They may cover multiples suburbs or all or part of a townsite. Structure plans illustrate road networks, housing density, land use zoning and buffer zones. A standard structure plan process applies across the State, and is guided by the Town Planning Scheme No. 3 and the Western Australian Planning Commission's Structure Plan Guidelines.

Source: City of Cockburn

Public Open Space (POS)

Public Open Space (POS) is space that is accessible to the public.
When a land owner develops a new residential area, they are required under WA planning legislation to set aside 10 per cent of the gross sub-divisible area as Public Open Space*.

Ownership of this POS is transferred by the land owner to the Crown free of charge once the land development has been completed. Maintaining the POS then becomes the responsibility of the local government authority.

Source: Department of Planning Heritage & Lands

Metropolitan Region Scheme (MRS)

The Metropolitan Region Scheme (MRS) defines the current and future use of land and provides the legal basis for planning in the Perth metropolitan region, dividing it into broad zones and reservations. The MRS area stretches from Singleton in the south to Two Rocks in the north and east to The Lakes. It requires local government town planning schemes to provide detailed plans for their part of the region, consistent with the MRS.

Source: Department of Planning Heritage & Lands

'Urban' zoning within Metropolitan Region Scheme (MRS)

Under the MRS, the entire site of the former Glen Iris Golf Course is zoned 'Urban'. The MRS defines urban as 'Areas in which a range of activities are undertaken, including residential, commercial, recreational and light industry.'

Source: Department of Planning Heritage & Lands

Western Australian Planning Commission (WAPC)

The Western Australian Planning Commission (WAPC) has state-wide responsibility for urban, rural and regional integrated strategic and statutory land use planning and land development. The WAPC's responsibilities include:

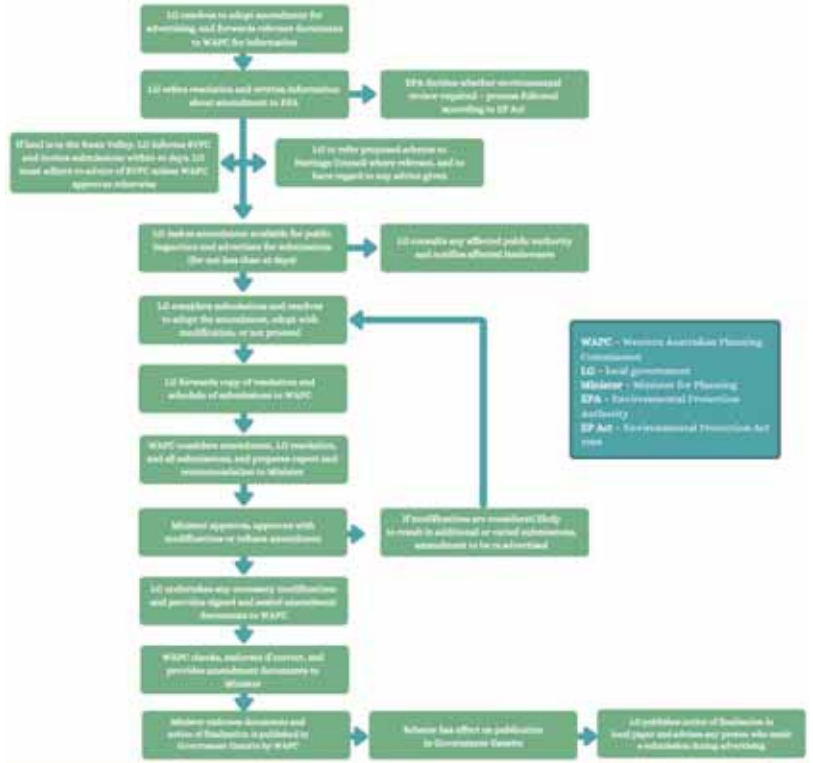
- Advising the Minister for Planning on strategic land use planning and land development, legislation reform and local planning schemes
- Making statutory decisions on a range of planning application types
- Implementing the State Planning Strategy to provide a vision for the future development of Western Australia
- Developing integrated land use planning strategies for the coordinated provision of transport and infrastructure for land development
- Preparing and reviewing region schemes to cater for anticipated growth
- Monitoring and forecasting land supply throughout the State and developing strategies for the timely supply of affordable residential land
- Researching and developing planning methods and models relating to land use planning, land development and associated matters
- Acquiring land for public requirement reservations in region planning schemes and negotiating compensation for affected landowners.

The flow chart below outlines the role of the WA Planning Commission in local planning scheme amendments.

Source: Department of Planning Heritage & Lands

Local Planning Scheme Amendment

Reproduced from 'Introduction to the WA Planning System'
(published by the Department of Planning and Western Australian Planning Commission)



GLEN IRIS ESTATE

Glen Iris Estate Project Information Sheet
Wildlife and Lakes

Wildlife at the site

The Glen Iris Estate Project Team is aware that a range of wildlife including ducks, parrots, black cockatoos and quenda (a type of bandicoot) inhabit the project site in Jandakot.

A fauna assessment has been completed by environmental consultants at Emerge Associates.

Other than some preliminary lake draining and regular maintenance, there is currently no work being undertaken at the project site.

Any residential development work undertaken in the future will be undertaken in accordance with an agreed fauna management plan prepared in consultation with relevant authorities.

This plan will need to be approved prior to any clearing or earthworks commencing.

Lakes

There are seven lakes at the Glen Iris Estate project site. One of these is a small unlined lake, while the other six are lined lakes. They were all created for the former golf course in the early 1990s.

As the bore pumps and irrigation system are no longer operating, these artificial lakes will start to dry up when the weather gets warmer.

Two of the seven lakes have recently been drained to safely remove and relocate 45 koi fish and two southwest snake-necked turtles before they dry up.

The draining of these lakes and the koi and turtle relocation were completed by a licensed fauna specialist, monitored by Emerge Associates.

The other five lakes will be slowly drained to ensure these unfenced waterbodies do not pose a drowning risk to the community or become a breeding ground for mosquitoes in the warmer months.

However, the Project Team is conscious that waterbirds such as ducks may breed around these lakes during the 2020 breeding season.

Accordingly, the remaining lakes will not be completely drained until waterbird nestlings have *fledged*, which means they can fly. This typically occurs between 45 and 60 days after being born.
It is important to note that water birds are accustomed to moving between wetlands so when the lakes are drained, they will naturally fly off to other locations.

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Dean Road Lake

The lake on Dean Road contained Koi Fish. It was drained following their safe removal and relocation to Woodvale Fish and Lily Farm to be rehomed by the Koi Society of WA.

In response to community feedback, the Glen Iris Estate Project Team will now have fencing installed around the lake as a public safety precaution.

The local community will still be able to access the adjacent footpath.

Landscape contractors will also be on-site shortly to mow and tidy the area surrounding the Dean Road lake and remove fallen tree branches.

Duck Breeding Season

The following facts are from the Wildcare Helpline Ducks and Ducklings section of the Department of Biodiversity, Conservation, and Attractions' website.

July to September is breeding time for ducks - before then, they are looking for safe places to nest and raise their young.

Ducks often nest a considerable distance from wetlands, and, being well adapted to urbanisation, they are often in backyards as they feel secluded and safe from predators.

The eggs hatch approximately 28 days after laying, and the following morning the mother will lead the young to water.

Ducks are attracted to swimming pools as they can clearly see there are no underwater predators that may take them or their young. However, there is nothing edible for them, and they can find it difficult to get out.

The best method in preventing ducks from using your pool is to use a pool cover.

Trees

While there is no plan for the proposed Glen Iris Estate as yet, trees will play a big part in the overall design.

In addition to retaining as many mature trees as possible, the Project Team anticipates there will be at least one street tree per new home and hundreds more in the parks and open space.

This means Glen Iris will continue to attract birds such as black cockatoos and parrots.

September 2020

Will site maintenance be undertaken during the consultation and planning phase?

We are undertaking regular maintenance including mowing and slashing grass, tree pruning, firebreak clearing and fencing repairs. Maintaining fairways and greens takes a considerable volume of groundwater so as the golf course is no longer operating, the irrigation has been turned off.

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What about birds and other wildlife at the site?

Our environmental consultants are visiting the site regularly to document all flora and fauna and provide recommendations for the best practice management of local birds and wildlife.

This has included the safe capture and relocation of some Koi fish and turtles that were in one of the irrigation lakes that is being drained with approval from the Department of Biodiversity, Conservation, and Attractions (DBCA) .

For more information on the relocation of the Koi fish and turtles, see Latest News.

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What about security at the site?

The land is securely fenced, and we have monitored alarms and CCTV in place as well as mobile patrols. If you notice any suspicious or anti-social behavior, please report it immediately to the Cockburn Police on 6174 9666.

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Will there be further opportunities for the community to share their ideas and thoughts about the proposed residential development?

The project team is committed to ongoing engagement with the Glen Iris community, through structured processes such as the Community Survey and the Reference Group Workshops, and by inviting community members to provide feedback directly to the project team either by emailing Louise at louise@glenirisestate.com.au or by calling 6615 6365.

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Who has bought the Glen Iris Golf Course site?

The new owners of the land are Eastcourt Property Group, a family-owned company with a proud 40 year history of developing in Western Australia.

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What is planned for the site?

While we don't have a design concept yet, the vision is to turn the 54 hectares of land that straddles Berrigan Drive into Glen Iris Estate - a vibrant residential community with quality homes, public parks, and leafy streets.

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How can a public golf course be closed?

Glen Iris was a privately-owned golf course that was open to the public. In recent years there was a steady decline in the number of golfers and the owners decided to close the business and sell the land.

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How can public open space be taken away from the community?

Glen Iris Golf Course was privately owned and only ever accessible to people playing golf. The new Glen Iris Estate will include new parks and other public areas that can be accessed and enjoyed by the entire community.

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How can land zoned for a golf course be developed as residential?

The land is zoned Urban under the State Government Metropolitan Regional Scheme. It is zoned Special Use 1 and Residential R40 under the City of Cockburn Town Planning Scheme. Any proposal to change the zoning must go through a formal process involving community engagement and applications for Local and State Government approval. For further information, see our FactSheet: Planning Terms and Definitions.

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I took the time to complete a survey and provide feedback to the project team. Will the project team share the survey findings with the community?

Thank you to everyone who took the time to complete the survey. Click here for a summary of the survey findings from Metrix Consulting (the research company that developed and managed the survey).

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Why would you purchase the land without having pre-approval to develop a residential estate?

We bought the land knowing we would have to consult thoroughly with the community and apply for Local and State Government planning approvals to create a residential estate on the site.

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What happens to people who bought a home with 'golf course views'?

We were not involved in the original subdivision or sale of land at Glen Iris and can't comment on how it was marketed to buyers.

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Who is running the Glen Iris Estate project?

A team of project consultants led by Acumen Development Solutions is planning and designing Glen Iris Estate. The team includes town planners, civil engineers, surveyors, traffic experts, environmental consultants, landscape designers and community engagement coordinators.

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How will you consult with the community?

We are running a comprehensive six to nine-month engagement program to enable the Jandakot community to contribute ideas for the new Glen Iris Estate and provide feedback on a range of topics. You can take part in surveys, workshops, and discussions to help explore what's important to residents and what the future Glen Iris Estate could look like by registering here.

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How can I get updates of the project?

HaveYourSayGleniirisEstate.com.au is also an information hub for the project. Here you will find the answers to frequently asked questions, feedback from surveys and topic discussions, and updates from the project team.

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How do I speak to someone from the project team?

Contact Louise@gleniirisestate.com.au or call the Glen Iris Estate Community Engagement line on 08 6115 6365

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GLEN IRIS ESTATE

Glen Iris Precinct Reference Groups

Terms of Reference

The **Glen Iris Precinct Reference Groups** (PRGs) provide a forum to facilitate communication between the community, stakeholders and Eastcourt about the proposed redevelopment of the site of the former Glen Iris golf course.

Three Precinct Reference Groups will be established – Southern, Central and Northern - each consisting of a maximum of 20 members.

The role of the PRGs is to:

- Assist in identifying, discussing and advising on areas of interest to the community associated with the proposed redevelopment.
- Receive information from Acumen Development Solutions and its specialist consultants for consideration with the wider community.
- Provide representative community input into the vision for the proposed redevelopment.
- Workshop specific topics and areas of interest relating to each individual precinct, to assist the project team in creating a community that reflects the priorities of existing Glen Iris residents.

The PRGs will not discuss reverting the site to its former use as a golf course.

PRG meetings will be facilitated by Metrix Consulting. Meeting summaries will be prepared and circulated following each meeting.

GLEN IRIS ESTATE

Meetings are expected to last around 2 hours and will be held outside of normal working hours at Cockburn Arc. At this stage we anticipate a total of three meetings for each PCG to be held on the following dates:

Southern Precinct Reference Group:
- Tues 22 September
- Tues 20 October
- Tues 17 November

Central Precinct Reference Group:
- Weds 23 September
- Weds 21 October
- Weds 18 November

Northern Precinct Reference Group:
- Thurs 24 September
- Thurs 22 October
- Thursday 19 November

Code of Conduct

All members of the Glen Iris Estate Precinct Reference Groups (PRGs) agree to the following standards of behaviour and rules:

- Understanding and respecting the purpose of the PRG
- Respecting and being courteous to others and their opinions
- Letting people have their say
- Accepting and embracing differences
- Resolving issues and differences before leaving meetings or advising the facilitator of issues and concerns
- Maintaining confidentiality as required
- Refraining from taking photographs or video, or electronically recording the proceedings in any way
- Representing broad community interests rather than individual agendas.

Glen Iris Estate Reference Group – Workshop #1 Summary

The first Precinct Reference Group workshop was held on 23 September 2020, facilitated by Metrix Consulting.

The group consists of 26 residents from the Glen Iris community, and 24 attended the first workshop. The aim of the first workshop was for residents to identify their top five areas of interest that they would like to explore in more detail with the Project Team in workshop #2.

This document is a summary of the top five topics and associated areas that the Reference Group would like to focus on.

The Top Five Priority Areas for Future Consultation:

Traffic & Access	Future Housing	Open Space & Environment	Interface	Local Amenities
• Traffic volumes • Connectivity • Entries • Public transport • Walking, cycling and vehicles	• Density • Lot sizes • Housing quality and guidelines • Property values	• Mature trees & habitat • Walking and cycle paths • Bridge • Parks (dog areas, playgrounds, active play) • BBQs and social spaces	• Buffers • Privacy • Greenbelts • Retained vegetation • Fencing	• Shops, cafes and pub • Social precincts • Community meeting places • Design quality

The Precinct Reference Group workshops are being held to gather ideas from the residents and work through options to inform the development master plan. If there is sufficient interest from residents, we will set up a second reference group.

Please contact Louise Richardson on 08 6115 6305 or louise@glenirisestate.com.au by 12 October to find out how you can be a part of our next workshop in the week commencing 19 October 2020.

HAVE YOUR SAY - Glen Iris Estate

Broadly, the same themes and topics emerged across all three Precincts. A summary of the key themes by Precinct is outlined below:

Northern Precinct

Residents in the Northern Precinct would like to see any future development maintain the current aesthetics and community feel of Glen Iris. The current uncertainty of proposed housing density and lot sizes is of concern for residents. The majority would like to see buffers and/or greenbelts incorporated into the plan to ensure privacy, and to minimise the impact on vistas from existing homes.

Traffic is also a key area of discussion, with many questioning traffic volumes given the number of anticipated lots and how more traffic will flow in and out of the estate and onto arterial roads.

Many would like to see new local amenities and green open spaces with interest in boutique shops, gourmet grocer, cafes, playgrounds, dog parks and walkways. All feel the key to successfully building new amenities in the estate is to ensure they visually complement Glen Iris and are maintained to a high-level once development has finished.

Central Precinct

Those living in the Central Precinct would like to see a balance between new housing and new open spaces and streetscapes with retained mature vegetation across the master plan. It is believed this will complement and align with the current vista of Glen Iris.

This group also expressed concern about how increased traffic volumes will be managed. Road safety was a priority, with low speed limits and efficient road planning to minimise traffic funnelling seen as potential mitigating solutions.

Many want to see social hubs incorporated into future plans e.g. cafes and some small shops. The retention of the existing clubhouse building and developing it into a shared community space (e.g. function area, cafe, restaurant, etc) was raised by some residents.

Southern Precinct

Traffic management is the key concern for residents in the Southern Precinct, including managing traffic flow and access to major arterial roads. Some also want to have more public transport options incorporated in the master plan.

Residents want to see child and dog friendly open spaces, that have facilities to cater for both small and large social gatherings (e.g. BBQs, picnic tables, community events, etc). Maintaining existing vegetation and habitats for fauna is considered important.

Residents also want to see boundaries and buffers around existing properties to minimise the impacts on vista and maximise privacy. There were also discussions about whether narrow pathways at the rear of property boundaries would create security risks.

HAVE YOUR SAY - Glen Iris Estate

Glen Iris Estate Reference Group – Workshop #2 Summary

The second Precinct Reference Group (PRG) workshop was held on 21 October 2020, facilitated by Metrix Consulting, with expert planning, design, traffic, environmental, civil engineering and landscaping consultants in attendance. The group consists of 29 residents from the Glen Iris community, and 22 attended the second workshop. The aim of the second workshop was to explore with the specialist consultants the key priority areas identified in Workshop #1.

This document is a summary of the key ideas and considerations identified for further detailed examination and consultation.

The top five priority areas identify in Workshop #1, and further discussed in Workshop #2 were:

- Traffic & Access
- Future Housing
- Open Space & Environment
- Interface
- Local Amenities

Traffic & Access

The PRG identified traffic and access into and out of the estate as one of the most complex topics associated with the Glen Iris development. Conversations centred heavily around the use of cars, followed by public transport and other modes of transport (e.g. cycling, walking, etc).

Key areas raised by residents for consideration by the Project Team include:

- Access to Berrigan Drive and other external road networks are currently limited. In order to disperse traffic efficiently and effectively, consider new access ways north east of Glen Iris, a connection into the existing 4-way signal interchange on Jandakot Road, or a new signalled intersection between Prinsep Road and Hartwell Parade (note: signals from additional intersections along Berrigan would need to align to manage traffic flow).
- Traffic should not be funnelled down any existing roads, especially Dean Road.
- There is currently inadequate and infrequent public transport services in the area. Existing roads are too narrow to accommodate a bus route, so the new road network will need to consider bus routes and access.
- The cul-de-sac at the end of The Lakes Boulevard needs to be retained to eliminate people using the street as a rat run.
- There is a desire to maintain the verges, trees and amenities on existing residential roads with little interest in adding walkways to existing infrastructure. New roads should include: walk paths, and adequate parking to ensure road and street safety.
- Retain and improve the existing pedestrian underpass for residential use, to provide safer options for crossing Berrigan Drive.
- Incorporate cycling connections from the development onto the existing Kwinana Freeway Principal Shared Paths (PSPs).
- Investigate other developments occurring and/or planned in the area to get a holistic view of the traffic impacts, and take these into consideration when planning the new road network for the development.

Housing and Interface

Housing and Interface were combined into one topic for Workshop #2, and generated a range of potential solutions and considerations for the Project Team, including:

- Buffer zones and greenbelts around existing and new properties. The benefits of these were considered two fold, with existing homes able to retain the existing natural vista, and new homes being able to enjoy more spacious blocks than traditional developments.
- Retain where possible or incorporate new water bodies into the development to retain the existing look and feel of Glen Iris.
- Those living on existing properties that border the golf course want to overlook the front of any new properties not the back, to help maintain privacy.
- Retain or replace key drainage outlets across the estate to ensure excess water is monitored and managed to reduce the risk of flooding. People feel the existing drain network is effective, however are open to a re-design as long as it maintains its current effectiveness.
- Retain the existing streetscapes, including mature trees. New streets should emulate what is currently loved about Glen Iris, while incorporating additional parking spaces to meet future demand. On street parking is preferred, however the roads need to be wide enough to ensure safety for passing cars, and pedestrians to cross.
- Design guidelines are required to ensure new homes are developed and designed in a way that marries with the existing homes of Glen Iris.
- To increase the vibrancy of Glen Iris, some participants thought functional public art could be incorporated into shared open spaces.

Local Amenities

Members of the Reference Group want to maintain the community feeling of Glen Iris and would like to see shared community spaces incorporated into the future development. Three key areas were considered important for future consultation and consideration:

- **Community hub** - future local amenities need to focus on creating a family friendly community hub for local residents.
  - Residents would like to see the existing club house utilised and developed into a shared community space (e.g. restaurant, function area, etc)
  - Casual dining cafes and restaurants were of interest. However, few felt there was a need for additional grocery or takeaway stores (e.g. McDonalds, KFC, etc.)
- **Walking, running and cycling trials** - use trails to increase connectivity within the development.
  - Incorporate nature into new pathways to connect various sections of the development. To promote use of new amenities, paths should be used to connect parks and other social gathering areas within the development.
  - Retain and incorporate the existing pedestrian underpass to increase connectivity and safety.
  - Ensure there is adequate shaded areas for residents and visitors to use.
- **Park facilities** – parks that pay homage to the natural beauty of Glen Iris.
  - Smaller parks were preferred over large ones, as it helps to create a sense of place and community.
  - As Glen Iris is home to dog lovers, families and grandparents, a range of different park types were desired, including dog friendly, nature play areas, playgrounds and general open green space.
  - Weather protection is required to promote year round use (e.g. shade sails, pagodas, etc)
  - To minimise the potential of anti-social behaviour and increase community safety, some felt lighting around shared spaces is required.
  - To pay homage to the history of Glen Iris, some felt a mini-golf course could be included in the development.

Environment and Open Space

Environment and open space is a topic that cuts across all areas of consultation, and as a result many of the ideas and feedback provided during these conversations were consistent with observations and comments made during the other topic discussions:

- Maintain the current vista of Glen Iris, by retaining and incorporating mature trees and other native vegetation into the master plan.
- Consider how waterways (e.g. lakes, water features, etc.) can be incorporated into the plan to retain and attract the abundant wildlife that live in Glen Iris and the surrounds.
- Ensure new open spaces are friendly for the whole community, and are connected by walk and bike paths.
- Consider how new spaces can appeal to local residents, without increasing the number of visitors to the area. This will also help to manage increased traffic volumes.
- New amenities within shared open spaces should focus on natural materials rather than plastic (e.g. nature play areas, rather than plastic playgrounds).

Glen Iris Estate Reference Group – Workshop #3 Summary

The third Precinct Reference Group (PRG) workshop was held on 18 November 2020, facilitated by Metrix Consulting, with expert planning, design, traffic, environmental, civil engineering and landscaping consultants in attendance. The group consists of 32 residents from the Glen Iris community, and 22 attended the third workshop. The third workshop provided participants with the opportunity to further explore key priority areas identified in Workshop #1 and #2, and draw aspects of the concept development plan with the specialist consultants.

This document is a summary of the key ideas, considerations and plans identified and drawn by residents.

Base Plan of Glen Iris was provided to PRG members

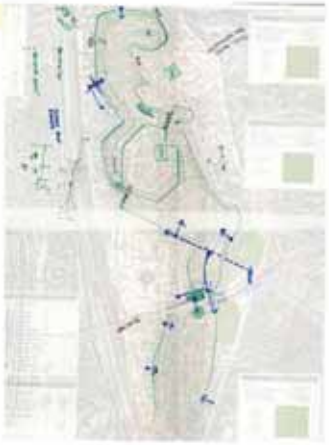
The top five priority areas identified in Workshop #1, and further discussed and drawn in Workshop #3 were:

Traffic & Access | Future Housing | Open Space & Environment | Interface | Local Amenities

Northern Precinct

When working through the plan, residents spoke of

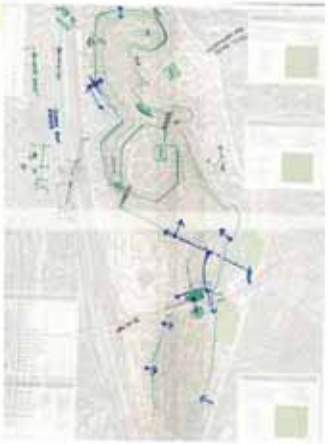
- **Retaining and utilising the underpass.** Many felt this provided a safer way of crossing Berrigan Drive for all residents, but especially for children and the elderly. Using **open space either side of the Berrigan Drive underpass** to retain the underpass option.
- The **new signalised intersection at Berrigan Drive being a good option for access** to the estate, so long as it managed the flow of traffic on Berrigan Drive (which is already considered excessive).
- A general agreement that there were **two viable road entry/exit points into the northern zone being to the northern end and the north western side.** Other possible entry points on the eastern side were considered problematic due to traffic levels.
- Examining options to **create a more equitable sharing of existing internal traffic** between Dean Road (currently 3000 movements / day), and Glen Iris Drive (currently 400 movements / day) and future traffic. A resident living on Glen Iris Drive was less supportive of this.
- Using **public open space as a buffer for some properties within the development** – however some residents noted that using public open space as a buffer for all properties backing on to the golf course was not viable. Other residents indicated that the largest proportion of public open space should be incorporated into community space and ensure picturesque entrances that align with the current Glen Iris look and feel.
- Considering the use of **buffers to the rear of existing properties backing directly onto the former golf course.** There were community member suggestions that this should be in the order of 40m wide to provide for tree retention and space between existing and future housing. Other widths were also discussed (e.g. 10m - 20m), but no one final dimension was settled on. A quick calculation revealed that if a buffer was allowed along the full interface to the northern zone it would be an approximate average of 7m wide however it was also noted this would not capture most existing trees nor allow any usable open space elsewhere.
- A need for **some community members' current view into the golf course to be preserved** leading to their suggestions for the resulting locations of public open space to be guided by that localised outcome.



Northern Precinct Continued

- Considering how community members could be **compensated for the potential impact on their existing properties** resulting from the loss of the golf course. This was noted as being outside of the Reference Group planning mandate.
- A general agreement that the **narrower sections of the former golf course should be open space** as there is not enough room there for either housing or roads.
- **Retaining the existing vehicular bridge and verge trees on Twin Waters Pass** - this was considered generally desirable if possible.
- **Including a café and/or bakery near Berrigan Drive** (but away from the busy road) being a good amenity for residents to use, possibly linked to open space.

Residents also feel the current Glen Iris retail/commercial "Hub" (shops on Berrigan Drive) is not visible and lacks appeal for both residents and prospective tenants. Residents wanted consideration to be given as to how to improve this existing area.



Central Precinct

When working through the plan, residents spoke of:

- **Having a visually appealing entry** that utilised public open space when you entered the precinct from the **new signalised intersection off Berrigan Drive** (as outlined by the Traffic Consultants).
- Continuing **Turnbury Park Drive** and **connecting into the new signalised intersection** – potentially using the existing roundabout. Removing the existing intersection with Berrigan Drive.
- **Retaining the pedestrian underpass and using public open spaces** on each end to make the entries safer, and installing adequate lighting in the underpass on the entries.
- **Access onto Dean Road being minimised** and **IF** an entry needs to be connected to Dean Road it should be before the bend down near the Berrigan Drive/Jannaled Road intersection. Reasoning was three-fold:
  - **Safety – the bend can be a blind spot and needs to be considered.**
  - **Visual appeal – the current landscape and interface of Dean Road is liked, and residents do not want to see this go (e.g. trees).**
  - **Traffic volumes – adding entry roads further up Dean Road would impact existing houses and residents – some were concerned Dean Road could become busier/a rat run.**
- **Using the approach titled Section C (see diagram to the right) to retain the vegetation that backs onto existing residential lots along Dean Road.** This would also act as a buffer between the properties and allow for a new road to be put in that could connect to a roundabout at Twin Waters Pass/Fortaise Gardens.
- **Retaining the bridge at Twin Waters Pass, and placing public open space on either side of it.** This could act as an entry statement (that aligns with those that already exist – e.g. Dean Road), while providing options for travel within the precinct. Residents appreciated the existing tree line would have to be reduced here, but if public open space was used in its place they were okay with it. Also, there are some trees here which are considered nuisance / dangerous near homes that some residents want removed.
- Connecting existing **public open spaces** via footpaths with new public open spaces.
- **Using conservation zones in new residential lots to act as a buffer** – however, like the Southern Precinct Group, this must be enforced (and there were also doubts about the effectiveness of enforcing this).

Section C

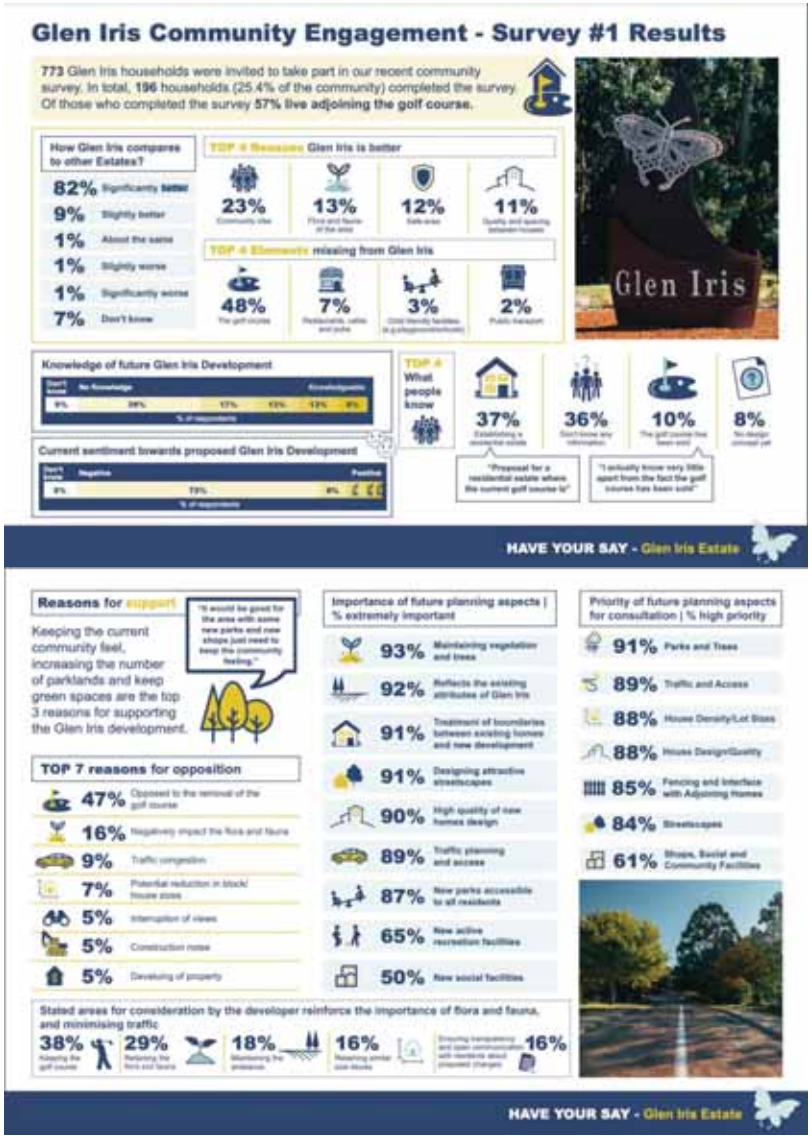
Southern Precinct

When working on the southern precinct plan, residents spoke of:

- **Retaining the underpass to ensure pedestrian safety** when moving between the Southern and Central Precincts. Using public open space to connect each end of the underpass and **make for an attractive entrance/exit.**
- Minimising connections from the Southern Precinct to the west onto The Fairway and The Lakes Boulevard. Residents wanted to consider realigning Princep Road through Princep Park connecting to the proposed light-controlled intersection and **removing the current intersection with Berrigan Drive which is considered unsafe.** At a minimum, any entry via Princep Road needed to factor in the already busy road conditions and look to **minimise adding traffic to this road**.
- Retaining the existing vegetation along the northern side of Harrivad Parade within a widened road reserve and not within the road pavement. **Residents like the aesthetic of this road and would like to see it retained.**
- **Considering how the existing Club House could be utilised.** Some examples included incorporating the building into a retirement village or using the area as public open space – however some thought this might require too much of the allocated public open space and also noted the proximity of existing open space to the east which is currently being upgraded by the City.
- Considering the use of **conservation zones within new residential lots** to act as buffers to existing properties. This would not only have the benefit of acting as a buffer, but also help with flora and fauna conservation. However, some residents did raise that the conservation zones would need to be enforced and monitored to ensure they remain and were not removed by new residents in the future (there was some scepticism about the reality of enforcement).

Residents also mentioned that a linear approach to public open space was not feasible (i.e. providing a buffer to all existing residential dwellings), nor did they consider it the most appropriate use of the allocated amount. Residents would rather see **larger areas of public open space be used to facilitate shared community areas**.

Residents also felt there **wasn't a need for any additional commercial areas** (e.g. cafes / shops) within the site which was already well serviced by way of the existing retail precinct to the east and the Cockburn Central commercial area.


Glen Iris Community Engagement - Survey #1 Results
773 Glen Iris households were invited to take part in our recent community survey. In total, 196 households (25.4% of the community) completed the survey. Of those who completed the survey 57% live adjoining the golf course.
How Glen Iris compares to other Estates?
82% Significantly better
9% Slightly better
1% About the same
1% Slightly worse
1% Significantly worse
7% Don't know
TOP 4 Reasons Glen Iris is better
23%
13%
12%
11%
TOP 4 Elements missing from Glen Iris
48%
7%
3%
2%
Knowledge of future Glen Iris Development
Current sentiment towards proposed Glen Iris Development
TOP 4 What people know
37%
36%
10%
8%
"Proposal for a residential estate where the current golf course is"
"I actually know very little apart from the fact the golf course has been sold"
HAVE YOUR SAY - Glen Iris Estate
Reasons for support
"It would be good for the area with some new parks and new shops just need to keep the community feeling."
Keeping the current community feel, increasing the number of parklands and keep green spaces are the top 3 reasons for supporting the Glen Iris development.
TOP 7 reasons for opposition
47%
16%
9%
7%
5%
5%
5%
Importance of future planning aspects | % extremely important
93%
92%
91%
91%
90%
89%
87%
65%
50%
Priority of future planning aspects for consultation | % high priority
91% Parks and Trees
89% Traffic and Access
88% House Density/Lot Sizes
88% House Design/Quality
85% Fencing and Interface with Adjoining Homes
84% Streetscapes
61% Shops, Social and Community Facilities
Stated areas for consideration by the developer reinforce the importance of flora and fauna, and minimising traffic
38%
29%
18%
16%
16%
HAVE YOUR SAY - Glen Iris Estate

Glen Iris Estate
Project Team
ROWE GROUP
emerge
hyd.o
logical
JDSi
Project Reference Group Outcomes

Master Plan Concept

Concept only - Subject to review and assessment by Local and State Government Authorities

Interface & Buffer

Open Space & Environment

- 20% green space – parks, green corridors, connected pathways & drainage swales
- Landscape species providing habitat for native wildlife
- 70% reduction of ground water use
- Parks include nature play, bbq/picnic shelters, and exercise equipment

Tree Retention

- Retention of over 500 mature trees in parks and green buffers

Street Trees

- Retain over 500 existing trees
- Plant over 1000 new trees

Dedicated Exercise & Leisure Circuit

- 6km dedicated exercise trail & leisure circuit through the new community
- Multiple smaller walking and cycling paths connecting to the existing residential area
- Retention of Berrigan Drive Underpass

Traffic

- Proposed 4-way traffic signals on Berrigan Drive to resolve existing congestion
- Minimal additional traffic onto existing residential streets
- Retention of the Twin Waters Pass bridge

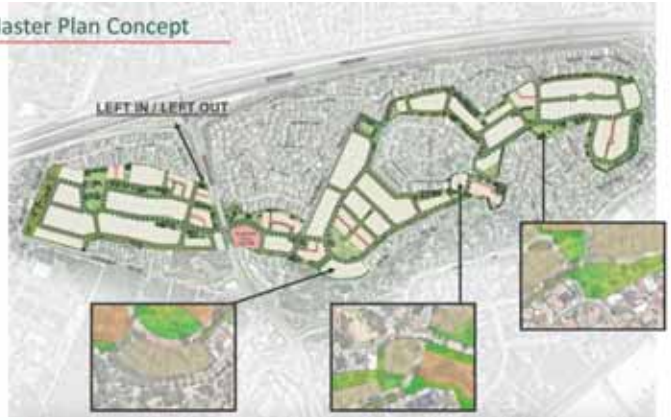
Housing

- Pontential 500 – 600 new homes
- Average lot size 550 – 600sqm for single residential lots, 300sqm for town-houses
- High quality housing achieved through design guidelines

Local Amenities

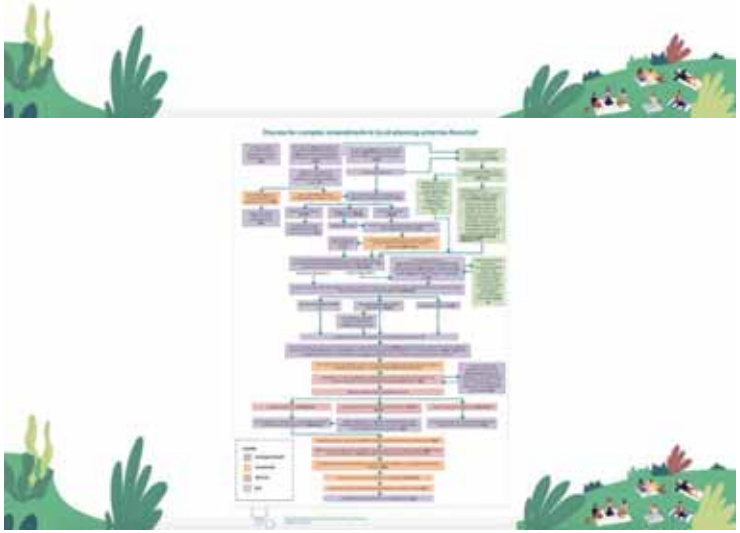
- Proposed local retail centre on Berrigan Drive
- Opportunity for local supermarket, café/restaurants and shops
- Potential for local community centre and meeting places

Master Plan Concept



Next Steps

- Concurrent lodgment of Town Planning Scheme Amendment and the Local Structure Plan – targeting mid-May 2021.
- Supported by full suite of expert consultant reports including a Flora and Fauna impact assessment/report and a traffic impact assessment.
- Council initiation of TPS Amendment and assessment of LSP will start the formal community consultation process following review by the Environmental Protection Authority.
- We are always available to provide a detailed briefing and respond to specific queries from residents through appropriate channels – as and when requested.



Questions

Master Plan Concept North

Master Plan Concept Central

Master Plan Concept South

Public Open Space North

Public Open Space Central

Public Open Space
South

Concept Only, subject to review and assessment by Local and State Government Authorities
Green space buffers to the existing Glen Iris community.
Strong focus on retention of existing trees across the estate.
Nature based play in parks to provide a high quality play experience for children.
6km exercise trail through the new community.
Proposed new 4 way traffic signals on Berrigan Drive to resolve existing traffic congestion issues.*
Proposed retail centre on Berrigan Drive with local supermarket, café/restaurants and shops.
New parks with retained trees, playgrounds & fitness stations
Key Features
Proposed 500 - 600 new homes
33% green space - parks, green corridors, pathways & swales
Retention of mature trees in parks & green buffers
High quality housing achieved through design guidelines
Proposed local shops on Berrigan Drive
Walking and cycle paths connecting with the existing community
Landscaping to provide habitat for native wildlife
Masterplan Concept
Glen Iris Estate | Jandakot
GLEN IRIS ESTATE

GLEN IRIS ESTATE

APPENDIX 2
COMMUNITY ENGAGEMENT REGISTER

DATE RECEIVED	DATE RETURNED	VIA	SUBMITTER REFERENCE NUMBER	NATURE OF ENQUIRY	RESPONSE	PRIMARY CONCERN	SECONDARY CONCERN	REGISTER ON EHQ?	ACTION REQUIRED
9.3.20		Telephone	REF001	Elevated block; purchased [year] for [amount] + = paid premium (est [amount] extra) for golf course views; doesn't want to overlook a sea of tin roofs. Specific questions - will pumps continue running on water bodies to keep mosquitoes down - one near her has two large aerators that come on morning and night; will grass keep being mowed and maintained?	Explained planning process; emphasised my role is to provide feedback to project team on areas of interest/concern from community; committed to providing answers re: water bodies and pumps etc. Said I would add her to db for future updates.	Property values	"Views Maintenance of golf course during planning process"		Project Team to address issue with fencing contractors.
9.3.20	13.3.20	Email	REF002	I am a resident in the Glen Iris estate having been here for over [Number] years and was dismayed to find in the letterbox tonight the notice regarding the closure of the golf course and redevelopment of the estate. I back directly onto the golf course and bought the house specifically due to its location paying a significant premium for this. I even re-developed my back yard and outdoor area a few years ago at a cost of more than [amount] just to take advantage of the views so do not want this to be replaced by a view of another group of houses, streets, and further infrastructure. I am also concerned that the scenic views and locale will be replaced by sand and construction for a number of years as has been the case for the never ending Kwinana Freeway project.Please let me know of any meetings planned or further information available.	Thank you for your email and feedback. I have also spoken to [Name] in the last few days, and documented your concerns which will be passed on to the project team. Our aim is to start engaging with the Glen Iris community as soon as practically possible, once settlement has occurred on 6 April. We are establishing an engagement and consultation platform which will provide a central information and contact point. Once this platform is live, we will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community. I have added your contact details to our database.	Property values	Disruption during construction		
10.3.20		Telephone and email	REF003	"Who are you engaged by? Has City of Cockburn given any indication it will be approved? Will fencing go on back of property? Lived here for [Number] years - house burnt down in [date], rebuilt. Concerned about golf course going to be left to go wild - snakes etc. Have 2 v tall gum trees on boundary fence showing signs of stress - asked golf course owners to remove but have had no response. Family friends of [Name] Ooserthoff (Eastcourt), [Name] also sent through photos of the view from her home. Follow up email received 10 March: Thank you for returning my phone call and answering my questions about the pending sale of Glen Iris. I am forwarding this email, plus two more, which contain photos of the gum trees in question. This is a sad time but understand that things change. We have lived on this property for [Number] years and loved living here. Our address is [redacted]. We have a beautiful view right up the fairway and we will be sad to lose the wonderful view, plus the daily visits of numerous birds including white, black, pink and grey galahs, small parrots and others. I hope that when parklands and open spaces are considered for the development that we will still have a beautiful view. It would be awful if the new owners simply put up a colour bond fence on our property. As I also mentioned, our house was devastated by fire in [month] [year] when we lost everything we owned [redacted]. The trees and a section of the golf course also caught fire. We rebuilt and have been back in our new home for [Number] years. Because of the fire we are anxious that the unattended golf course grass will grow to a height which will cause us concern in case there was a fire in this area, plus the concern of snakes (of which we have seen a couple) with our small pets. I will look forward to receiving updates and consultation(s) as things progress."	Engaged by Acumen (project manager) and Eastcourt (land purchaser). Explained planning process. Advised we would have more info about fencing, maintenance etc once purchase has settled. Advised once purchase has gone through we will look at trees if they have not already been removed.	Maintenance of site during planning process			Project Director [Name] Rendall will contact to discuss.
10.3.20	13.3.20	Email	REF004	Hello [Name] The letter from your company we received yesterday was quite a disappointment however we realize progress must occur. It is obviously why we have not heard from the management of the golf course on numerous occasions I have emailed with regard to the dangerous limb dropping gums on our back boundary. Can I please ask you to have it noted that they must be looked at with regard to safety when your development goes ahead. We have had big limbs drop and fall many times. I note you say you want to retain large mature trees . I would hope you would consult the residents who have the danger of these falling on our houses in the future who have these huge trees at our back door. We have loved the view and are also concerned about the privacy now, but I am sure you will afford us the decency of consulting with us about our back fences. We back on to the course from the [Number] Tee on the left over the little bridge. On numerous occasions we have cleaned up ourselves from falling branches and its such a shame someone couldn't have seen it remain the lovely course it was in years past. We have been very lucky in our crime and security here in Glen Iris and that is also a worry to us. We hope it continues. I am sure you are fielding many queries today.	Dear Mr and Mrs [Name] Thank you for your email and apologies for taking a while to respond – it has been a busy week! You are not the only residents to have mentioned to me their concerns about large trees on their property boundary. There is little we can do until the purchase settles on 6 April, but I have made the project team aware and one of their first actions will be to have an environmental consultant and/or arborist do an inspection. I'll flag your property along with another resident's as a priority. Rest assured we are committed to consulting with the local community, particularly residents like yourself that back on to the golf course. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme. We will also be ensuring that residents' security is protected, with the site being fenced off and no public access, to reduce any risk of anti-social behaviour or vandalism. We will be in contact with residents again once the sale has settled.	Maintenance of site during planning process	Tree limbs falling onto the property		Trees - risk of limbs dropping
10.3.20		Telephone	REF005	Short call - doesn't back on to golf course, 'can't believe this land can be sold for development without consultation with residents.'	Explained land was privately owned, therefore landowner can sell in the same way that any other property owner can.	Opposed - no specific issue raised			Organise to attend and inspect.
10.3.20		Telephone	REF006	Purchased [date], shocked that this could be allowed to happen and that Council has allowed it. Checked with Council prior to purchasing in [date] and was advised that 'golf course was on a water mound and could never be developed.'	Advised that the sale of the land is not a matter for Council as it was privaetly owned land, and that Council will be the authority that has to approve the rezoning application.	Opposed - no specific issue raised			

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10.3.20	13.3.20	Email	REF007	Hi [Name] We have just received the community letter and we are devastated that people would consider destroying the golf course and bistro, this was the main reason we bought in the estate which was 40% above the other estates in the area. It would be such a shame, the golf course has had a decline in golfers due the pervious owners running it down as they wanted to sell for the last few years. Please reconsider destroying a beautiful golf course and restaurant	Hi [Name] and [Name] Thank you for your email. I absolutely understand that this news may come as a disappointment to you. Obviously, we were not involved originally and have only recently agreed to purchase the site. While we appreciate the concerns of the residents, views cannot be protected—this has always been the case in WA. Glen Iris Golf Course is privately owned land, zoned 'Urban' under the Metropolitan Region Scheme. Under the City of Cockburn Town Planning Scheme, the land is zoned Special Use 1 and Residential R40. Any proposed land use changes will be considered in accordance with the Western Australian Planning System. Eastcourt Property Group plans to redevelop the 54.9h site into a quality residential community. The vision is for a residential development that delivers premium housing options while retaining mature trees and creating leafy streetscapes and parklands to be enjoyed by the whole community. Our aim is to start engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform called Have Your Say Glen Iris Estate which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme.	Opposed - no specific issue raised			
10.3.20	13.3.302	Email	REF008	Hi [Name] First of all, let me introduce myself. I [redacted] and have so for [Number] years and more. Our Club is in it's [year] so we are gutted to find the course will no longer exist. We play for the [redacted] trophy every year on Opening Day (in 2 weeks' time) as a mark of respect to Bill. The Pro Shop has always donated a pair of golf shoes as a prize. We get on very well with the current owners, but have obviously been kept in the dark for legal reasons about the future of the course. In regards to the letter, the paragraph on declining numbers really grates on me. It's more like mismanagement and lack of spending on the course and I understand it's family run. The restaurant used to be a thriving business run by [Name] who had great vision for the venue but was always knocked back and it consequently stayed shut for over 6 months. I'm sure you'll get to develop the land in the long run as developers usually do. I'm one of the lucky ones whose house doesn't back onto the course [Address].	Hi [Name] Thank you for your email, and apologies for taking a couple of days to respond. I understand that this news will have come as a disappointment to you, particularly given your long association with the golf club. Our aim is to start engaging with the Glen Iris community as soon as practically possible, and I really hope you will take the time to provide your feedback and ideas. The new owners' vision for the site is for a residential development that delivers premium housing options while retaining mature trees and creating leafy streetscapes and parklands to be enjoyed by the whole community. We are setting up an engagement and consultation platform called Have Your Say Glen Iris Estate which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme. We will be back in touch with residents once the purchase has settled in April.	Opposed - no specific issue raised			
10.3.20	16.3.20	Email	REF009	"Dear [Name] As a Glen Iris resident I would like to register my protest at your so called Circular Notice on the future of the Glen Iris Golf Course. Rather rude I thought and sounding very much like a 'fait accompli' and that we should all be delighted you are stepping in and transforming the land that we have enjoyed as a golf course for over [Number] years. The reason the number of golfers using the course has been declining is plain and simple. The current owners have not put in the time, effort, money and more importantly enthusiasm to make it the thriving business it could be. You will also be aware that the bar and restaurant closed down for over 12 months! Who would play 18 holes of golf on any day without the reward of lunch and a cold beverage at the 19th? Of course the golfers went elsewhere!! We already have a proud legacy for Jandakot and it's called the Glen Iris Golf Course Hi [Name] Thank you for your reply. As you can imagine there are rumours abound about the sale and the development of the course. Many residents feel their land and house values will plummet so you will need to pull out all the stops to reassure the Community that this will not happen. You have to be honest and we have to trust you will do the right thing by us all. Our concern now is that lakes will be drained - the dependant wildlife will disperse; the sprinklers turned off and course maintenance stopped - gone will be the manicured greens and the beautiful outlook we currently enjoy. Regards [Name]"	Dear [Name] Thank you for your email and the feedback you have provided. I'd like to reassure you that this is not a 'fait accompli' – there is a rigorous planning process that needs to occur in order to achieve the required rezoning for any proposed development. Under the State Government Metropolitan Regional Scheme, the land is zoned Urban. Under the City of Cockburn Town Planning Scheme, the land is zoned Special Use 1 and Residential R40. Any proposed land use changes will be considered in accordance with the Western Australian Planning System. The vision is for a residential development that delivers premium housing options while retaining mature trees and creating leafy streetscapes and parklands to be enjoyed by the whole community. We believe that there can be very positive changes by changing land uses and creating public open space parklands with access for all residents that may still allow outlooks in many areas. This is in addition to increased property security, access to community facilities and better overall walkability and connectivity to the area as a whole. Our aim is to start engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme.	Opposed - no specific issue raised			
10.3.20		Telephone and email	REF010	"[Name] (phone call) [redacted] used to work at [redacted] so have known this would happen - have a view over golf course from kitchen window. Will impact on the value of our home. This is a very active community - people have problems trying to make the most simple changes to their properties with neighbours complaining etc. Portsea Gardens is considered the best street in the whole estate - on the 2nd tee. [Name] (via email): Dear [Name], I am a resident in the Glen Iris estate having been here for over [Number] years and was dismayed to find in the letterbox tonight the notice regarding the closure of the golf course and redevelopment of the estate. I back directly onto the golf course and bought the house specifically due to its location paying a significant premium for this. I even re-developed my back yard and outdoor area a few years ago at a cost of more than [Number] just to take advantage of the views so do not want this to be replaced by a view of another group of houses, streets, and further infrastructure. I am also concerned that the scenic views and locale will be replaced by sand and construction for a number of years as has been the case for the never ending Kwinana Freeway project. Please let me know of any meetings planned or further information available. Regards [Name]"	Explained planning process; emphasised my role is to provide feedback to project team on areas of interest/concern from community;	Property values	"Views Construction duration & impact"		
10.3.20		Telephone	REF011	Believes the developer should offer to buy back properties from those overlooking the golf course. Bought property [Number] years ago. Believes that the developers will let the site turn wild so that people get worn down and decide a residential development would be better than a dustbowl/eyesore.	Advised that it is unclear who would be liable in terms of property buy backs, as the WA legal system is very clear that a propery owner does not buy a view in perpetuity. Emphasised we are keen to work with residents to come up with a quality development; advised we would be managing the site in the interim and at a minimum fencing it off and maintaining fire breaks for safety and security.	Property values			

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10.3.20	13.3.20	Email	REF012	I have received a flyer in my letterbox notifying me of your intention to develop the Glen Iris Golf Course. As a resident of this community directly effected by this decision, I wish to voice my strong objection to this development. We purchased our property in [date] purely based on proximity to the golf course, to have a house that overlooked a fairway. We paid accordingly for this luxury! It was very reasonable at the time for us to assume this would remain a golf course given the zoning of the land and history of the estate. The original owners sold this land to people wishing to live on a golf course. I understand you are a property developer and your business is to develop land/sell land, make money with very little thought for families such as mine. The value of our home will substantially reduce due to this development. The loss of green open spaces such as this in a era of infill development of surrounding areas will negatively impact the environment and liveability for all residents. I do find your letter amusing where it states 'its too early in the process to have a definite concept in mind at this stage'. I am sure you provided your financial institution a slightly stronger business case than 'it's too early to know' when you applied for the funds to purchase this land. You will obviously already have a plan for this land beyond your 'mature trees, premium housing options, leafy streetscapes' sales pitch. You will know what is required to make this work and will already have plans for the estate. It appears from your initial letter (and the fact you are providing 21 days' notice of closure of the golf course), transparency is not high on your priority list. I have already spoken with the City of Cockburn to voice my objection to any potential rezoning. Today, I will be engaging with local councillors, my local member of parliament, department of sport and recreation, environmental protection authority and all other relevant parties including the media. I can assure you this development will be fought every step of the way by a large number of Glen Iris residents.	Thank you for your email and feedback. I understand your position in relation to the proposed development of the golf course. Obviously we were not involved originally and have only recently agreed to purchase the site, and while we appreciate the concerns of the residents, views cannot be protected—this has always been the case in WA. Under the State Government Metropolitan Regional Scheme, the land is zoned Urban. Under the City of Cockburn Town Planning Scheme, the land is zoned Special Use 1 and Residential R40. Any proposed land use changes will be considered in accordance with the Western Australian Planning System. We believe that there can be very positive changes by changing land uses and creating public open space parklands with access for all residents that may still allow outlooks in many areas. This is in addition to increased property security, access to community facilities and better overall walkability and connectivity to the area as a whole. Our aim is to start engaging with the Glen Iris community as soon as practically possible once settlement has been completed on 6 April. We will be establishing an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme.	Property values	Loss of green space		
10.3.20	13.3.20	Email	REF013	I just received a flyer in my mail box today regarding the sale and proposed development of Glen Iris Estate. Needless to say that I am appalled that this could occur without any consultation with existing residents of the area, who purchased their homes based on the fact that it would be beside a long established and peaceful golf course. What compensation will the developer be providing current property owners for the fact that their property values will now drop dramatically now that this is not the case? Also for the change in environment and quality of lifestyle with increase in residents in such a currently peaceful environment. This will definitely change with an increase in number of residents and properties, and construction that will now occur for several years to come.I await your reply.	Thank you for your email and the feedback you have provided. I understand your position in relation to the proposed development of the golf course. The Glen Iris Golf Course is privately owned land, and as the purchaser Eastcourt Property Group is committed to ensuring that any proposed land use changes will be in accordance with the Western Australian Planning System. Obviously we were not involved originally and have only recently agreed to purchase the site, and while we appreciate the concerns of the residents, views cannot be protected—this has always been the case in WA. Under the State Government Metropolitan Regional Scheme, the land is zoned Urban. Under the City of Cockburn Town Planning Scheme, the land is zoned Special Use 1 and Residential R40. Any proposed land use changes will be considered in accordance with the Western Australian Planning System. We believe that there can be very positive changes by changing land uses and creating public open space parklands with access for all residents that may still allow outlooks in many areas. This is in addition to increased property security, access to community facilities and better overall walkability and connectivity to the area as a whole. Our aim is to start engaging with the Glen Iris community as soon as practically possible once settlement has been completed on 6 April. We will be establishing an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme.	Property values	"Loss of lifestyle Disruption during construction"		
10.3.20	13.3.20	Email	REF014	Hi [Name] [Name] and [Name] [Name] I live on the golf course, my [redacted]. Last evening I sat watching the sunset contemplating how I paid a premium for the view only now to have you lot destroy that view. Not to mention the negative effect this will have on the valuation of my property. Property developers make money by selling land and/or houses. The more they can squeeze into an area the greater the revenue and the better the apportionment of costs. There goes the view that I paid a premium for. If this sounds an oversimplification of your business model please correct me. You notice said that "it's too early in the process to have a definite concept in mind at this stage." There must be some concept. Or are you saying that Eastcourt purchased the property without a design, however rough, and no accompanying business plan as to what they were planning to do? Considering the blurb on both of your websites, this does seem improbable. Bottom line - I find it hard to believe that what you are proposing is in my best interest.	Thank you for your email. As the new owner of the site from 6 April, Eastcourt is committed to consulting with local residents to help shape a residential development that delivers premium housing options while retaining mature trees and creating leafy streetscapes and parklands to be enjoyed by the whole community. We will be establishing an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme.	Property values	Views		
10.3.20	13.3.20	Email	REF015	Dear [Name] Good afternoon. I refer to an undated letter by [Name] [Name] to Glen Iris residence regarding the above matter and my first response is that I find it is very poorly written. Firstly I ask using RACI methodology used for project management what category does the Glen Iris residence have in this project as it is unclear from the letter. Both consult & informed which are two different roles for this project are used in the letter. Secondly what compensation will Glen Iris residence receive due to the reduced value of their individual properties, as this is the first I have heard from the council regarding the sale of the course and was never mentioned when I purchased the land in 2004. As a retiree I shall be taking a very proactive role in this project. I look forward to receiving a timely response.	Dear Mr [Name] Thank you for your email. In relation to the sale of the land, Glen Iris Golf Course has been privately owned land for decades. Eastcourt, which is purchasing the land, was obviously not involved originally in the development of the area and has only recently agreed to purchase the site. While we appreciate the concerns of the residents, views cannot be protected—this has always been the case in WA. Under the State Government Metropolitan Regional Scheme, the land is zoned Urban. Under the City of Cockburn Town Planning Scheme, the land is zoned Special Use 1 and Residential R40. Any proposed land use changes will be considered in accordance with the Western Australian Planning System. Our aim is to start engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform called Have Your Say Glen Iris Estate which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme	Property values			

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10.3.20	16.3.20	Email	REF016	Hi there my name is [Name] and I am a local member of the community. I am absolutely devastated to hear that it has been sold. I walk around the gold course every morning as it is such a pretty sight. I just wanted to ask what the plans were for the development? Is there still going to be beautiful parks and greenery or is it all going to be residential? I would love to attend some community meetings to keep informed. I am feeling really anxious as our property value will decline because of this. I would love to hear what is going on. Thanks	Hi [Name] Many thanks for your email. The sale of the land is due to be finalised on 6 April. The new owners, Eastcourt Property Group, plan to redevelop the 54.9h site into a quality residential community. The vision is for a residential development that delivers premium housing options while retaining mature trees and creating leafy streetscapes and parklands to be enjoyed by the whole community. The Glen Iris Golf Course is privately owned land. Obviously, Eastcourt was not involved with the original development around the golf course, and while we appreciate the concerns of the residents, views cannot be protected—this has always been the case in WA. However, we believe that there can be very positive changes by changing land uses and creating public open space parklands with access for all residents that may still allow outlooks in many areas. This is in addition to increased property security, access to community facilities and better overall walkability and connectivity to the area as a whole Under the State Government Metropolitan Regional Scheme, the land is zoned Urban. Under the City of Cockburn Town Planning Scheme, the land is zoned Special Use 1 and Residential R40. Eastcourt Property Group is committed to ensuring that any proposed land use changes will be in accordance with the Western Australian Planning System. Our aim is to start engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme. I hope that answers your initial questions at this early stage.	Property values	Plans for development - wants parks & greenery		
10.3.20	16.3.20	Email	REF017	"You guys better not bring down the value of Jandakot, and make the Glen Iris estate like these new suburbs with 400sqm blocks... Have a heart, instead of feeding your greed."	"Hi [Name] Thank you for your email, which was sent through to Eastcourt and which they have passed on to me as the Community Engagement Manager for this project. Eastcourt Property Group plans to redevelop the 54.9h site into a quality residential community. The vision is for a residential development that delivers premium housing options while retaining mature trees and creating leafy streetscapes and parklands to be enjoyed by the whole community. We believe that there can be very positive changes by changing land uses and creating public open space parklands with access for all residents that may still allow outlooks in many areas. This is in addition to increased property security, access to community facilities and better overall walkability and connectivity to the area as a whole We will be actively engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community, and seeking their feedback."	Property values	Density / lot sizes		
10.3.20		Telephone	REF018	Contacted Ciy of Cockburn who claimed to know nothing. Doesn't back on to golf course, but people paid a premium for views and location.	Advised that we are not yet the land owner so interaction with Council has not been extensive, though we have been in contact with the planning department. Advised that we have contacted Council requesting to brief them post settlement.	Views	Property values & overall ambience		
10.3.20		Telephone	REF019	"General information "	Explained planning process; emphasised my role is to provide feedback to project team on areas of interest/concern from community;	Views	Property values		
10.3.20		Telephone	REF020	"Bought a vacant block [Number] years ago and built; golf course has not been maintained and owners have made it unviable; [Name] and a lot of other [redacted] elsewhere due to condition of course and attitude of owners; traffic and access will be an issue - already difficult exiting out of Berrigan during peak hour; would prefer it remain as a golf course but is it goes ahead want it done in the best possible manner. [Name] expects there to be significant community opposition. "	Explained planning process; emphasised my role is to provide feedback to project team on areas of interest/concern from community; (NOTE: I know [Name] from my work on [redacted]; he is pragmatic and focused on achieving outcomes, understands the consultation/engagement process.)	Views	Wants a quality development		

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10.3.20	16.3.20	Email	REF021	Today we received a document from Acument Development Solutions advising they have purchased Glen Iris Golf Course for housing redevelopment. We have resided at [Address] and am absolutely devastated at this prospect. We believe the local residents were not aware and will oppose this development. Please provide any relevant details of the proposal, the impact to our property, and advise our rights to fight this occurring. Our initial concerns include, loss of local wildlife, the loss of golf course outlook from our house, the reduction in house prices in this area, the increase of traffic into an area that is already saturated with vehicles, and planned development timeframes.	Dear [Name] and [Name] Thank you for your email and the feedback you have provided. The sale of the land is due to be finalised on 6 April. The new owners, Eastcourt Property Group, plan to redevelop the 54.9h site into a quality residential community. The vision is for a residential development that delivers premium housing options while retaining mature trees and creating leafy streetscapes and parklands to be enjoyed by the whole community. The Glen Iris Golf Course is privately owned land. Obviously, Eastcourt was not involved with the original development around the golf course, and while we appreciate the concerns of the residents, views cannot be protected—this has always been the case in WA. However, we believe that there can be very positive changes by changing land uses and creating public open space parklands with access for all residents that may still allow outlooks in many areas. This is in addition to increased property security, access to community facilities and better overall walkability and connectivity to the area as a whole Under the State Government Metropolitan Regional Scheme, the land is zoned Urban. Under the City of Cockburn Town Planning Scheme, the land is zoned Special Use 1 and Residential R40. Eastcourt Property Group is committed to ensuring that any proposed land use changes will be in accordance with the Western Australian Planning System. Our aim is to start engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme. In addition to the community engagement that we will be undertaking once the sale has been finalised, the formal planning process includes an opportunity for people to make submissions to Council once the plans have been lodged. Council will then review these submissions along with all the technical reports and other data before making their decision. These technical reports will address issues such as environmental considerations and traffic management. Managing the needs of any native wildlife or fauna will be a priority. We have expert environmental consultants on the project team, and all environmental requirements and best practice will be followed when planning and redevelopment commences. It is anticipated that the planning process will take at least 18 months to two years to complete.	Opposed - no specific issue raised	"Flora & fauna Views Traffic Development timeframe"		
10.3.20	30.3.20	Email	REF022	"Hi [Name], I live [redacted] to the golf course, but did not get the following letter. I doubt anyone in my street actually did. Can you include The Fairways in your mail outs, please? By the way, I read that Glen Iris Golf Course was "operated as a privately owned public golf course designed and built by owner Billie Oran Wilson who had the foresight and dream to turn the golf course into a golf and housing estate development." Doesn't that mean the Glen Iris Estate was developed as part of a golf course estate, not developed by a third party? If so, there is a legal onus on the purchaser to retain much of the golf course. If houses were built with certain covenants to size and craftmanship because they were on a golf couse, then the golf course purchaser has to live up to those private efforts or pay a penalty. Thanks in advance for any help you can give me. "	" First of all sincere apologies for taking a while to respond to your email. I have added you to our database. I'm not sure why you wouldn't have received the flyer – we letterbox dropped 754 properties and your street was definitely included – but I have made a note to double check your street for all future letterbox drops. In relation to the original development of Glen Iris, obviously the new owners were not involved at that time and so cannot make any comments about any claims made by the developer of the estate or the selling agents. While we appreciate the concerns of the residents, views cannot be protected—this has always been the case in WA. For Eastcourt to develop the land as a boutique residential community, we will need to apply for an amendment to the Town Planning Scheme. Currently, under the State Government Metropolitan Regional Scheme, the land is zoned Urban. Under the City of Cockburn Town Planning Scheme, the land is zoned Special Use 1 and Residential R40. Any proposed land use changes will be considered in accordance with the Western Australian Planning System. The sale of the land is due to be finalised on 6 April, and our aim is to start engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform called Have Your Say Glen Iris Estate which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme. "	Golf course and/or tavern to remain open			
10.3.20	13.3.20	Email	REF023	Good morning [Name], As a resident that abuts the course [Address], the letter of intent today was disappointing but not unexpected. We look forward to the concept planning and how the development caters to the residents that have purchased the view and lifestyle. Please can I comment on the second paragraphWith the number of golfers declining over the past decade, predominantly at Glen Iris due to inept management, poor customer service, total disinterest of owners, poor basic upkeep of course and terrible culture in workforce. And yes I do [redacted] so have some insight of how a great facility has been so poorly managed to facilitate the decline of golfers.	Dear [Name] Thank you for your email. I will add you to our database, and hope you will take the opportunity to provide feedback to help shape a concept plan for the proposed development once the purchase of the land settles in April. Our aim is to start engaging with the Glen Iris community as soon as practically possible after settlement. We are establishing an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme.	Golf course and/or tavern to remain open			
10.3.20	13.3.20	Email	REF024	"Dear [Name], thanks for the community notice that you circulated today regarding the Glen Iris golf Course. While it is very unfortunate that the course is closing, as residents we need to continue to move forward with our community and the best use of the land. We would very much appreciate being included in the consultation process you are planning as we have both living style and financial positions to oversee. I look forward to hearing from you"	Hi [Name] and [Name] Thank you for your email, and apologies for taking a few days to respond. Our aim is to start engaging with the Glen Iris community as soon as practically possible once the purchase has settled on 6 April. We are setting up an engagement and consultation platform called Have Your Say Glen Iris Estate which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme. We will be back in touch with residents in late April (if not before) and look forward to hearing your feedback as part of the consultation. In the meantime I have added you to our database.	Consultation opportunities			

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10.3.20	13.3.20 & 16.3.20	Email	REF025	Dear [Name] Thank you for your informative briefing delivered to our mailboxes this week. While I understand that it is early days, is it possible to advise us of the intention regarding the second hole of the current Glen Iris Golf Course. We as owners of a property with a swimming pool have been advised by Cockburn Inspectors that we need to raise our fence line on the golf course side to 1.8m to abide by new regulations that came into effect May 2016. We are required to comply with these regulations, however the substrate that we utilise to comply depends on the planned development of that area. As you will appreciate if the space which is currently the second tee box and has a pleasant outlook remain as park land we would be prepared to erect a fence line with pleasing aesthetics allowing us to continue to enjoy this vista to which we have become accustomed over the last [Number] years. Should development of housing take place within this precinct a simple wall either limestone or Colorbond will suffice, is it your intention as developers to erect such boundary walls replacing the current fencing on the properties should you develop in front of our homes and if so what is your intended substrate and what time frames are we to expect? I have spoken to a number of residents in the area, a few major concerns are that once the golf course closes it gates on the 31st March 2020, what procedures have been put into place to: (1) Maintain the area so that it does not become either overgrown or a dust bowl; (2) Prevent the area from becoming overrun with vermin; (3)Secure the property (Golf Course) so that we the residents are ensured of the security of our properties. In my understanding application for zoning is yet to take place, when does this go to council and what time frame is expected before we will be advised of your intentions? While we understand there is planning involved in a project of this magnitude, we the residents have concerns regarding our lifestyle and safety, not to mention the value by which our properties have the potential to devalue during development stages of the area. I look forward to your correspondence regarding any developments around the project timelines and the areas I have addressed in this email.	"13 Mar: Thank you for your email and apologies for taking a few days to get back to you. I have forwarded your email to the project manager, as my layperson's view is that it is going to be quite a while before we know that level of detail to assist you in deciding what to do with your boundary fence, yet I expect Council will be expecting you to increase its height sooner rather than later to be compliant. If you can bear with me I will have a chat with the PM and get his advice. I'll address your other questions all in the one email if that's okay. 16 Mar: Hi [Name]s I've spoken to the project manager, and he has provided the following information in relation to your boundary fence: "Given that we don't expect any development to start for at least 2 years (subject to planning approval), we wo'nt have any details on development outcomes in the vicinity of this property or fencing specifics until around that time. We will engage with all adjoining residents over the course of the next 6-12 months as planning is progressed to discuss a range of items including fencing and interface between existing and new development." – [Name]s, if you can bear with us we will be in contact in the coming months to discuss this. Not sure what timeframe City of Cockburn is expecting you to work to, but there will be little concrete advice we can give for a while. On site maintenance and security, this has been raised by a few residents. We will be maintaining the site from a fire hazard reduction perspective – slashing grass and maintaining fire breaks. More details will be developed as part of a maintenance plan once the sale has been finalised. In relation to security, the site will be fully fenced off, and we have arranged for the monitored security at the golf course to continue. We are also working with the City of Cockburn's safety and security service CoSafe. After settlement, the time period for engaging with the community is fairly open ended depending on the issues to be resolved and process; we anticipate around 6-12 months. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme. The statutory rezoning and approvals period after the initial engagement is likely to be 18 months to 2 years, which includes other public advertising periods. I hope that answers some of your initial questions."	Timing / uncertainty	Specific issue in relation to pool fence		May need to contact resident post 6 April to assess?
10.3.20	13.3.20 & 16.3.20	Email	REF026	Good afternoon, Just letting you know I, like everyone in Glen Iris have just received the letter drop regarding the closure of the Glen Iris Golf course and adjoining Restaurant. I would say I am not massively surprised about the sale, the current owners have not been particularly pro active these past couple of years and where obviously just waiting to sell. What killed that place was the owners allowing the restaurant to go un leased for a good few months and therefore the golfers took off as well. (my personal observation). Pretty annoyed that it is going since we moved here due to the golf course (can't stand golf but love walking around our beautiful estate) we are growing our family here and to have it now ripped up and filled with houses is pretty disappointing to say the least. Anyway, shame to see it go. Now to my questions and concerns; (1) How long will the buildings be vacant before being demolished? (assuming they are?); (2) How long will the consultation period be? (3) What is the overall timeframe for development? (4) For the love of god please put a Tavern in the new development!! ....when Glen Iris had a Restaurant with a motivated lease holder it was amazing and you were lucky to get a seat....I'm not talking [Number] years ago either, this was last year. (5) there are a lot of seniors living in this community who loved having a drink or a bite to eat at The Iris; (6) The shops at the front of Glen Iris are crap, so to have a purpose built Tavern in the new area would be fantastic. The worst thig about Glen Iris is we are 10 minutes drive yet 1hrs walk from anywhere. Make sure you dot your I's and cross your T's because, I like the rest of Glen Iris will be pretty annoyed if this development drags on for years and winds up looking like a smashed up over grown tip. (For example the land being sub divided and sold between Berrigan and North Lake Rd South lake). Feel free to contact me	"13 Mar: Hi [Name] Thanks for your email, and apologies for not getting back to you sooner – it's been a busy week! I need to have a chat with the Project Manager to get more detailed answers to your first three questions. If you can bear with me until early next week, I'll get the info to you. In relation to the tavern – this is the kind of detail that we need to work through during the consultation with the community and the development of the concept plan. So your observations about the role the tavern has played within the community will form part of the feedback that I will be providing to the project team. Will be back in touch early next week about your first three questions. 16 Mar: Hi [Name] Thanks for your email and apologies for taking a while to respond – I had to check some details with the project team. Answers below: (1) The future of the existing building is not yet resolved as that will be part of the overall planning and development consultation, however adequate security measures will be in place to ensure they are protected as far as practical in the consultation and rezoning period, until it is decided what will happen to them. (2) There is no fixed time period for the initial community consultation prior to lodging formal rezoning and planning applications. We envisage a series of engagement opportunities over the next 6 to 12 months post settlement, depending on the issues to be discussed and resolved. (3) The statutory rezoning and approvals period is expected to be around 18 months to 2 years after initial engagement. Development work across the majority of the site cannot commence until that is resolved and approved by City of Cockburn and the WA Planning Commission. (4) Tavern – noted, and feedback provided to the project team! (5) Ditto above (6) Ditto above. In relation to the maintenance of the site while this process plays out, we will at a minimum maintain fire breaks and reduce fire risk, the site will be fenced off to prevent public access and we have also arranged for the monitored security at the golf course to continue. We are also working with the City of Cockburn's safety and security service CoSafe. A more detailed management plan for the site will be developed post-settlement."	Timing / uncertainty	"Timing of development process Wants a tavern in the new development"		
10.3.20	13.3.20 & 16.3.20	Email	REF027	[Name] I, along with many other residents, were quite concerned to receive the notice today regarding the redevelopment of Glen Iris golf course. If Acumen has already purchased the site, they no doubt have an initial plan of what they propose to do. Are you able to share that? It would help to ensure the adverse reaction to the proposal would be based on fact rather than fear.	Thank you for your email. The sale of the site is due to settled on 6 April. The new owners, Eastcourt Property Group, plans to redevelop the 54.9h site into a quality residential community. The vision is for a residential development that delivers premium housing options while retaining mature trees and creating leafy streetscapes and parklands to be enjoyed by the whole community. There are no detailed plans as yet, because we recognise that this will be a significant change for residents within Glen Iris and we want to provide the community with the opportunity to have input into the concept for the development. Our aim is to start engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform called Have Your Say Glen Iris Estate which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme. We will be in touch with local residents during April with an update and more information about how they can provide feedback and input into the concept plan.	Lack of information at time of writing	Concept plan		

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10.3.20	16.3.20	Email	REF028	Hi [Name], I'm assuming you are getting loads of emails/calls, as a local resident all I'd like to know is what the long term development plan is ie, housing, hotel etc Obviously under current zoning housing isn't an option. Thank you for taking the time to read my email.	Dear [Name] Many thanks for your email, and apologies for taking a while to respond – it has been a busy week. It is very early days for this process – the sale of the land is not due to be finalised until 6 April, and once that has happened there is a significant amount of work to be done, including engaging with the local community, before we will be in a position to submit an application to council. Eastcourt Property Group plans to redevelop the 54.9h site into a quality residential community. The vision is for a residential development that delivers premium housing options while retaining mature trees and creating leafy streetscapes and parklands to be enjoyed by the whole community. We believe that there can be very positive changes by changing land uses and creating public open space parklands with access for all residents that may still allow outlooks in many areas. This is in addition to increased property security, access to community facilities and better overall walkability and connectivity to the area as a whole. In relation to the zoning, under the State Government Metropolitan Regional Scheme, the land is zoned Urban. Under the City of Cockburn Town Planning Scheme, the land is zoned Special Use 1 and Residential R40. Any proposed land use changes will be considered in accordance with the Western Australian Planning System.Our aim is to start engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme	Opposed - no specific issue raised	Concept plan		
10.3.20	16.3.20	Email	REF029	Please add us to database concerning redevelopment.	I've added you to our database, and we will be in touch late April/early May once the sale has been finalised. We are setting up an engagement and consultation platform which will provide a central information and contact point, and will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community.	Consultation opportunities			
10.3.20	16.3.20	Telephone	REF030	"Original voicemail: Maintenance of course during rezoning. Security - back fences are vulnerable. 'Devastated'. Follow up conversation: No answer 11.20am - left voicemail"	Original call responded to 11 Mar; subsequent call responded to Mon 16 Mar 11.20am - left voicemail	Opposed - no specific issue raised	"Maintenance of course during rezoning Security - back fences are vulnerable"		
10.3.20		Email	REF031	"Hi [Name], I'm assuming you are getting loads of emails/calls, as a local resident all I'd like to know is what the long term development plan is ie, housing, hotel etc. Obviously under current zoning housing isn't an option."	"Dear [Name] Many thanks for your email, and apologies for taking a while to respond – it has been a busy week. It is very early days for this process – the sale of the land is not due to be finalised until 6 April, and once that has happened there is a significant amount of work to be done, including engaging with the local community, before we will be in a position to submit an application to council. Eastcourt Property Group plans to redevelop the 54.9h site into a quality residential community. The vision is for a residential development that delivers premium housing options while retaining mature trees and creating leafy streetscapes and parklands to be enjoyed by the whole community. We believe that there can be very positive changes by changing land uses and creating public open space parklands with access for all residents that may still allow outlooks in many areas. This is in addition to increased property security, access to community facilities and better overall walkability and connectivity to the area as a whole. In relation to the zoning, under the State Government Metropolitan Regional Scheme, the land is zoned Urban. Under the City of Cockburn Town Planning Scheme, the land is zoned Special Use 1 and Residential R40. Any proposed land use changes will be considered in accordance with the Western Australian Planning System. Our aim is to start engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme."	Lack of information at time of writing			
10.3.20		Email	REF032	"Hi [Name] Just wondering when the "Discussions by Topic" is going to start as website says ""commencing June"" and we are now mid July. Thank you "	"Hi [Name] Thank you for your email and for bringing that to my attention. We ended up releasing the survey a little later than we had expected, so the June timeframe for the next round of engagement has now been pushed back. I've updated the website to reflect the change. We will be distributing a project newsletter in August, and that will give the community an update on the project and information about future engagement activities. Kind regards [Name]"	Lack of information at time of writing			
11.3.20	16.3.20	Email	REF033	Good morning [Name], Can you please confirm if a meeting with the residents will be held to discuss the future development of the estate?	Hi [Name] Thank you for your email and apologies for taking a few days to respond. The sale of the land is due to be finalised on 6 April. Once that has occurred, Our aim is to start engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community. I anticipate we will be back in touch with residents in April, with active consultation commencing by early May.	Consultation opportunities			

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11.3.20		Telephone	REF034	What is going to happen to site while planning process is happening? Will bores be turned off? We are on [Address] and spent [amount] reorienting house to overlook golf course. When Jandakot airport was developed black cockatoos move into golf course in search of habitat. Council don't maintain estate well - eg London Plane Trees were planted and they are lifting pavers.	Advised that fire breaks will be maintained, site will be fenced for security, beyond that we will review once settlement has been completed. Artifical water bodies will probably be allowed to revert to their natural state over time. Developer will do a full environmental flora and fauna audit, and feedback on preference around types of trees etc is welcmed.	Maintenance of site during planning process	Environment		Contact to discuss fencing and easement at property.
11.3.20		Telephone	REF035	Surprised it could be developed, is a realist but would prefer no development; asked about zoning and area that is currently R40; concerned about maintenance of site while planning is progressed	DEtailed discussions re: planning (MRS and TPS); genuine and intelligent questions but is not in favour of development	Opposed - no specific issue raised	Site maintenance		
11.3.20		Telephone	REF036	Why is City of Cockburn allowing this? Very concerned about destruction of habitat for wildlife (also made submissions when Treenby was developed); concerned site will become a fire hazard; said lake aerators have been turned off weeks ago and mozzies are really bad; residents will be looking for a rate reduction due to loss of amenity. Developers just interested in $.	Older lady, very passionate but very polite - upset at prospect of more development. Explained process, advised that one of the first things we would be doing was a flora and fauna study to understand the environment; said I would pass on her concerns relating to the environment and habitat for fauna.	Environment	Overall amenity & outlook		
11.3.20	11.3.20	Telephone	REF037	"Spoke to [Name] [Name]: Runs website for [Name] Ward-Wilson Lives on [redacted] Golf numbers have only dropped due to poor management and terrible restaurant. Community needs more info, where is your plan, give it to us now. We will fight you via action groups, we shut Roe Highway down, we will do the same to you. [age] Happy to help facilitate group meetings. [redacted] of original owner Bill. Why don't you, develop the back 8 (south of Berrigan) and redo front 9 and club house as a destination facility. Feels the deal on the rezoning must be done, otherwise [Name] wouldn't spend $30m plus."	I was vague, indicated we would go through a community consultation process, consider feedback and then finalise our position/development. And suggested he contacts [Name] to be put on the register – which his wife has already done.	Opposed - no specific issue raised			
11.3.20		Telephone	REF038	Our 'retirement dream' - currently working away to pay it off - property is tenanted. Thought there was a caveat over whole of Glen Iris protecting it from development. Love the bandicoots and mature trees. Don't want 200m2 lots. Devastated. NOTE: Property Manager is [redacted]. Continue to letterbox drop property but also email info to owner.	Explained planning process; emphasised my role is to provide feedback to project team on areas of interest/concern from community;	Property values	Property values & overall ambience		
11.3.20		Telephone	REF039	Follow up call - will aerators be turned off? Who will compensate us for loss in value of property? Believe the section of the course in front of my house is class A reserve.	Advised we will be reviewing our plans for maintaining site once settlement has been completed; there is noone to provide compensation as the land was privately owned; if premium prices were paid because of the view or location that was market forces, not an indication that the outlook has been purchased; committed to checking Class A reserve query	Property values			
11.3.20	16.3.20	Email	REF040	"Hi [Name] Firstly, I am not having a go at you personally, I know the role of a Community Engagement Officer is a tough role so please be assured I understand the difficult position you are in. No doubt I am not the first person to contact you following the letter drop on Monday and I am sure I wont be the last. To say I am stunned by the news of the golf course being sold to a private developer is an understatement, I am baffled as to how this was allowed and I like others am in contact with the City of Cockburn as well as the local member (Yaz Mubarakai) who I have copied into this email. I moved to this area [date] and paid considerably more for my house than others I had looked at in the estate because it backed onto the golf course, your plans will not only severely impact the value of my house it will take away the main reason I bought it. Secondly I am amazed Eastcourt bought the golf course when it has yet to be rezoned from recreational to residential, a huge gamble in my mind especially with the local community backlash. I have seen first hand what the local community is capable of when pushed and taken for granted by a developer, look at Piara Waters as an example. I have no doubt that you are in for a tough ride, the residents will not let this one go and will not let go of their golf course, local wildlife, and pleasant outlooks. Can you answer a couple of questions for me? 1) Why did Eastcourt purchase land that had yet to be rezoned and knowing that it was a huge gamble to get this change made? 2) City of Cockburn advise that land wont be rezoned without public consultation, what did Eastcourt think would happen, the community would agree? 3) Did Eastcourt think the community would roll over? I think they have grossly underestimated the power of this local community. I found the letter to be very presumptuous, already taking for granted that the rezone will occur and "leafy streetscapes" will be part of the development, HELLO! We have that already! It is a travesty that people look at their own greed rather than what affects a community, but that's how people operate now and why the world is in such a state. These are just my initial thoughts, no doubt we will chat again as "the project evolves" I look forward to hearing from you."	"Hi [Name] Thank you for your email and in particular the respectful way in which you have framed it. As you can imagine, it has been a busy week with lots of interest from local residents. I've provided some information below that addresses the questions you have raised. The golf course is private land which has been owned by the same family for many decades. Obviously, the purchaser (Eastcourt) was not involved originally with the development of Glen Iris, and has only recently agreed to purchase the site. Settlement is due on 6 April. You are correct that the site will need to be rezoned in order for any residential development to take place. Under the State Government Metropolitan Regional Scheme, the land is zoned Urban. Under the City of Cockburn Town Planning Scheme, the land is zoned Special Use 1 and Residential R40. Any proposed land use changes will be considered in accordance with the Western Australian Planning System. It is not unusual for land developers to purchase a site that requires rezoning a local level, if the relevant zoning at the Metropolitan Region Scheme level is in place. However, as you indicate, there is a robust regulatory process that the new owners will need to go through to apply for the rezoning. In relation to community engagement, this will occur both as part of the formal planning process – once an application for rezoning is submitted to Council, Council will then 'advertise' the application and invite people to make submissions about the application. Separate from that, and commencing much earlier in the process, the new owners will be proactively seeking feedback from the local community to help inform plans for the site. We expect this process to start around May, and will be setting up an online engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme. Eastcourt is committed to having a meaningful and respectful discussion with the community in relation to their proposal. While we appreciate the concerns of residents, we believe that there can be very positive changes by changing land uses and creating public open space parklands with access for all residents that may still allow outlooks in many areas. This is in addition to increased property security, access to community facilities and better overall walkability and connectivity to the area as a whole. I hope this answers your initial questions. "	Property values			

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11.3.20	16.3.20	Email	REF041	"Hi, I'd like to be kept up to date with any future plans or anything to do with the Glen Iris golf course. My husband and I bought our house as it was overlooking the golf course which meant paying a premium so we didn't have neighbours and had a nice outlook. If we were to lose this outlook I'm fairly certain it will make our house lose value, not to mention the construction for years to come driving prices down and causing issues. 21 March: Thank you for your response. Could you advise what stage the redevelopment is at? There's rumours rezoning has already been approved without consultation? I've also heard rumours about keeping the front 9 as a 9 hole golf course and redeveloping the rest but I'm assuming this is false? Also would there be any additional main roads into the estate? With only 2 current roads in and out the traffic congestion is already quite bad, especially trying to turn right onto Berrigan from Turnbury Park, I can't imagine a few hundred more cars trying to exit from there? Has there been any thoughts regarding schooling in the area? The only school in the Jandakot catchment is South Lake Primary and I also can't imagine them being able to take too many more children?"	"Hi [Name] Thank you for your email. I have added you to our database. Our aim is to start engaging with the Glen Iris community as soon as practically possible following the finalisation of the sale in April. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme. We will be back in touch once settlement has occurred to let residents know about the new engagement platform and how to provide feedback to the project team. Hi [Name] Thanks for your email. It's early days to address some of your questions, but most importantly please be assured that the site has not been rezoned. There is a lengthy and detailed planning process that the new owners will need to go through, and this is anticipated to take around 18 months to 2 years. Currently, under the State Government Metropolitan Regional Scheme, the land is zoned Urban. Under the City of Cockburn Town Planning Scheme, the land is zoned Special Use 1 and Residential R40. Any proposed land use changes will be considered in accordance with the Western Australian Planning System. None of the site will be retained as a golf course. In relation to roads, we will need to develop a detailed traffic management plan, and this will be reviewed by the relevant authorities when they assess any rezoning application. Finally, there are no plans to have a school within the new development. I hope that answers your immediate questions. Our aim is to start engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform called Have Your Say Glen Iris Estate which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme."	Property values			
11.3.20		Telephone	REF042	Requested general information about process and why a land developer would buy site with uncertainty around zoning. Advised there was a residents meeting on 10 March, and another one planned for 21 March. Invited me to attend.	Provided background on planning and zoning; advised that it was too early for us to attend a community meeting as purchase hasn't gone through yet, but we will be contacting residents for feedback late APril/May.	Views			
11.3.20		Telephone	REF043	Lived there for [Number] years; everyone bought because of views; devastated. Traffic will be an issue. Kids of original owners of golf course are 'drop kicks who ran the place into the ground'. Will be happy if the 7th green turns into a beautiful park.	Explained process and encouraged him to participate in providing input during consultation.	Views	Property values		
11.3.20		Telephone	REF044	Bought house [Number] years ago 'sight unseen' due to location and views - backs on to golf course. How will site be maintained during planning application? Planning process wil take years and years and years. It is not a 'perception' that we have a right to that view - we bought on a golf course. Not just abouti reidents who live on the golf course, it's about the broader community losing an amenity. It's the only golf course in City of Cockburn. My husband [redacted], we are there every [redacted], Only reason golf is declining is because owners have run it into the ground and we have told them over and over that we are not happy.	Provided info on site maintenance - fire breaks and security fencing at a minmum, emphasiesed that I am passing on people's concerns about how it will be maintained to project team and we will develop a plan - advised arborist would be assessing tress that residents have told us are dangerous vfor etc and taking action if required, environmental consultants will do a flora and fauna audit. Generally listened rather engaged with her slightly argumentative tone - v concious that whatever I was saying was being written down and will be shared more broadly. She didn't request a meeting so I didn't offer at this stage.	Views	"Maintenance of site Loss of amenity (ie no golf course locally)"		Contact property owner to undertake tree inspection and advise of action
11.3.20	16.3.20	Email	REF045	"Hi, I'd like to be kept up to date with any future plans or anything to do with the Glen Iris golf course. My husband and I bought our house as it was overlooking the golf course which meant paying a premium so we didn't have neighbours and had a nice outlook. If we were to lose this outlook I'm fairly certain it will make our house lose value, not to mention the construction for years to come driving prices down and causing issues. "	"Hi [Name] Thank you for your email. I have added you to our database. Our aim is to start engaging with the Glen Iris community as soon as practically possible following the finalisation of the sale in April. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme. We will be back in touch once settlement has occurred to let residents know about the new engagement platform and how to provide feedback to the project team."	Views	"Property values Disruption during construction"		
11.3.20		Telephone	REF046	Will it still be a golf course?	No	Golf course and/or tavern to remain open			
11.3.20		Telephone	REF047	Left voicemail with contact details	Returned call 10.25am but went to voicemail - left message				
11.3.20		Telephone	REF048	Left voicemail with contact details	Returned call 10.30am but went to voicemail - left message				None
11.3.20		Telephone	REF049	Wants to buy a block in the new development.	Advised we are several years away from that point!	Sales opportunity			
11.3.20		Telephone	REF050	Called Eastcourt office angry that his call hadn't been returned.	Could find no record of him having called - call number but went to voicemail - left message				

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11.3.20	16.3.20	Email	REF051	Hello [Name] Hope your well been living near the course for [Number] years as you will know the area isn't a high salary and no other public course for miles nearest would be Marri Park or the course at Bentley we keep the course if u tidy it up dont in crease too much and make it a resturant clubhouse something like wembley complex more than just indian food you will lots of people coming for dinner good earner and do junior schools and group lessons so much potential pro shop with left and right hand pros and clubs i walk to the course im on [Address] as on maps 1[Number] walk thanks for your time	Thank you for your email and your feedback. With a steady decline in the number of golfers using the course over the past decade, the decision has been made to close both the course and restaurant which relies heavily on the golfers for patronage. The golf course and restaurant will close on31 March. As you mentioned, there are several golf courses in the nearby area that are open to the public including Whaleback, Marri Park, Collier Park and Point Walter. More details can be found at www.golfwa.org.au The sale of the land will be finalised on 6 April. The new owners, Eastcourt Property Group, plans to redevelop the 54.9h site into a quality residential community. The vision is for a residential development that delivers premium housing options while retaining mature trees and creating leafy streetscapes and parklands to be enjoyed by the whole community. Our aim is to start engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community.	Golf course and/or tavern to remain open	Wants golf course and restaurant retained		
11.3.20	16.3.20	Email	REF052	" Good Afternoon, I am disappointed that the golf course will no longer exist for the residents of Cockburn. There is no other facility in Cockburn to play Golf. The council should support it's residents and be proud of offering services not taking them away. The letter we received states that the number of people playing golf has declined. The golf course has not been looked after and the restaurant has been poor and non-existent, therefore people are not attracted to use the facility. The sale of the course seems to have been kept very secretive, I hope this will not be the case with future developments. As a resident of Glen Iris I was always told that the land behind my property would remain nonresidential. "	"Dear [Name] Thank you for your email. Once the sale has been finalised on 6 April, we will be actively engaging with residents to help us understand the key issues that will be important to them in any future residential development. I hope you will take the opportunity to provide your input."	Golf course and/or tavern to remain open			
11.3.20	16.3.20	Email	REF053	"Hello [Name] We currently own [Address] and as it is currently rented out we have had no information about the sale. Can you please forward me any correspondence that was sent to the property "	"Hi [Name] Thanks for the email. Attached is the flyer that was letterbox dropped to all properties in Glen Iris on 10 March. I will make a note on our database to send information to you at this email address in future, as well as pop info into the mail box of your property. "	Lack of information at time of writing			
11.3.20	16.3.20	Email	REF054	Good morning [Name], Thanks for your prompt reply. My property is located [redacted], therefore, the construction/development will have a direct effect on my property value. In order to make a right decision for my family future. Are you able to provide me some advise about the followings; 1. Will R20 zoning be changed? 2. Would average new land sizes be matched/around the current area land sizes or they will be smaller? 3. Is there any plans to sell new lands to Home West or a public service place like a (nursing home, school, etc)? I understand it is an early stage but I am sure there should be a project construction strategy in place. Happy to discuss over the phone if it is more convenient for you.	Dear [Name] Many thanks for your email. Eastcourt Property Group plans to redevelop the 54.9h site into a quality residential community. The vision is for a residential development that delivers premium housing options while retaining mature trees and creating leafy streetscapes and parklands to be enjoyed by the whole community. Under the State Government Metropolitan Regional Scheme, the land is zoned Urban. Under the City of Cockburn Town Planning Scheme, the land is zoned Special Use 1 and Residential R40. Any proposed land use changes will be considered in accordance with the Western Australian Planning System. It is too early to be specific about lot sizes in the proposed development. However, the vision for the site is for a premium quality development. There are no plans for Homes West housing or other public service type uses. Our aim is to start engaging with the Glen Iris community as soon as practically possible. We are setting up engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme.	Lack of information at time of writing	Density HomesWest		
11.3.20	16.3.20	Email	REF055	"Hi [Name], Could you please advise if there is any state housing being built in the new estate replacing the golf course? Regards, [Name]"	"Hi [Name] Thank you for your email. I can confirm that there are no plans for any State housing within the proposed residential development. Eastcourt Property Group plans to redevelop the 54.9h site into a quality residential community. The vision is for a residential development that delivers premium housing options while retaining mature trees and creating leafy streetscapes and parklands to be enjoyed by the whole community."	HomesWest			

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11.3.20	11/03/2020 and 20.3.20	Email	REF056	"18 March: Hi [Name], It is now the 18 March..so I am assuming there will be no further communications from you. Kind Regards 11 March: Thank you for the opportunity to comment on the promise of a new development and "community" for Glen Iris Residents. [Name] Randell provided a somewhat inaccurate reason as to the untimely demise of a Western Australian Icon...my understanding was that the recent death of a parent of the "Glen Iris family" had passed - his daughters and sons had a disagreement as to the fate of the golf course and restaurant. The daughters won. The restaurant bistro was always popular with locals and would have survived the family rift , however the bistro owner been provided with the two year lease (necessary for an adequate return on his investment and risk). Further, the only reason for the decline in the number of golfers, was that the course was left to deteriorate to a point where serious golfers would not consider playing there anymore. You may call me out by claiming Chinese whispers, but let's call a spade a spade - this sale was motivated primarily and solely by money. I have a question for Acumen, [Name]. Why would Acumen envisage that existing residents would be supportive of a property development, when most purchased into a golf course estate? I am doubtful that they bought into this estate for its low flying aircraft, heavy traffic and a very busy freeway(planes, trains and automobiles). What type of housing development do they feel would make up for the loss of the golf course and bistro? Well, it really does not matter what comments I make , the die is cast and the subdivision will begin. The State and Local council are similarly motivated, so the smaller the lots , the greater the yields - the better their profit margin. It is all a feeding frenzy! As for me, I will remain where I am , I raised my family in this home, [redacted]. Thank you for the opportunity to comment."	"11-Mar: Thank you for your email relating to the sale of the Glen Iris Golf Course, and apologies for not responding in full at this stage. As you can imagine, the notice to residents has generated significant interest, and I am currently working through the emails. Hi [Name] 20 March: First of all sincere apologies for not responding more promptly – not sure how I missed your email in my inbox. Firstly, in relation to the golf course, we are not really in a position to comment on how that business was run, and how that might have affected the decline in the number of golfers. Secondly, I understand your strong connection to your home, and your concerns around possible future changes. As a family owned company of more than 40 years' standing, I know that the new owners are committed to creating a high quality, boutique development that reflects the standard of the surrounding estate and which retains mature trees, creates leafy streetscapes and parklands to be enjoyed by the whole community. To achieve this, they want to start engaging with the Glen Iris community as soon as practically possible once the sale is finalised in April. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme. We will be back in touch with residents with more information about the engagement process once the sale has been finalised. I hope to have responded to everyone by close of business Friday 13 March. Thank you for your patience."	Opposed - no specific issue raised			
12.3.20	16.3.20	Email	REF057	"Hi [Name] As a home owner at Glen Iris Estate I am very interested to know if there is an initial plan for the establishing of new houses. As this is obviously the early stages, will there be an initial meeting for residents to hear some of the planning that will be carried out? Thank you in anticipation."	"Hi [Name] Many thanks for your email. As you say, it is very early days, and no detailed plan exists as yet. The new owners are keen to get input from the community as part of their overall planning, and this will help to shape the initial concept for the site. The sale is due to be finalised on 6 April; once that has happened, our aim is to start engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme. We will be in touch with residents again in the near future with more details of the engagement platform and ways in which they can provide input."	Consultation opportunities			
12.3.20	16.3.20	Tele	REF058	Size of lots - don't want smaller lots; no group dwellings; concerned about traffic; lives [redacted] from course, would prefer it remains as is.	Advised will be a premiumquality development that reflects the existing quality in the area if not improves on it; group dwellings - not that level of detail yet; traffic - detailed traffic maagement plan will need to be developed.	Lot sizes / density	Traffic		

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12.3.20	16.3.20	Email	REF059	"Good afternoon [Name], I am a resident currently residing with my family in Jandakot on the Glen Iris Golf Estate. My reason for writing is not to stop the development, but for you to be fully aware of our concerns in the coming years for my young family, my neighbourhood and community. It would be naïve to believe that housing won't occur in place of the golf course, but the way it is done is important for the future of those living here in the estate. This has the obvious impact of reducing the value of my property, but equally the loss of living in a unique suburb is something as important to me. One of the things of living here that differs from other suburbs, is the number of trees that attracts birdlife and wildlife. We have a number of bandicoots that live in the bushes behind our house, and rainbow lorikeets, pink and grey galahs and other varieties of birds being in the trees around our house daily. Putting in medium to high density housing would do nothing but eliminate this completely. You only have to look 3km down the road at Treeby estate (ironic name by the way) to demonstrate this. It is nothing more than a sea of houses with no trees, packed in as tightly as possible to maximise profits for the developer, and maximise land rates accrued for the city of Cockburn. I understand that the developers intent to develop 'premium housing and retain developed trees', however I know that this could mean they will keep 1 out of every 50 trees and have 400m2 blocks as opposed to 350m2. I believe matching the current zoning of R20 housing would be required as a minimum to achieve public acceptance, with many trees along the fairways needing to be kept. If anything, this could be an opportunity for the developer and City of Cockburn to develop something that attracts positive interest for decades. Similar to the Bibra Lake playground, establishing something that utilises the current strengths of the existing area would be far more beneficial. Creating a unique environmentally family friendly hub for people to go to with exercise facilities/restaurants/cafes/playgrounds/ etc. could make assist the developer becoming a leader in innovation throughout Perth/Australia, rather than another example of poorly planned urban infill. Integrating appropriate housing and the existing environment could be a game changer for future urban development. It always pains me to see new developments, where the first thing that is done is every single tree is cleared across massive tracts of land, with soulless houses crammed against each other. This I fear is what will happen here as well. I have resided to the fact I will most likely lose my current view of the golf course, however I believe the community would be far more accepting of the situation if their opinions and views were heard and adopted at some mutual middle ground. Whether this happens however is the real question I look forward to your reply, and request to be included in any updates that occur concerning the development."	"Hi [Name] Thank you for your email, and the detailed and constructive feedback you have provided. It is this kind of information that we are genuinely wanting to find out once the sale of the land has been finalised in April and we can start actively engaging with the community. Tthe details you have provided will be passed on to the project team. Several people have mentioned to me the birds and wildlife, and one of the first things the new owner will be doing is having an environmental consultant do a flora and fauna study to really understand what is currently there and the habitats the existing vegetation provides. This development will not be a 'cookie cutter' or 'off the shelf' solution – we recognise the qualities of the site and the standard of homes in the area, and are committed to creating a high quality residential community that reflects its surroundings. Our aim is to start engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will notify residents as soon as that is live (most likely in April) and I would strongly encourage you to continue to provide detailed feedback to the project team in the early stages of this project."	Lot sizes / density			
12.3.20	23.3.20	Telephone	REF060	"Spoke to [Name]: backs onto the driving range (zoned R40 land), rough summary was: Q. Are we going to let it get overgrown and turn the retic off. A. We are looking at what maintenance to put in place, but it will not be watered because the water is only required to maintain the golf course. Chance is minimal of getting the approval through... if you do we will get the CCC to investigate, because you have obviously paid someone off I explained we have purchased, will consult and then submit a request for rezoning and during the consult process, its important for people to tell us what they want. [Name] doesn't want small blocks and would like buffers if possible AND parks he can use. He asked what projects we have, I explained Providence and Florida, but highlighted that neither was an example of what Glen Iris would look like, as they are positioned for their localities and demographics. He was very passionate a Providence was not what the people wanted in their backyards. Chatted around block sizes, has a few developers what as small as possible, I indicated that wasn't always the case and referenced large lots at Florida Beach. Suggested that was another point he could tell us about in the future. FEAR – petty crime and hooligans will move in. I indicated we wouldn't be happy with that. FEAR – the community doesn't want another Stockland Calleya estate, as its just average first homebuyer country. I indicated I thought we could do better and would be disappointed if we could only deliver a Calleya. At this point the conversation changed and [Name] dropped his aggression. I want to be involved in a community ref group or similar, because if its going to happen, I want to help shape the outcome. But, I am still not happy the golf course is going. Glen Iris has a country club feel, that was lost in recent years because the restaurant is not any good, years gone by it was a great place for a Friday night drink, I suggested he tells us that when we ask and we might be able to try and plan something into our plans. Overall he feels let down, as they thought it would stay, and he didn't really like finding out about it in the mail box. But acknowledged how else do you do it! Feels sorry for the people up the top with million dollar homes overlooking the lake, they thought it would stay forever."	See text box to left for summary of conversation				Call and ask for email address to register? Check register?
12.3.20		Email	REF061	Advised of poor integrity of large gum trees - trees will need pruning before the onset of winter.	Organised for and completed tree lopping on site which will benefit several homes.	Maintenance of site during planning process			

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12.3.20	16.3.20	Email	REF062	"Hi [Name] According to the city of Cockburn article about the sale of Glen Iris golf course , it was stated : "Acumen has since confirmed with the City that its client is not proposing to remove any trees from the golf course site until it has undertaken detailed planning for the site, in consultation with the local residents and they have obtained the necessary approvals. The lakes are all reliant on pumped groundwater to remain full as part of the golf course irrigation system, so it is likely they will dry out over time once the golf course is closed and extraction of groundwater is significantly reduced." I am sure you are also aware that the new owner is obliged to maintain the course against weeds, to minimise fire risk, and to ensure the safety of any person who may be on the site. Any maintenance to be undertaken should be in close consultation with City of cockburn and with a full Health and safety management plan. Can you please confirm this ? Hi [Name] Thank you for your response. Eastcourt and Acumen seem genuine to be wanting to work with Glen Iris community to share thoughts and ideas on how you can best 'fulfil the vision for a high-quality, boutique residential community ... whilst still allow outlooks in many areas'. If this is the case, would you please not allow the lakes and fairways to dry up as this would preserve the current outlook? It wouldn't cost too much money for you to keep it in a decent condition but bring more goodwill from the community. Your positive response to this would be greatly appreciated. "	" Thank you for your email. In relation to maintaining the site once the sale has been finalised, we will be ensuring that all fire breaks are maintained and fire hazards reduced, as well as fencing off the site to public access for security reasons. Once the sale settles in April, we will be developing a management plan for the site which will have more details. Thank you for your email and apologies for taking a while to respond. We are currently working through how the site will be maintained once the sale is finalised and while we are working through the planning process. Unfortunately the water bodies are all man made (with the exception of one, to my understanding), and draw from the groundwater via a water licence. It wouldn't be sustainable to continue to draw this volume of water from the groundwater source. As a result these water bodies will be allowed to revert to their natural state over time. However, we will be maintaining the site in terms of monthly slashing of grass and fire breaks, ensuring all fencing is secure and retaining the CCTV that is currently in place. Once we take ownership of the site we will develop a more detailed maintenance plan, and I will make sure your feedback is passed on to the project team."	Maintenance of site during planning process			
12.3.20	16.3.20	Email	REF063	"Hi [Name] Myself, family, residents and fellow golfers will totally oppose any redevelopment plans for the Glen Iris Golf Course, Bar & Bistro. Our vision is that the golf course, bar & bistro should be retained and the course and restaurant returned to the magnificent condition it once was. If this was the case the golfers and patrons of the restaurant would return in droves,"	"Hi [Name] Thank you for your email and feedback. The golf course was open to the public, but the land and business were privately owned. The decision has been made to close the course and restaurant, and the new owner of the land has purchased the site as a future residential development, subject to all relevant rezoning being achieved. Kind regards"	Opposed - no specific issue raised		NO	
12.3.20	16.3.20	Tele	REF064	Disappointed at decision, would not have purchased home if it didn't have those views; property prices, traffic in area, community feel, loss of ability for people to be exercise and associated mental health, Dean Road is a busy road and would be concerned if two entrances/exits only would make Dean Road busier; hooning and speeding in area so there was a push to put speed humps in; [year] purchased; local area in terms of [redacted] - congested ATM before additional residents; will we be backing on to another house? Uncertainty makes it difficult if want to sell; my role; when lots of trees added oxygen; fencing if we are backing onto another property then shouldn't have to bear cost of new fencing; two large trees at boundary of property; ducks; rainbow lorikeets; black cockatoos every day; amenity - currently no corner shop, schools etc within local area; very community-orientated suburb - street parties etc; if this goes ahead will need to do something to avoid a them and us situation.		Views	"Property values Traffic Fauna & flora"		
12.3.20	16.3.20	Email	REF065	"Hello [Name]....please refer to attached email to my local MP....F.Y.I. Good Morning Yaz, I am contacting you with regard to the recently disclosed closure of the Glen Iris Golf Course and associated amenities.... I built my home at [Address] [Number] years ago with the view that it would be a nice place to live when I eventually retire, with pleasant views across the fairways and an easy walk to the clubhouse. Having retired approximately [date] I am sure you can imagine my disgust at the news of its closure and potential development of another housing estate (wth just 20 days notice). I am also sure my story and concerns are very similar to the hundreds of residents of Glen Iris, the letter drop note from the developers state.... "The vision for the Glen Iris Land is to create a high quality residential estate that retains mature trees and delivers premium housing options, leafy streetscapes and parklands for the whole community"" This statement makes absolutely no sense.....the whole reason people built or bought here in the first place is because that is exactly what we have already ! If Cockburn Council agree to the rezoning of this area it would be a disgraceful and reprehensible act not only to the local residents but the whole of the Cockburn community....surely they should be promoting more outdoor activity and sport, encouraging leisure & restaurant facilities for the community at large. Yaz.....the entire local community are relying on people such as yourself to put pressure on the relevant authorities to not allow this rezoning to occur. Thanks in advance, [Name] "	"Hi [Name] Thank you for your email and for sharing the email you sent to your local member. I will include this in my summary of feedback to the project team. Our aim is to start engaging with the Glen Iris community as soon as practically possible once the sale has been finalised in April. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme."	Views			
12.3.20	16.3.20	Telephone	REF066	Voicemail left	Returned call Mon 16th 3.45pm - no anwer, left voicemail				

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12.3.20	16.3.20	Email	REF067	"Hi [Name], I am contacting you as I am a resident of the Glen Iris Estate and would like to be engaged & informed of the development and plans for the Glen Iris Golf Course site. If you could kindly include me in any information or applications that are made for the site please"	"Hi [Name] Thank you for getting in touch – I will add you to our database, but also keep an eye on your letterbox – I expect we will be in contact via letterbox drop in April (once the sale has been finalised) with more information. "	Lack of information at time of writing			
12.3.20	16.3.20	Email	REF068	"It would be a great asset for the development if it could be retained as the local watering hole similar to O'Connors for the local residents. Best regards"	"Dear [Name] Many thanks for your email and the feedback you have provided, which I will pass on to the project team as part of my overall report into community feedback."	Golf course and/or tavern to remain open			
12.3.20	12.3.20 & 16.3.20	Email	REF069	"12- March: Hi [Name], Is it possible to meet with you when you have time. We would be interested in providing our auctioneering services for you for any excess equipment you may have following the closure of the golf course and restaurant. I did the closure auction [redacted]. Regards, Thanks [Name] 13 March: Any idea of a contact "	"12-Mar: Hi [Name] Thanks for your email, but I am engaged by the project managers for the company that is purchasing the land – you would need to contact the golf club owners in relation to this. Kind regards 16- Mar: You can contact [Name] [Name] at Eastcourt – new owners of site from 6 April: [Name] [Name] <sam@eastcourt.com.au>"				Contact passed on to [Name]
12.3.20	13/03/2020 and 16.3.20	Email	REF070	"9 March: Dear [Name], I am a resident in the Glen Iris estate having been here for over [Number] years and was dismayed to find in the letterbox tonight the notice regarding the closure of the golf course and redevelopment of the estate. I [redacted] onto the golf course and bought the house specifically due to its location paying a significant premium for this. I even re-developed my back yard and outdoor area a [Number] years ago at a cost of more than [amount] just to take advantage of the views so do not want this to be replaced by a view of another group of houses, streets, and further infrastructure. I am also concerned that the scenic views and locale will be replaced by sand and construction for a number of years as has been the case for the never ending Kwinana Freeway project. 13 March: Thanks [Name] for your response. Besides the long term future of our estate and community the most immediate need for us is that our estate and surroundings are maintained to a high standard now and we continue to live the life we have had for many years in our community. Already the negative signs are starting to appear, mowing is not being done, watering reduced, fountains in lakes not turned on.....nothing will get the residents more offside from the start and make the consultation platform problematic if the golf course is let go from a maintenance standard so I would pass this on to the project team as a highest priority."	"13 Mar: Dear [Name] Thank you for your email and feedback. I have also spoken to [Name] in the last few days, and documented your concerns which will be passed on to the project team. Our aim is to start engaging with the Glen Iris community as soon as practically possible, once settlement has occurred on 6 April. We are establishing an engagement and consultation platform which will provide a central information and contact point. Once this platform is live, we will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community. I have added your contact details to our database. 16 March: Thanks [Name] – this is a common issue that residents are raising, and which I am raising with the project team on their behalf. Once the sale has been finalised I expect we will have a more detailed management plan for the site that we can share with everyone. "	Views	"Construction - disruption; maintenance of site during planning process"		
13.3.20	16.3.20	Email	REF071	"Hi [Name] As a concerned resident I was hoping you could answer the following 1 I understand vast majority of the golf course needs City of Cockburn and West Australian Planning commission approval for rezoning before any development could occur 2 .Should EastCourt properties be successful in getting a rezoning of the whole Golf Course for residential development are you able to advise the proposed block sizes of the land to be sold. Due to the prestigious houses already on the estate in order to maintain the current appeal and style I would be devastated if any developer considered small block sizes and cramming houses in such as in a nearby estate at Calleya. I would expect they should have block sizes at least 600 m2 or above with purchasers to then have the option to build exclusive double storey homes to blend in with the existing estate portfolio of properties I would also expect those houses directly backing onto the Golf course to have a reasonable level of distance from a neighbouring property. And of course fantastic streetscaping Any reduction on the block sizes will bring down the quality of the estate and affect the house prices of current housing Our house does not back onto the Golf course but I know many residents are very concerned at the potential changes. I look forward to your response to my points above."	"Hi [Name] Thanks for your email, and in particular for the detailed feedback you have provided, which I will be passing on to the project team. In relation to the zoning – you are correct in that the site will require an amendment to the City of Cockburn Town Planning Scheme to enable residential development. To briefly summarise, under the State Government Metropolitan Regional Scheme, the land is zoned Urban. Under the City of Cockburn Town Planning Scheme, the land is zoned Special Use 1 and Residential R40. Any proposed land use changes will be considered in accordance with the Western Australian Planning System. As you can imagine, it is too early to have specific details about block sizes. However, the new owners (Eastcourt) are seeking to create a high quality boutique development the reflects the existing quality of housing within Glen Iris. Without wishing to comment on what other developers may have done at estates such as Calleya, I can assure you that Eastcourt's vision is for a premium residential community. Our aim is to start engaging with the Glen Iris community .– and particularly with those residents whose properties currently back directly on to the golf course - as soon as practically possible once the sale of the land is finalised. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme. In the meantime I will pass on your feedback to the project team, and add you to our database."	Lot sizes / density	"Quality streetscaping Distance between existing homes backing on to the golf course and any new development"		
13.3.20	16.3.20	Tele	REF072	Lives [redacted] to golf course; talking to friend heard there is a meeting on March 21st with Deputy Mayor and East Ward councillors in attendance; - I've been playing golf since [year] and numbers have dropped off due to bad management of golf course; kids drained $$ from business; when site becomes closed on 31st will there be security - concerned about kids on trail bikes, growth of wild oats, will fire breaks be maintained, value of home will drop with views lost; from a personal POV we would like it maintained as a golf course; City of Cockburn is only local council without a golf course; otherside of Berrigan is a different situation; don't want same situation as Rosehill golf course - closed down and now developers have gone bust - [redacted]- sit on patio and can watch birds in big tall trees; access only one way in and out via Turnberry Park and then Dean - only 2 in and outs; this is a positive - means absolute minimum crime due to restricted access; mentioned to Dep. Mayor Kirkwood that it's through bad management of golf course; in 90s about 6 golf clubs playing there; tavern was packed on Friday night with workers from airport;	Advised fire breaks maintained as a minimum, security fencing; advised tg on 21 mar is residents mtg only; discussed vision for development and assured [Name] we want to hear from the whole Glen iris Community not just those that back on to the golf course. Explained my rile and that we will be back in touch in April.	Maintenance of site during planning process	"Wants to keep golf course Worried about crine if estate develops so that there are more than two entrance/ exits"		

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13.3.20	16.3.20	Tele	REF073	No answer Mon 16 11.25am - LR left voicemai					
13.3.20	16.3.20	Telephone	REF074	Voicemail asking me to call back after 3pm	Returned call adn left voicemail				
13.3.20	16.3.20	Email	REF075	"Hello [Name], I am interested to learn about the plans for development at the Glen Iris golf course site. My home [redacted] and I would like to know how the changes will affect me and my property. Regards, [Name]"	"Hi [Name] Thank you for your email. The sale of the site is due to be finalised on 6 April. Once that has happened, the new owners aim to start engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme. We will be in touch with residents again in April when the engagement platform is live. In the meantime I have added you to our database."	Lack of information at time of writing	General information		
15.3.20		Email	REF076	Letter in capacity of Pres of Glen Iris Lakes Golf Club (on file)	Response sent from [Name]	Golf course and/or tavern to remain open			
15.3.20	16.3.20	Email	REF077	Dear Sirs, With regard to your Community Notice received on the 10 March 2020. We fully oppose any redevelopment on the Glen Iris Golf Course and any change of use. We purchased our house because of its prime positioning next to and overlooking the golf course. Any redevelopment will have a significant and detrimental impact, including but not limited to: • Loss of views and amenity • Privacy eroded • Environment and sustainability with loss of habitat for local wildlife • Increase traffic and noise • Significant reduction in value of property In our view, the Golf Club is sustainable in its current configuration and requires investment to return it to its former glory. We will be supporting the community to oppose any redevelopment on the Golf Course.	Thank you for taking the time to email me and outline your concerns in relation to the proposed development. I will be passing on your feedback to the project team. While the golf course was open to the public, the land and business are privately owned. The decision has been made to close the course and restaurant. As the new owners (from 6 April) our aim is to start engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme.	Views	Loss of amenity Loss of privacy Environment and sustianability with loss of habitat for local wildlife Increased traffic and noise		
15.3.20	16.3.20	Email	REF078	"Hi there, Was going to respond by email (still might) but was told by a neighbour that there is meeting to attend either next or weekend after. Please advise so we can attend to try and save our lifestyle. "	"Hi [Name] Thanks for your email – I think the meeting you are referring to is organised by residents, so maybe chat to your neighbours for more info? Please feel free to email me your feedback about the proposed project if you would like to."	Opposed - no specific issue raised			
16.3.20	16.3.20	Telephone	REF079	Property values - will we be offering cash rebates to residents who are losing their views? Is sale going through - rezoning - suggests a done deal; what happens to the land if it doesn't get approved? Shocked there was no pre-consultation; how many lots; how will be it be maintained; don't need parks etc already have that in area, don't need cafes. medical centres etc already have that	No legal entitlement to view; normal practice - explained MRS and TPS and rezoning process; no pre-consultation as land was privately owned so no obligation for private seller to get agreement from community re: sale; too soon to say how many lots, but will be premium quality development in keeping with area; fire breaks, security - management plan for maintenance will be put in place.	Property values	"Maintenance of course during rezoning Looks like a 'done deal'"		
17.3.20	30.3.20	Email	REF080	"Confused??? I received an email from the current owners [Name] 6 months ago when my daughter was enquiring about the Lease at the Glen Iris bar and Resturant, which stated that there was no decline of the number of golfers????? as stated in your letter. The residents will be taken legal action against the proposal of re zoning. I also contact the City of Cockburn and spoke to them, they assured me that it would be very unlikey that the A1 reserve would ever change. There is a lot of questions to be ask??? why would any company buy land on the chance that it would be rezoned ??? why did the owner let the Golf course get into such a terrible condition??? The residents have invested time, and money built there homes around the golf course and will fight every step of the way of re zoning. "	"Hi Thank you for your email and apologies for taking a while to respond. In relation to the zoning of the land, under the State Government Metropolitan Regional Scheme, the land is zoned Urban. Under the City of Cockburn Town Planning Scheme, the land is zoned Special Use 1 and Residential R40. Any proposed land use changes will be considered in accordance with the Western Australian Planning System. Eastcourt Property Group plans to redevelop the 54.9h site into a quality residential community. The vision is for a residential development that delivers premium housing options while retaining mature trees and creating leafy streetscapes and parklands to be enjoyed by the whole community. Our aim is to start engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform called Have Your Say Glen Iris Estate which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme."	Opposed - no specific issue raised		N	

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18.3.20	23.3.20	Email	REF081	"Firstly as a resident of the Glen Iris Golf Course Estate I wish it to be known that I am incredibly disappointed at the way local home owners were kept in the dark regarding the sale of the course till just before it's closing date. My home has a golf course view as I [redacted] so immediately the value of my property will decrease with the golf course disappearing. Rows of houses do not attract the same appeal as a green fairway. Secondly as a concerned homeowner I realise that generally my objections will have little impact on what is being proposed. This brings me to the subject of the location of my home in relation to the golf course. Your leaflet indicates that mature trees will be retained. Between my home and the golf course [redacted] is a walkway. Lining this walkway on the golf course ground are several very mature trees reaching 150 to 200 feet into the air. These provide a constant source of worry to the [Number] home owners that back onto this particular green as frequently large branches, twigs and a constant barrage of leaves land on our properties 24 hours a day. Whilst I love trees my fear is that one day these huge gums will fall and wipe out my whole house and any person unfortunate enough to be home at the time. Another relevant concern is that there are four levels we are dealing with here. My house is on one level, the walkway drops down around three to four feet, then the land rises up a few feet where the trees are growing and then the putting green is a few feet higher again. My worry is that if the developers start to level out the land there is a definite possibility of disturbing the root system thus making the trees a further hazard. If this estate does go ahead as planned I would be most appreciative if careful thought and consideration would be given to removing these trees. In several places the wire fencing is already leaning over due to the size of the trunks."	"Dear [Name] Thank you for your email and the feedback you have provided. I am not able to comment on the land owners' management of the announcement of the sale of the golf course and its closure, as that was a decision for them. The sale of the site is due to be finalised on 6 April, at which point Eastcourt will become the new land owner. We are aware of some residents having concerns in relation to mature trees that believe may pose a risk to their properties. Once the sale has been finalised we will have environmental consultants/arborists assess the site, and identify trees that may need some work to protect adjacent properties. I've entered your email and address details into my database, so your property and your immediate neighbours will be flagged as an area that may need attention in this regard. In terms of retaining mature trees in any future development, this will be done where it is safe to do so, to enhance streetscapes and any future parklands."	Property values			
19.3.20	23.3.20	Telephone	REF082	Wildlife, trees global environment, golf restaurant closure. Don't want it changed - sneaky way in which land was sold, no one gave residents a chance to have a say, switching water off, don't want trees chopped down, global warming, switching water off will kill trees, ducks and swans	Mostly listened!	Environment			
19.3.20	20.3.20	Email	REF083	"Hi I gather your company is planning on developing residential stands Glen Iris in Jandakot, City of Cockburn. I was hoping you could furnish me with details of: proposed zoning requirements of the suburb/location, standard size of stands/lots, map of intended area for development. Any other relevant information pertaining to project you might have. I am looking for a place to buy and build."	"Hi [Name] Thank you for your enquiry. It is very early days for this proposed development – the sale of the land won't be finalised until April, and then there will be a rezoning process to be gone through with City of Cockburn. We anticipate that this will take 18 months to 2 years. The land is in Glen Iris – it is the site of the privately owned Glen Iris Golf Club, which is closing on 31 March. The new owners plan to redevelop i54.9ha site into a quality residential community. The vision is for a residential development that delivers premium housing options while retaining mature trees and creating leafy streetscapes and parklands to be enjoyed by the whole community. Any proposed land use changes will be considered in accordance with the Western Australian Planning System. We are setting up an engagement and consultation platform which will provide a central information and contact point. Once that is live I would encourage you to check in regularly to learn more about the progress of the project. Thanks for your interest."	Opposed - no specific issue raised	Intersted in buying land		
20.3.20	30.3.20	Email	REF084	"Hi [Name], In relation to your proposed development, Have you taken into account that the golf course is on the main flight plan of Jandakot airport, what this means to the local environment is the heightened noise levels of aircraft taking off and landing. A lot of this noise is dispersed / absorbed through the trees and soft grass areas of the golf course. If you interfere with this by building roads and roof tops etc, this will cause the sound waves to be reflected off irregular surfaces causing echo etc, it will lift noise levels by an estimated 5- 10 decibels. The more property's added would increase the problem. The noise generated at times by the emergency services that use Jandakot can regularly reach 110db (measured with atm-103 sound logger) on the putting green, Iris clubhouse. This noise and land vibration from the Bell Hellitaks and fixed wing water bombers can be almost constant in bushfire season. The fixed wing water bombers when fully laden have a slow height trajectory skimming the tree tops at times which would bring them dangerously close to the new proposed roof tops. This airport operates on a 24 hour basis for the Policeand air ambulance emergency services. At the noise level we accept, any increase on this noise will probably be a different matter. On top of this you have the international flying schools that use Jandakot, they constantly fly around in circles doing take off and landings, which create a constant industrial noise pattern. This will have a two fold impact, making life unbearable for existing residents, and you would have to declare as a materiel fact to new purchasers that they will need to invest money sound proofing their new homes in the " premium blocks" you will have on offer. This problem has been put before the courts in Europe , and developer's have been forced to provide compensation for sound insulation for home owner's. https://journals.sagepub.com/doi/abs/10.1260/0957456011498948?journalCode=n-vwa I will be asking for and expecting during the consultancy period, an independent full noise impact study / report and this will probably need to be done over at least a 24 month period as the airport noise can be seasonable with the bushfire season etc. "	"Hi [Name] The new owners of the site, Eastcourt Property Group (as of 6 April), are aware of the proximity of the Jandakot Airport, its activities and the associated ANEF noise contours. These will be fully considered as our engagement and development planning is advanced for the site, which will include expert assessments and reports as part of a comprehensive Town Planning Sscheme and Local Structure Plan approvals process."	Airport noise			

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20.3.20	23.3.20	Email	REF085	"Hi my name is [Name] from 8 [Address]. I was wanting to get some clarification on who would be responsible for financial compensation for the redevelopment of the golf course if the development goes ahead!! I purchased a block of the developer Prodev back in [year], as a golf course estate. My original purchase was bought of the plans by the developer Prodev, and they were employed by the current owners of the golf course. There was no caveat informing us that after [Number] years the golf course would or could become a housing development. Had I or most of the original owners known of this proposed change I can assure you that the current owners of the golf course would not have sold any properties. Needless to say there will be a compensation agreement made by the golf course before any development could possibly go ahead. The current owners of the golf course have a responsibility to there land owners and cannot simply walk away after reaping the benefits of the original subdivision. Thanks again, [Name]."	"Hi [Name] Thank you for your email. As you know, Eastcourt were not involved with the original sub-division, and have only recently agreed to purchase the site. While, we appreciate the concerns of the residents, views cannot be protected—this has always been the case in WA. The Glen Iris Golf Course has always been privately owned land, and any proposed land use changes will need to be in accordance with the Western Australian Planning System."	Property values			
22.3.20	30.3.20	Email	REF086	" Hi [Name] Just reaching out to be added to your mailing list for future updates. Do you have any new information? "	"Hi [Name] and [Name] Thank you for your email and apologies for taking a while to respond. I have added you to our database. It is still very early days – the sale of the land isn't due to be settled until 6 April. Once that happens, our aim is to start engaging with the Glen Iris community as soon as practically possible. We are setting up an engagement and consultation platform called Have Your Say Glen Iris Estate which will provide a central information and contact point. We will be encouraging the community to share thoughts and ideas as to how we can best fulfil the vision for a high-quality, boutique residential community which aligns with the Urban zoning under the Metropolitan Region Scheme. We will be in touch with everyone in April, to provide them with a link to the online platform and commence our engagement."	Lack of information at time of writing			
23.3.20	26.3.20	Email and telephone	REF087	"Bought in [year] for the view. Questions about site maintenance during planning. Believes new development could improve property values. Lives in a type of 'gated community', is trying to encourage neighbours to be positive. Wants to be kept informed. [Name] Thanks for your time but I wanted also to mention and had forgotten when I was talking to you earlier (not prepared— had my notes at the office). What I wanted to mention and I am sure your owners have thought about and done their due diligence was to keep the Golf Club and car park etc and renovate/convert to a 'reputable' restaurant / licensed area which would also cater for the larger population of Glen Iris once the development has been completed. Surely the owners could lease the new restaurant out or even start advertising for a buyer to buy as freehold. The financial reward surely would be worth looking at rather then the costs of building homes and knocking down the 'iconic' golf club. As a sales agent ' how good would it be to be able to add to the sales pitch that there is an amazing ex golf club that has atmosphere and local feel to new residents to the new Glen Iris Estate. I believe with a bit of thought this could be financially viable to the new owners."	"Provided overview of project and thanked him for taking a positive view and wanting to help achieve a good otucome for everyone. Hi [Name] Thanks for the extra feedback. Unfortunately under its current licence, the restaurant cannot operate independently of the golf course. However, I'll pass on your general feedback around having some form of restaurant/hospitality venue within any future development to the project team."	Golf course and/or tavern to remain open			
26.3.20	6.4.20	Telephone	REF088	Media enquiry	[Name] called				
27.3.20	6.4.20	Email and telephone	REF089	Asking to be placed on database.	Emailed to confirm he would be added.	Consultation opportunities			
30.3.20	2.4.20	Telephone	REF090	People all over golf course; had to take a duck to be euthanised - kids hitting it with golf clubs; people have cut holes in fences etc.	Provided update on proposed secutirty measures and flora fauna study that is planned.	Security	Fauna		
31.3.20	2.4.20	Telephone	REF091	Outdoor area and backyard [redacted]. No neighbours on one side - concerned this may be used as an access point to new development. Recently remarried, returned from honeymoon to discover golf course had been sold. Was planning to put house on market in September and retire. Boundary fence is collapsing. Concerned about security - [age] daughter home alone a lot.	Provided update on situation and plans for community engagement. Encouraged her to participate and keep in contact with us - we will provide her with as much info as possible to help her make the best decision for her situation. Advised traffic management and access will be developed a bit further down the track - need tto have a concept plan for traffic ocnulstnats to assess first.	Timing / uncertainty	"Planning to sell in September traffic and access Bandcoots etc Property value"		
31.3.20	7.4.20	Telephone	REF092	Concerned about access roads into new development being located near his area. Fought a long battle with Council re: Imlah Court and Prinsep Road being opened up, doesn't want new access roads in his area. Also queried what kinds of issues are being raised by the community. Also queried whether online engagement on its own was enough.	Advised that traffic management would be a major consideration for the new development; explained that traffic often comes up in conversation, as well as environmental stuff and what will happen to the site (Security) during planning process. Explained that online engagement is necessary under current circumstances, and that we will be drilling down to topics and location specific questions - it's the same way in whih LGAs engage.	Traffic	Online engagement		

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8.4.20	9.4.20	Email	REF093	"Hi [Name], I hope you are fairing well given the current pandemic and impact on the community. As a concerned resident of the Glen Iris Estate it would be great to have some understanding of the intentions of East Court Development Group on the purchase of the golf course which we understand settled on Monday, 6 April 2020. We understand that you are communicating with Jandakot Ratepayers Association regarding your intentions for the land, but unfortunately this information hasn't been disseminated through to the broader community. While we love living in a golf course estate we understand that this type of venture is not sustainable so we are hoping you will deliver on a proposal that maintains a balance of community open space and new living and it would also be great if the club house could be repurposed into something useful and valuable we could also use and enjoy as a community. The Jandakot Ratepayers Association appears to be highly emotion driven and does not necessarily represent the views of the broader community. Any additional information or prospective timeframes/milestones you could provide would be greatly appreciated and we would be more than happy to discuss community feedback and proposals. "	"Hi [Name] Thanks for your email, which is quite timely – we are letterbox dropping the community early next week to let everyone know next steps and ask them to register on our engagement platform so they can share ideas and provide feedback in relation to the project as we start our consultation process. If you want, I can automatically upload your email to the site once it goes live next week, and that way you will automatically be registered – you will receive an email just asking you to confirm and activate the registration. The new owners are absolutely committed to developing a high quality residential community, with streetscapes and leafy parklands that the whole community will be able to access and enjoy. Let me know if you are happy for me to add you to our database when the site goes live on Tuesday, and we look forward to having a constructive conversation about how we can work together to ensure the best possible outcome in terms of quality and design"	Consultation opportunities			
14.4.20	14.4.20	Email	REF094	"Hello again [Name], Hope you had a relaxing Easter break. Our house is located next to [redacted]. Some years ago, with the permission of Management of the golf course, we planted and cultivated multiple flowering native plants on the vacant land to provide additional natural habitat for the existing Quenda family living in that area. Over the years, as the plants have grown into large established bushes, we have seen significantly increased levels of activity from Quenda, birds and bees. Obviously, we are concerned that any planning takes into account this natural habitat which we believe should be retained at all costs. How do we make sure that this kind of concern is given adequate consideration in the early planning stage?"	"Hi [Name] Thanks for your email. Easter was a strange one this year! Hopefully we will all be back to normal soon, whatever normal looks like. There are two ways to make sure your feedback about this vegetation and habitat is provided to the project team for consideration – one is to email me, as you have done, and I will pass it on. The other – and the most effective way – will be to participate in our online engagement via https://www.haveyoursaygleniriseestate.com.au/ We will be running surveys and asking for feedback on a range of topics, including vegetation and habitat, over the coming months. The reason why providing your feedback through the website is the best way to ensure it is reported back to the project team is because the website is set up to document and report on feedback. That's why so many local councils use the same platform – it has really strong reporting functions that enable them to collect feedback and collate it into reports that help identify key concerns and areas of importance as expressed by the community. If you haven't already registered on the site I'd encourage you to do so – that way you will receive updates about the project and have the opportunity to contribute to surveys etc. If you're happy for me to start the process for you I can add you to the database within the website and you will receive an email that will enable you to activate your registration. In the meantime I'll enter your comments into my spreadsheet which I share with the project team. The spreadsheet will enable me to categorise your particular area of interest – in this case flora and fauna – as well as include your email text."	Environment			
14.4.20			REF095	"Hi there [Name] I live at [Address], and spoke to you Thursday week ago (from memory) Below is a link to photo's from my house that overlooks [redacted]. The point I most wanted to highlight is that the design of the house was done so as to incorporate the beautiful outlook up the fairway from the Masterbedroom, kitchen, family room, 2 bedrooms upstairs, pergola and balcony. I have huge concerns as to what is planned for the space [redacted] in front of my house. As I mentioned to you in our phone conversation, I have recently married, and was planning to sell my property very soon. I am now really in a difficult position. Is there any light you can shed on the plan for [redacted]? Also, will watering be done, i can see thtat the grass is turning yellow already? The other concern that i would like to raise with you, is the security of my property. The boundary fence between the golf course and the house is not very tall, and easy for someone to climb over have access the house. We are very careful with security, however my daughter and our dog are here often on there own, and with a lot of people using the broken fence that is next door to my house to access the golf course, i have major concerns re security. Please let me know if you cannot access the photo's in the link. Many thanks for your time. "	"Good morning [Name], Thanks for reaching out to the Community Engagement Team for the Glen Iris Estate Project. It is really important that Eastcourt Property Group hears from the surrounding community and understands the issues that are important to people living adjacent to the project site. I have recorded your concerns in the database but also wanted to respond to you with some information. Security Eastcourt Property Group shares the local community's desire to maintain safety and security in the Glen Iris area. On-site security has been boosted with CCTV, mobile patrols and monitored alarms and the project team is also working with the City of Cockburn's safety and security service CoSafe. If you do notice any suspicious or anti-social behaviour it would be much appreciated if you could report it immediately to the Police on 131 444 so we can stay on top of these issues. Watering As you would be aware, maintaining fairways and greens takes a huge volume of groundwater. Since the site will no longer operate as a golf course the irrigation has been turned off. However, please be assured that Eastcourt Property Group will undertake regular maintenance of the site with mowing and slashing of grass, installing firebreaks and fencing repairs as required. Future Plans I realise the community is keen to known what the future plans are for the site, but the project is at the very early stages and no plan has been developed. Now that Eastcourt Property Group has settled on the purchase, they can commence community consultation to gain input on all aspects of the proposed redevelopment. They will be running surveys and workshops and of course asking for ongoing feedback via the Have Your Say Glen Iris Estate engagement platform. I hope you will participate in the consultation process and make sure you provide input – especially when it comes to what the 6th green might look like. Please let me know if you have any other queries at this stage. Kind regards, [Name] [Name]"	Development information request			

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15.4.20		Hand-Delivered Personal Letter	REF096	Letter sent to [Name] Oosterhof stating general opposition for the development (see attached PDF of letter for detail).	No response given.	Opposed - no specific issue raised			
15.4.20	16.4.20	Email	REF097	"Hi [Name], Could you please delete my registration immediately. I would like a follow up email to make sure this has been done. I DO NOT want any further correspondence from yourself or the developer (EASTCOURT PROPERTY GROUP). I DO NOT want the rezoning to be changed to residential and I want the golf course to be retained. We as a community will fight you and the developers every inch of the way. We do not want our golf course to be taken away from us and instead be replaced by a cheap and nasty housing redevelopment as you have done in Wellard-The Providence, very little public open space and tiny blocks. Jandakot is full of luxury homes and beautiful surroundings and we won't allow this to be cheapened by your development. "	"Hi [Name] Thanks for your email. I have removed you from our registered mailing list as requested. This means you won't receive any newsletters or other communications sent from our database. Kind regards [Name]"	Consultation process			
17.4.20	22.4.21	Email	REF098	Can you please let me know how I am able to withdraw my registration to the 'Have your say Glen Iris Estate' Website?	"Good morning [Name], Thank you for letting us know that you would like your details to be removed from the Have Your Say Glen Iris Estate community engagement platform. I can confirm that this has been done. You are able to re-register your details at any time should you decide you would like to participate in future engagement activities or receive regular updates. Kind regards [Name]a Glen Iris Estate Community Engagement Team"	Consultation opportunities			
18.4.20	22.4.20	Email	REF099	Emailed asking to be removed from the database.	"Good morning [Name] Thank you for letting us know that you would like your details to be removed from the Have Your Say Glen Iris Estate community engagement platform. I can confirm that this has been done. You are able to re-register your details at any time should you decide you would like to participate in future engagement activities or receive regular updates. Kind regards [Name] Glen Iris Estate Community Engagement Team"	Consultation opportunities			
18.4.20		Email	REF100	"Please withdraw my details from this subscription, we are against the development of the golf estate and do not want to engage in this forum "	"Good morning [Name], Thank you for letting us know that you would like your details to be removed from the Have Your Say Glen Iris Estate community engagement platform. I can confirm that this has been done. You are able to re-register your details at any time should you decide you would like to participate in future engagement activities or receive regular updates. Kind regards [Name]a Glen Iris Estate Community Engagement Team"	Consultation opportunities			
19.4.20		Email	REF101	"Hi [Name] As you can see from the attached photos the fence wire next to the gate on Hartwell Parade has been cut to make it easy for people and motor bikes to enter the premises. Today a dirt bike was doing the rounds on the 'golf course' and rode past our side fence. My husband has a short video of the bike. Also yesterday my husband saw three 'larrikins' by the club house and they exited over the fence on Dean Road. His suggestion is to barbwire the fence, otherwise anybody can just jump over it. I presume you wish to be contacted about such things. "	"Good morning [Name], Thank you so much for taking the time to reach out to the Community Engagement Team. I have passed this information and the photos on to the Project Team to ensure it is dealt with as soon as possible. Eastcourt Property Group shares the local community's desire to maintain safety and security in the Glen Iris area. On-site security has been boosted with CCTV, mobile patrols and monitored alarms and the project team is also working with the City of Cockburn's safety and security service CoSafe. If you do notice any future suspicious or anti-social behaviour it would be much appreciated if you could report it immediately to the Police on 131 444 so we can stay on top of these issues. Thanks again. Kind regards [Name]"	Security			
20.4.20	22.4.20	Email	REF102	Complained about salutation in automatically generated email when he signed up for email newsletters	LR advised that the issue arose because he had registered twice with two different email addresses				
22.4.20		Email	REF103	Advised they are pleased with responses from [Name]a Shearman.	Advised pleased to hear the problem has been resolved.				

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22.4.20		Email	REF104	"Good morning [Name]. I hope this email finds you well, this Is a photo taken from my iPad today with the beautiful morning sun radiating through the tall eucalyptus trees! You must admit it's simply breathtaking isn't? And you are mediating for the Eastcourt Group to tear down all these beautiful trees and natural habitat where rare birds have been roosting for years for a profit. Surely you must have a family and a conscience, what right does anyone have really over a few laws and profit. Anyway I was wondering if you could find out who would be responsible for my compensation if this view is destroyed and taken away from me, considering this is where I bought my land [Number] years ago from the Glen Iris golf course developers."	"Good morning [Name] and [Name] Thank you for taking the time to reach out to the Community Engagement team. Eastcourt Property Group was not involved in the original sub-division or sale of land surrounding the golf course, so I am sure you understand they are unable to comment on concerns about the way it was marketed to buyers. While Eastcourt appreciates the concerns of residents, views cannot be protected, and this has always been the case in Western Australia. In consultation with the surrounding community, Eastcourt is hoping to be able to redevelop the land into a quality residential community, by changing land uses and creating public open space parklands with access for all residents that may still allow outlooks in many areas. This is in addition to the increased property security, access to community facilities and better overall walkability and connectivity to the area as a whole. I have of course noted your comments as part of the ongoing feedback we are collecting from community members who get in touch with our project team. Kind regards [Name] "	General opposition	Property values & overall ambience		
24.4.20		Email	REF105	"Please find a copy of a letter received from the Minister. It states clearly that Eastcourt has not yet put in any formal proposal for the land, yet in all the correspondence you send out through letter box drops etc give the assertive impression that this is a done deal, which is very misleading and confusing. Eastcourt like to promote themselves as an ethical company, that is not what is being projected at the moment. You would be aware that this is being less than honest, and for a professional such as yourself to engage in such conduct could lead to all sorts of problems in future actions to come. I would suggest that you word future documents accordingly using only facts, as they stand."		Opposed - accuses Eastcourt of a lack of transparency			
26.4.20		Email	REF106	"Dear Ms. [Name] Late yesterday afternoon, I watched your security guard in his silver Hyundai station wagon chase a 10-year-old girl child with his vehicle. I happened to notice this as I was out [redacted]. While I worked I heard the sound of a child laughing and running around. The sound of laughter suddenly turned to one of screams of terror. This caused me to go to the fence and see the child running and screaming. She was being chased by the vehicle. The security vehicle roared up and came to an abrupt halt about 30 metres from me. I was not the only witness to this event. What a wonderful way your organisation has of ""engaging' with the Glen Iris Community. Most of the people in the Glen Iris Community are bcc'd on this, who in turn, are free to send this on to whomever they may choose."	"Good morning [Name], Thank you for immediately reaching out and letting me know if the situation that has occurred. Eastcourt Property Group shares the community's desire for a safe and secure Glen Iris, and I understand that you would have of course been concerned to witness this. I will take this up with the Project Team first thing in the morning. If you or any other residents who witnessed the event have any further information, I would appreciate additional details. If you know the child in question's family I would also like to make contact with them. Please be assured this will be followed up immediately."	Maintenance of site during planning process			
26.4.21	26.4.21	Email	REF107	" Hi [Name] I've just had another look at my message to you yesterday. I meant to delete the last comment but hit send to soon. Apologies as it is not your responsibility as to what Acumen does - or doesn't do - but would at least like to see their letters dated. "	"Good morning [Name], Thanks for providing feedback on the letterbox drops to residents. Eastcourt Property Group and Acumen see the letterbox drops as an important way of communicating to residents - particularly those people who are not computer savvy or would prefer not to register for the Have Your Say Glen Iris Estate engagement platform, so all feedback is welcome and appreciated. I have passed the comments on to the Project Team for consideration for future letters."	Consultation process			

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28.4.20		Email	REF108	"We are NOT in approval of changing the zoning of the Glen Iris Golf Course land to residential zoning. I have registered on the platform that was set up by the Cockburn City Council even though I know that 'have your say' is just a 'tick the box' procedural process by the Cockburn City Council (CCC) and Eastcourt Property Group. However, we do not intend to provide a statistic that shows that the CCC or Eastcourt Property Group that they have 'engaged with the community', and then do whatever they wish. Please give my husband and myself the time to read our views on the proposed plan by Eastcourt Property Group to apply for rezoning to the CCC and then redevelop of our beloved golf course site as a residential site. No concern has been given regarding how the proposed new development of the golf course will have on our community, and the flora and fauna that have thrived in our corridor of parkland for over the past 60 years. We are long term residents (and golfers) of this estate and are very dismayed at how the CCC have not prepared the residents in any way or manner in which to enlighten us that the golfing facility would cease to exist, once the Glen Iris Golf Course (GIGC) had sold it. We are not talking about the sale of a hotel, an apartment block or a shopping centre in which once the sale is over, the function of the site would continue, albeit with some minimal changes. The GIGC is the heart of our community. We are also very disappointed with the CCC for not sending a Councillor to attend our resident's 'meeting'. Yes, admittedly the meeting was hastily planned because of the sudden notice from the GIGC, that it would cease to exist in two weeks. Also, the announcement by the Prime Minister of the two metre distancing Covid-19 regulation may have been a concern for Councillors, but that was a manageable situation by remaining reasonably separated from people. I must say however, that it was a little unnerving to observe the arrival of two police 'paddy ' wagons and four policemen attend the meeting. One resident mockingly enquired to them, if they were present to 'enforce' the social distancing law . Seriously though, we had children playing about and the police being there, wasn't a good message for anyone. Not Councillor or representative of the CCC was to be seen or volunteered their attendance. It seemed clear to us that councillors who had been elected by us were not interested to hear our views or concerns about the future of our Glen Iris estate. Our local community feels that we had been abandoned by the CCC completely, and that the only concern that interests them is for us as ratepayers to pay our land rates and to conform to Council management of the city, generally. That in itself, says a lot. As said, it was a very disappointing lack of 'engagement' from the CCC all round and the lack of courtesy shown to its ratepayers regarding this upheaval in our community, is deafening."	"Hello [Name] and [Name], Thank you for taking the time to reach out to the Have Your Say Glen Iris Estate team. It is important for the local community and in particular residents adjacent to the golf course site to put forward their views. I am pleased to hear you have registered on the platform as this is where information updates and FAQs are posted, and it will ensure you can participate in all future community consultation activities. I thought I would just clarify that the haveyoursayglenirisestate.com.au platform is independent of the City of Cockburn. It has been established by Acumen Development Solutions who are the Project Managers for the Glen Iris Estate Project. However, it uses the same Engagement HQ software foundation that the majority of Local Government authorities use for their stakeholder and community engagement – including the City of Cockburn. All calls to the Glen Iris Estate Project telephone line and this email address are logged and the views expressed either verbally or in writing are captured, so please be assured that the project team will see your views. I look forward to you both participating in the forthcoming surveys and workshops that will occur to enable the local community to provide more specific feedback. Kind regards, [Name] [Name]"	Opposed - no specific issue raised			
28.4.21	28.4.21	Email	REF109		"Hello [Name], Apologies for the delay in responding. I understand where you're coming from in terms of the security patrols and the fact that you and your children are enjoying the opportunity to kick the footy on the grass at the Glen Iris site – especially during these times of social isolation. As you said it is private property and the owners have a responsibility to keep the area safe and secure and this is posing some challenges. We have people like yourself who at the moment feel families using the area for recreation could be afforded a bit of leeway. Then we have other residents who have been requesting upgraded security since the golf course closed. The project team has installed CCTV, monitored alarms and random patrols to ensure that residents backing on to the golf course feel that everything possible is being done to keep the area secure. You may not be aware that the fences surrounding the land have been cut in several locations for people to gain access and there have been reports of people riding dirt bikes across the grass and other acts of vandalism. Another issue is that not all children who venture onto the site are supervised like your family, and we want to ensure that no one has an accident or gets injured. When the security guards do their job and let people using the site know they are technically trespassing, people like yourself feel personally affronted and unfairly targeted. Please be assured the project team and thee guards are mindful of striking a balance. I have passed on your comments to the Project Manager and we are continuing to try and focus on unruly behaviour and vandalism not families having a kick of the footy. I hope you will participate in the forthcoming community consultation surveys to put forward your views on what will be important to your family if the site is redeveloped. Putting forward ideas about parks and recreational spaces and areas that are family friendly are important. Please let me know if you have any further incidents in relation to the security measures on site. [Name]"	Security			

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29.4.20		Email	REF110	"I wish to register my concerns in relation to an existing 35 metre white gum positioned 14 metres from the rear fence / north end of the driving range at Glen Iris Golf Course – aligned to No 9 and 10 Woodlands Way. Event 1 – 3 April 2020 approximately 8.50 pm a 4 metre branch cracked and fell 8 metres from 10 Woodlands Way back fence. Event 2 – 24 April 2020 at 9.05 pm a 9 metre branch cracked and fell 2 metres from 9 and 10 Woodlands Way back fence Event 3 – 29 April 2020 small to medium fell overnight from upper canopy Please find attached photos of the tree and size of branches. Observation – this tree is about 35 metres high consisting of a large canopy of branches that are having an impact on the three main vertical branches of the tree. With winter approaching and the structural integrity of the tree there is a possibility of the main branch breaking and causing damage to Residence 9 and 10 Woodlands Way. We would like to arrange a site meeting with an Eastcourt personnel to address our concerns. We have lived here for (number) years and have not experienced this issue before. We acknowledge you have inherited this problem but would appreciate your involvement ASAP."		Tree maintenance issues			
29.4.20		Email	REF111	"[redacted] I wish to register my concerns in relation to an existing 35 metre white gum positioned 14 metres from the rear fence / north end of the driving range at Glen Iris Golf Course – aligned to No 9 and 10 Woodlands Way. Event 1 – 3 April 2020 approximately 8.50 pm a 4 metre branch cracked and fell 8 metres from 10 Woodlands Way back fence. Event 2 – 24 April 2020 at 9.05 pm a 9 metre branch cracked and fell 2 metres from 9 and 10 Woodlands Way back fence Event 3 – 29 April 2020 small to medium fell overnight from upper canopy Please find attached photos of the tree and size of branches. Observation – this tree is about 35 metres high consisting of a large canopy of branches that are having an impact on the three main vertical branches of the tree. With winter approaching and the structural integrity of the tree there is a possibility of the main branch breaking and causing damage to Residence 9 and 10 Woodlands Way. We would like to arrange a site meeting with an Eastcourt personnel to address our concerns. We have lived here for [Number] years and have not experienced this issue before. We acknowledge you have inherited this problem but would appreciate your involvement ASAP."		Tree maintenance issues			
30.4.20		Email	REF112	"[redacted] His email references a member of his electorate who has contacted his office expressing her concerns that at some point in the last week or so, a rock on the former golf course has been placed on her back fence, making it easier to scale. She has asked that Wittey get in touch with Eastcourt to see if that rock can be removed. Additionally, she has some concerns around the upkeep of the former course. Whilst she acknowledges that it is no longer a golf course, she is concerned that if things are left to overgrow it may become a fire risk. Wittey requests information about steps being taken to ensure that the fire risk is minimised. "		Security			
30.4.20		Email	REF113	"Contacted [Name], Electorate Officer for Yaz Mubarakai MLA, WA Labor Member for Landakot, expressing her concerns that at some point in the last week or so, a rock on the former golf course has been placed on her back fence, making it easier to scale. She has asked that Wittey get in touch with Eastcourt to see if that rock can be removed. Additionally, she has some concerns around the upkeep of the former course. Whilst she acknowledges that it is no longer a golf course, she is concerned that if things are left to overgrow it may become a fire risk. Wittey requests information about steps being taken to ensure that the fire risk is minimised. "		Security			

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30.4.20		Email	REF114	"Hello [Name] Our office has been contacted by [Name] from [Address] regarding a potential security risk to her property. At some point in the last week or so, a rock on the former golf course has been placed on her back fence, making it easier to scale. She has asked that I get in touch with you to see if that rock can be removed. Additionally, she has some concerns around the upkeep of the former course. Whilst she acknowledges that it is no longer a golf course, she is concerned that if things are left to overgrow it may become a fire risk. Could you please provide me a bit more information about steps you're taking to ensure that the fire risk is minimised? I know that you'll be slashing and maintaining a firebreak, but she'd like to know how regularly. Thank you for keeping myself and the community informed. It's greatly appreciated. "	"Hi [Name], Thanks for making contact. I just checked back through our phone and email records, and unfortunately it appears [Name] hasn't reached out directly to the project team. It's a pity because we can attend to these things immediately when we are alerted to them and I have had a few residents with problems with trees and security who have reached out and we have responded straight away. If [Name] is happy for you to pass on her details, we would be more than happy to call her and put her mind at ease about security and also the maintenance program. I have arranged for [Name] from our Project Team to visit [Name]'s property tomorrow when he is on-site and he will ensure the rock is removed. In relation to security in general, we have got monitored alarms on all buildings, mobile security patrols operating, and CCTV footage has been installed. People can call the information line on 08 6115 6365 and we will definitely make sure we respond to people's concerns or requests. In terms of the maintenance program, the fencing repairs, mowing, slashing and tree pruning will be carried out on a monthly basis. The first maintenance visit is scheduled for mid-May 2020. Having said they, we have had a couple of residents ring with immediate concerns about trees that have branches overhanging their fences and causing problems, and we have had those issues addressed immediately. Thanks [Name]. Please let me know if you would like me to speak to [Name] directly. Regards [Name]"	Site maintenance			
1.5.20	1.5.20	Email	REF115	"I refer to the recent acquisition of the golf course by Acumen. Would you please advise what are the future plans for the use of the land and timeline you will be working towards. I note the reticulation and lawn has started to be removed and before long we will be living amongst a dust field. I, as are other residents, are very concerned about the loss of amenity we are suffering. I purchased here specifically because of the lifestyle and zoning of the Glen Iris Golf Course. I am very concerned about my investment that I believe has been severely affected by the apparent loss of the golf course. "	"Hi [Name], Thank you for reaching out to the Glen Iris community engagement team. The Glen Iris Golf Course was closed by the previous owners in March this year after a steady decline in the number of people using the course meant the golf business was no longer viable. The owners actually took a decision some years ago to sell their land and Eastcourt Property Group was recently offered the opportunity to buy it. Settlement occurred on 6 April 2020. Eastcourt hopes to redevelop the site into a boutique residential estate, but at this stage they have no specific plan drawn up and they don't have any approvals to redevelop. The next step is for the project team to engage with local residents – in particular those who live adjacent to the land – and start to discuss that might be possible. An engagement platform has been set up to help facilitate surveys and other consultation including workshops. If you haven't visited the haveyoursaygleniriseestate.com.au it is worth taking a look as it outlines the process Eastcourt will need to go through to seek approval to develop on the site. At this stage there is no set timeline and Eastcourt wants to spend some time talking to the local community before it starts to design up a plan of what the development might look like, so it is likely to take many months before a concrete timeline is known. Having said the future is unknown at this stage, one thing I can confirm is that it will no longer operate as a golf course. As you may be aware, maintaining fairways and greens takes a huge volume of groundwater. Since the site will no longer operate as a golf course, the irrigation is no longer running and is being decommissioned. Throughout the planning stage, the project team will undertake regular maintenance of the site with the mowing and slashing of grass, installing firebreaks and fencing repairs as required. The first maintenance visit is due to take place in mid-May. [Name], please let me know if you have any more queries at this stage. I hope you will participate in the future surveys and workshops to ensure you make your views known and can have a say in the development plans. [Name] "	Property values			

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4.5.20		Email	REF116	Wanted to know if Eastcourt was interested in buying her property for use as a site office	"Response from [Name]. We appreciate your confidential email below, and I thank you for your time on the phone this afternoon. I appreciate the position you are currently facing with your home is a bit uncertain, but hope that the consultation process and resulting plans will help to provide a bit more clarity over the next 6-9 months. We are committed to a high quality outcome for the re-development of the former golf course and want it to reflect the unique location of Glen Iris. I can provide my word that your registration and participation in our consultation is not simply a "tick" for redevelopment, we genuinely want to understand the full range of views across the community. We have over 120 residents already registered and our first community survey will be commencing before the end of May. UPDATE FROM JARROD 5.5.20 Hi Team I have spoken to [Name]a [Name]rey (nee Parnell) following our discussion earlier today. She is an articulate and friendly young lady who has a young family and has been considering selling their home to upgrade, as their family grows. They are not really golfers, but bought there more for the quality of the estate and the surroundings and really liked the leafy outlook. She appreciates that COVID-19 means it isn't a good time to be thinking about selling, and that the course closure has added more uncertainty to this. She appreciates that the course closure was a result of decline in people playing golf, and herself told me she believes there is a real opportunity in the market for a development of larger lots for family sized homes. She doesn't think 300sqm lots are a good thing for the area, and I said our vision for some larger lots and high quality housing is aligned to her views. I told her we aren't likely to be buying individual homes, and that getting through the engagement and planning process will be the best way to provide certainty for all residents in Glen Iris. She seemed to understood how a high quality development outcome would be the best way forward. She asked a lot about when we will have plans, etc and I said we are just at the start of 6-9 months of consultation with the community to gain an understanding and to build the layers of information needed to prepare a plan for the future development. I re-iterated we are not rushing the process and we want genuine consultation with the community. She seems to appreciate this and wanted to know when the workshops, etc will start. I confirmed a survey would be open before the end of May as a starting point to understand as many thoughts of the residents to inform the next level of detailed discussions. She said, she (like many residents) are very confused because the activists (her words not mine) are telling everyone if they register for our consultation then that is a tick for the development. I made it very clear that was definitely not the case and suggested she can check that with City of Cockburn planning team or even with local State politician Yaz Mubarakai, if she wanted an independent point on this. When I asked if she was registered, she said she was initially, and then subsequently asked to be removed because of the Residents Assoc advice. I encouraged her to re-register because we want to hear from as many as we can in the community, and a range of views on lots of topics will be essential for good outcomes. (Be interesting to see if she does that in the coming day or so.) I offered her the chance to pick the phone up and call me whenever she feels like we aren't providing enough information, or she has an issue she would like to talk about. No need for a further face-to-face meeting at this stage. Regards [Name]"	Property values			

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6.5.20	6.5.20	Email	REF117	Further to my email on March 10th regarding the danger of the trees out the back of at least 4 properties. As the storm raged last night another big limb came down and as you can see from the view above our patio the huge gums are overhanging our house. With nothing being done as to your redevelopment in the immediate future can you please make note of our concerns for insurance reasons should our house be subject to one of these trees falling on it.	"I have just hung up from having a good chat [redacted]. [Name] is organising for the tree loppers who are going to be on site on Friday to attend Mr and Mrs [Name]son's property and when I advised her of this, [redacted] said how grateful she is. She wanted to let the Project Team know that they understand the site needs to be developed and they are very keen for the opportunity to be involved in the consultation process moving forward. She said 'we are not interested in the groups and carry-on' and advised that there are many people like themselves who have been disgusted in the way in which the former owners have let the site ""go to wrack and ruin"" and also the lack of support they have had up until now on the issue of the trees. They are looking forward to 'progress'. [redacted] said they are so frightened that one of the trees on the fence line will come crashing down and that last year - after inaction from the owners - they hired a chainsaw to deal with the worst of the branches themselves. I just thought it was worth passing on the above as she was lovely to speak to and genuinely grateful that the new owners 'care about the neighbouring residents"". She could be a good ally in the future. [Name] - [redacted] said her husband [Name] will be home on Friday and if at all possible, they want the dangerous trees lopped down instead of just being pruned. She also said the major offending tree is HUGE. I explained that depending on the situation it may or may not be able to be dealt with on Friday, but it will most certainly be looked at when the tree loppers are there. Hello again [Name], I have Metro Tree loppers coming out on site this Friday 8 May and have added the trees that back on to your property to the list of those trees that need to be pruned. If you have any specific requirements other than general pruning to ensure overhanging branches etc are removed, please let me know. You also mentioned in your email that at least four properties are impacted by the trees – if any of your neighbours want to provide specific feedback on areas for attention, please ask them to send me an email and I will make sure this is all covered off on Friday. If you wish to speak to someone in person regarding this, please call [Name]a from the Glen Iris Community Engagement Team on 0418 140 220 as she is working with the Project Manager on this particular issue and would be happy to chat to you directly. Kind regards [Name]."	Tree maintenance issues			
7.5.20		Email	REF118	"Good afternoon My [redacted] gave me your details. The storm from Tuesday has caused the tree to drop several branches and we are concerned with the overhead branches which if not pruned may fall during the next storm and damage our property. Can you confirm what time you will be here on Friday so I can make myself available if required."		Tree maintenance issues			
8.5.20		Email	REF119	"Just a note to thank you very much for attending to our tree concerns. It was exactly what we were hoping would be done and want to thank you again . Please thank [Name] also. "		Happy. Issue resolved.			
11.5.20	11.5.20	Email	REF120	We are advising that a part of the fence bordering the former Glen Iris Golf Course and The Fairway in the Fairway Estate, Jandakot was blown over during last week's storm and is enabling easy access to the golf course. Could you please arrange for repair of the fence.	"Hello [Name] and [Name], Thank you so much for letting us know. We had some contractors out onsite last Friday fixing storm damage, but I haven't had a report on this issue. I will let the Project Team know and get someone on to this ASAP. Kind regards"	Fence maintenance issues			
14.5.20	14.5.20	Email	REF121	"Hi [Name] I have left you a message on your phone regarding the security fence. The fence in question is between 20 and 22 Glen Iris Drive it has already been reported to you by the owner [redacted] No [redacted] I live in No [redacted]. As you can see attached photos it is in much need of repair. The fence at the resturant carpark which was damaged has been fixed. Somehow this has been forgotten? Could you please advise me, when this will be done, as it is not just a eyesore but for security. I had intruders last night, which was quite distressing, 2 males with torchlights on the now, wasteland, I need also the name and number to contact when this situation arises, in the past it was [Name] the owner of the golf course, and a security guard was sent out, and the police was informed. "	"Hi Mrs, [Name]a from our Glen Iris Engagement team has just given you a call and also left a text message for you. If you could please call her on 0418 140 220 that would be great. Thank you so much."	Fence maintenance issues			
19.5.20	19.5.20	Email	REF122	"I hope you are well. We live on the Glen Iris Estate and are very interested in what is going to happen with the area. It's been a couple of months now since the new owners have taken over and I was wondering what sort of timescale they are looking at to redevelop the area and when we are likely to see some plans for the area. We are currently looking for a new block of land to build our final home - down sizing - and we were hoping to stay in the area. We see this redevelopment as a possible good opportunity for us but obviously it depends on what sort of time sales you are looking at and what sort of housing/land sizes/packages might be available. Can you give us any idea when we are likely to get more information on this?"	"Hello [Name], Thanks for reaching out to the Glen Iris Engagement team. The formal community engagement is about to commence with a survey that will go out to all residents. You can either Register on the HaveYourSayGlenIrisEstate.com.au platform or we will be putting a hard copy of the survey into the letterboxes of all homes surrounding the site. The survey will be followed by some workshops on specific topics such as traffic, parks, access, homes etc and once the project team has a good understanding of what the local residents aspire to they will produce a design concept. If you have ideas for the sort of lot sizes and amenities you would be keen to see in the next estate, ensure that you participate in the survey as the team wants to hear is many ideas as possible. We will also be providing updates on the site as we move forward. Feel free to reach out at any time if you need more information."	Possible sales opportunity			

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19.5.20		Email	REF123	We have registered and are looking forward to seeing what ideas are put forward. We just wondered about a rough timeline for lots to likely become available? Are we looking at a couple of years or longer? Also, will current residents get preferential treatment on the lots? i.e. - first pick/discount?		Possible sales opportunity			
21.5.20	21.5.20	Email	REF124	I live in [redacted] , we have noticed Motor Vehicles driving on the Fairway up to club house approx. 10.30-11.00 PM, do you have security vehicles operating during this time please ???	"Hello [Name], Thank you so much for reaching out to the Community Engagement team. We share the community's desire for a safe and secure Glen Iris We do have random mobile patrols attending the site, but I will check in with the Project Team to see if I can pin-point if the timing. I will come back to you."	Security			
24.5.20		Email	REF125	Responded to email reaching out to discuss the community enagagement process. Advised he is an activist and continue to be writing to the client to keep them informed of community objections. Informed the article on the Golf Course closing its doors is inaccurate and deceptive, used as a means to demonstrate viability for the change of its use and is considered fake news amongst the community. Mentioned he is "saddened that a fellow project manager is involved in the potential social, environmental and ecology destruction that will entail."	[Name] has attempted to make contact on three occassions. Also texted to advise that the Community Survey went live.	Opposed - no specific issue raised	Innacurate information being used		
25.5.20		Email	REF126	Asked when the Community Survey portal will go live. Showed concern for terms and conditions on the website around the content which will be published and the privacy statements.	Advised residents will be notified of survey release and letterbox delivery of printed surveys. Informed website disclaimers are standard wordings that are embedded into licenced website. The platform is also used by City of Cockburn and other Local Government Authorities across Australia. Stated that privary and security of information is taken very seriously.	Consultation opportunities	Website terms and conditions, content publishing and privacy statements		
25.5.20		Telephone	REF127	Anonymous phone call received on Information Line stating 'mobs of children' were congregating under the area between 16th and 17th under Twin Waters Pass and tormenting Black Cockatoos. Caller advised Project Team to have a CCTV camera installed to deter this behaviour	Unable to provide a response to anonymous caller.	Security	Potential misbehaviour occuring on site		
25.5.20		Telephone	REF128	Stated his [redacted] had resigned and another three members left club due to difficulty in finding a good quality course that's not too far from Glen Iris and isn't experiencing a high volume of bookings. Explained [redacted] had a meeting, deciding they didn't want to play there anymore. Mentioned he has funding from the City of Cockburn for the Club's 60 year celebration that may need to be repaid. Additionally advised of vandalism happening on site and that he [redacted].	Stated that we are likely unable to take any action on assisting with the Marri Park players.	Security	Potential misbehaviour occuring on site		
25.5.20		Telephone	REF129	Reported a large whitegum tree that has uprooted at the back of her property. Tree is resting on another tree, however she has concerns for it falling and fitting the fence and entering her backyard.	Advised organising someone to attend and inspect.	Tree maintenance issues	Unsafe tree behind property		Respond re: Class A reserve
26.5.20		Telephone	REF130	Wanted to discuss relocation of the Koi Fish which are in one of the lakes on the former golf course land.	Explained relocation plan to [Name].	Fauna & flora			
26.5.20		Email	REF131	"Hi [Name] As a passionate animal lover and supporter of many wildlife rescues I am concerned about all of the wildlife that call the golf course their home, but at this stage and the purpose of this email is the large Koi fish that live in the front pond at the entrance to the golf course and country club. They have obviously been dumped in there in the past and have managed to somehow survive, however now that the ponds/lakes are going to dry up once winter is over I thought approaching the Koi Fish Society to enquire about the possible rescue and rehoming of them would be the humane thing to do. Having spoken with you in the past I gained the impression Eastcourt intends to do what is ethical and right in regards to the animals and their relocation if needed. After contacting The Koi Society of WA yesterday, it seems this is possible however they will need the permission of the current owners, namely Eastcourt and they have asked if they can have a contact name and phone number to liaise with in order to organise their retrieval from the pond."	Explained relocation plan to [Name].	Fauna & flora			
28.5.20		Telephone	REF132	Explained the community's dissatisfaction with the development project. Additionally requested his responses to survey 1 to be printed before submission via the engagement HQ portal.	Advised [Name] at ADS following up with answers on 29-5-2020	Opposed - no specific issue raised			

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30.5.20	31.5.20	Email	REF133	"Dear [Name], I have reviewed the questionnaire and it is obvious that there is no opportunity to lodged our objections to any development, nor is there any reference to retaining the Golf Course. This is a heavily biased questionnaire! This is a one-sided tactic to filter out objections and showcase the developers plans to Council as community accepted. There is little or no support for any change of use. Glen Iris Golf Course Estate is the reason why the community built or purchased here. Any redevelopment will be seen as social, ecology and environmental vandalism. I and others will be alerting State, Local Government, and the industry that this is a biased questionnaire and does not enable the residents to voice their true objections with regard to retaining the golf course. Finally, your email header should say -have your say Glen Iris "Golf Course" Estate. You may have overlooked the entrance to the estate which has a sign stating Glen Iris "Golf Course" Estate."	"Good morning [Name] Thanks for sending your feedback on the survey through. The project team understands that some members of the community are disappointed the Glen Iris Golf Course is no longer operating. However, the former owners had experienced a steady decline in the number of people using the course and the golf business was no longer viable. Reduced revenue led to a lack of preventative maintenance and almost all of the infrastructure, including the irrigation system and the machinery was well beyond its design life. The owners took a decision some years ago to sell their land and Eastcourt Property Group was recently offered the opportunity to buy it. They propose to create a new residential community on the site. The land is zoned Urban under the State Government Metropolitan Regional Scheme. Any proposal to change the zoning must go through a formal process involving community engagement and applications for Local and State Government approval. The survey that has just been released is the first in a series surveys, workshops and discussion that will take place over the coming months. It is being managed by independent market research company, Metrix Consulting. It is designed to help the project team understand the existing Glen Iris community and what elements should be included in the new residential estate. The project team respects the right of local residents to express their views to the City of Cockburn and the State Government about the proposal to create a new residential at the site. All comments and feedback received about the proposed development whether they are positive or negative are recorded on our Community Engagement Register. I hope my response clarifies the direction of the project and the purpose of the first survey. Yours sincerely [Name] "	Opposed - accuses Eastcourt of a lack of transparency			

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31.5.20		Email	REF134	"Good morning [Name], Thanks for sending your feedback on the survey through. The project team understands that some members of the community are disappointed the Glen Iris Golf Course is no longer operating. Your statement is not based on fact. The majority of the community are disappointed. This is proven in change.org where over 2000 people from the community reject any infill development. However, the former owners had experienced a steady decline in the number of people using the course and the golf business was no longer viable. Your statement is not based on fact. There was no significant decline in patrons from my observations and those of the community whilst sitting in our backyards overlooking the golf course. It is wildly accepted through observations by the community that the former owners slowly neglected the facilities as a way of falsely claiming a decline. Reduced revenue led to a lack of preventative maintenance and almost all of the infrastructure, including the irrigation system and the machinery was well beyond its design life. Your statement is not based on fact or reasonableness. As a Project Director delivering services in the operations and maintenance sector for a major university project, where I am developing the budgets for planned preventative maintenance operations and lifecycle elements over a 33 year concession, your statement is a nonsense. A well maintained and lifecycled infrastructure is achievable through careful budget management. This is something they could have easily implemented but instead chose to spend the revenue elsewhere. The owners took a decision some years ago to sell their land and Eastcourt Property Group was recently offered the opportunity to buy it. Noted. They propose to create a new residential community on the site. As stated before, and as clearly demonstrated, this is not welcomed by the majority of the community. Refer to change.org. The land is zoned Urban under the State Government Metropolitan Regional Scheme. It is zoned Special Use 1 and Residential R40 under the City of Cockburn Town Planning Scheme Noted. Any proposal to change the zoning must go through a formal process involving community engagement and applications for Local and State Government approval. Noted. The community will be fighting any change to zoning. The survey that has just been released is the first in a series surveys, workshops and discussion that will take place over the coming months. It is being managed by independent market research company, Metrix Consulting. I doubt they are independent. They are paid for by the developer, and therefore their terms of refence and deliverables are defined by the developer. It is designed to help the project team understand the existing Glen Iris community and what elements should be included in the new residential estate. The only elements that need to be considered are the reinstatement of the golf course, restaurant and bar. Also, remember, the correct name for the estate is Glen Iris Golf Course Estate. The project team respects the right of local residents to express their views to the City of Cockburn and the State Government about the proposal to create a new residential at the site. Noted. And we will continue. All comments and feedback received about the proposed development whether they are positive or negative are recorded on our Community Engagement Register. We request that this register is circulated to the community. I hope my response clarifies the direction of the project and the purpose of the first survey. The survey appears to be nothing more than a "smoke and mirrors" exercise to generate a flimsily consensus that the community are in agreement. This is evident through the use of numbering each postal survey so that responses can be filtered. Also, we are planning our own survey across the local community and will present our findings to Council and the State. Finally, it is disappointing that the developers team are promoting these inaccuracies as fact. This will be flagged to Council and the State. "	Second of two similar communications. Decision is no response from us. Characterised as vexatious.	Opposed - accuses Eastcourt of a lack of transparency			
3.6.20		Email	REF135	Thanks for sending your feedback on the survey through.	"Hello [Name], I have checked with Engagement HQ and you can go back and edit the survey as many times as you like up until the point you press submit, Unfortunately, there is no print function at the submitter's end. However, I can offer two solutions: Once your survey has been submitted, I can arrange to have a copy run-off and posted to you. Or I can forward you an electronic copy of your survey submission once the HQ engagement platform has received and recorded your submission. Let me know what is best for you and I will organise for you."				

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5.6.20	10.6.20	Email	REF136	"Good afternoon [Name], I am a resident of Glen Iris landakot at [Address]. I am aware of the recent sale of the Glen Iris Golf Course and also that an arborist went through the property to look at the trees. I have 2 questions regarding this if you could help me at all. Also to assist in my requests, I have attached a picture with the areas circled. There are very large tall tree at the end of [redacted] which tower over my house and the other houses along the walkway there. The trees are very large considering how close they are to my house and others. They often drop a lot of branches and debris. In the recent storms, a branch hit the east side of my house and which left some damaged to my upper story. No major damage but this is an ongoing concern. I, along with others along this strip would not be opposed to the removal of these trees. What was the arborist view on these trees? Circled in red in picture attached. Can I view anywhere the current plans of the site? The land at the start of [redacted] is what is of interest to me. Circled in black in picture attached. Thank you for your time."	"Hello [Name], Thanks for reaching out to the Glen Iris team. Our Project Director, [Name] Rendall, would like to have a chat to you and arrange to come and look at the trees. Would you mind sending through your mobile number for me to pass on to [Name]?"	Tree maintenance issues			
8.6.20		Email	REF137	Advised of hazardous fence line along Prinsep Road side of golf course.	Confirmed Project Team is addressing the issue with fencing contractors and work will be undertaken in a couple of weeks.	Maintenance of site during planning process			
12.6.20		Telephone	REF138	Originally opposed to redevelopment, but beginning to support development - wants to sell her home and buy a more affordable block in the new community. Insisting on an old-fashioned sit down meeting with community to discuss a range of matters be done ASAP to stop destructive influence in the community.	Looking to consider a meeting moving forward.	Opposed - no specific issue raised	Quality development		
15.6.20	15.6.20	Voicemail	REF139	Emailed looking to see if Eastcourt would be interested in buying her property for use as a site office.	"Thanks for the chat last week. I have spoken to the Project Manager for the proposed development at Glen Iris, and as anticipated he said that they don't anticipate purchasing any properties. Always worth asking the question though. If you haven't already, I'd encourage you to register on our engagement platform here - https://www.haveyoursayglenirisestate.com.au/ - that is the best way to keep up to date with the project. If you don't want to register, it's still worth having a look at the website from time to time, as we will be regularly uploading more information as it becomes available. "				
16.6.20	16.6.20	Email	REF140	Couldn't log on to survey. Wanted a soft copy to be emailed.	Emailed a PDF copy of the survey by LR (16.6.20)	Consultation opportunities			
20.6.20	23.6.20	Email	REF141	"Hi [Name] Its been a while since I last wrote and just wanted to ask you something which I hope you would be so kind as to send onto Eastcourt. I appreciate and understand people own businesses and are keen for these to be a success, what I am perplexed about is at what cost? Eastcourt's plans for the Glen Iris estate has devastated the community, they are opposed 100% to any plans to change the golf course, are Eastcourt aware of the upset that the residents are experiencing? What I have just said above is no exaggeration, there are a large number of people who are greatly stressed by this prospect, they had built homes to retire in facing and utilising a golf course. I personally could not live with myself if my business decisions would affect so many people in such a negative way. If the plan goes ahead and once Eastcourt move onto the next development do they have no conscious as to what they will have left behind? Surely they have a heart and it is not all about money? I am just one person who lives on the estate but I know that my view is the same throughout the estate and also the wider community. Again, if Eastcourt proceed with their plans to change the estate, decimate wildlife, and take away an amenity of the community's do they not give that impact a second thought? I just wanted to share my thoughts and hope you will pass them on. [Name]"	"Hi [Name] Thank you for your email, which I will pass on to Eastcourt as requested. Whilst we understand that the proposed rezoning of the site has caused some concern within the community, the sad reality is that the golf course was not financially viable. That is why the previous owners were unable to find a purchaser willing to maintain the site as a golf course; they even approached City of Cockburn in 2017 to offer Council the opportunity to purchase the business, but a council feasibility assessment concluded it was not an economically viable proposition for them either. Unfortunately this is the economic reality of the situation. Given this reality, there now exists the opportunity for the community to help shape a new residential community that reflects the standards and quality of the existing Glen Iris Estate. That is why Eastcourt is engaging with the community so early in the design process. By understanding community views on lot sizes, parks and public open spaces, landscaping and vegetation, house designs etc, we can ensure the new residential community maintains and reflects the qualities and standards that are important to existing residents. Our recent survey was the first step in this engagement process and we are looking forward to sharing the outcomes of the survey with the community in the coming weeks. The survey marks the start of what we hope will be a constructive and respectful engagement process with the community, and I would encourage you to continue to share your views and ideas with the project team."	Property values			
22.6.20	22.6.20	Survey	REF142	Left comment on hard copy survey that there is a large tree with limbs overhanging his property that he believes to be unsafe - would like tree/limbs removing.	Advised that we have sent tree loppers to address similar situations and will arrange for the tree to be inspected and made safe.	Opposed - no specific issue raised			
22.6.20	23.6.20	Email	REF143	"[Name] - as per chat on the phone, attached are the photos of the gum tree very close to our house - i.e. on the golf course behind our house at [Address]. Large branches from this tree hang over our house which has been a constant safety concern, but to be frank, the whole tree is a safety concern, particularly in bad weather when branches drop. There are a number of other large gum trees very nearby but further away from the house, I have also circled the tree on an overhead picture taken from Google Maps if that helps. Let me know if you need us to tie a ribbon on the tree or anything else to help in identification. "	"Hi [Name] Thanks for sending these through. I've passed them onto the Project Manager – I've flagged this to him already, and he said he is working on a number of tree inspections, and should have a date / time organised in the coming days. It should be pretty obvious to the tree guys which tree you are referring to – it's big! I'll try to give you a heads up when the inspection/work will be done."	Opposed - no specific issue raised			

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17.8.20	17.8.20	Email	REF144	"My name is [Name] I live at the above address with my wife [Name]. We own our property and have lived on the estate for the past [Number] years. [redacted] with a view to the second tee box. Of late the trees have sprouted to a height well above the roof and causing undue problems with Debris landing especially on the roof. On Saturday I climbed onto the roof to remove the tree branches, twigs and gum leaves that had accumulated over the past two months. Bearing in mind this is the third time this year I have had to do this and at [age] years I am getting too old and shaky when on the roof to continue doing this. I will get to the point, the amount of debris on the roof was shocking and I filled 3 buckets that had mainly accumulated between my patio roof where it joins the main house roof. Had this been summer time I had enough fuel to set my house alight. Coupled with this, the trees causing the debris are too close to my property and with the long unkempt grass will be a very serious fire hazard. should, during the summer, this catch alight my house will most definitely catch fire and burn to the ground rather quickly. My wife is partially disabled and does not move too quickly and God forbid if the house did catch fire I doubt if she would get out on time. I want to address this problem now rather than wait until summer when it may be too late. Also my house and house content insurance is up for renewal in September and I have to let them know of the potential fire hazard and have it recorded that I have addressed the problem and not wait until something dreadful should happen. I would really appreciate if a representative from Eastcourt/ Acumen visit the house and trees in question and do a "Risk Assessment" on how high this potential fire hazard is and the likelihood my house being damaged by fire from the golf course. If it is deemed low risk then I can pass these findings on to my insurance company and the matter will be closed. I have attached photos and you will see just how close the trees are and the potential fuel load to my house. "	"Hi [Name] Thanks for getting in touch – I am the right person, so that's a good start! We have had some tree surgeons on site at various times since Eastcourt took ownership of the land; they have lopped branches off trees at the request of property owners where the branches have been overhanging people's properties and causing safety concerns for the residents. I will pass on your email to the project manager who has been coordinating the tree loppers. He will let me know when they are next likely to be on site, and can take a look at the trees you are concerned about. We are also maintaining fire breaks around the perimeter of the site, so I will flag your concerns about your particular location as well so that it can be checked. I'll come back to you once I have more information from the project manager. Thanks [Name] Kind regards [Name] Hi [Name] I've just spoken to the project manager and he said the tree loppers are back on site in a few weeks – he will add your address to their list of areas for them to check out, and if there are branches overhanging your property they will trim them back. Kind regards [Name]"	Tree maintenance issues			
11.8.20	13.8.20	Email	REF145	"Dear [Name] and [Name], Since my last email dated the 31st May, which I note you have failed to respond to (its only 10 weeks ago.....), I thought it would be prudent to reinforce not just mine, but the majority of the communities ongoing lack of support to your folly. It is obviously there is no intention to participate in any two-way communication with the community. This is demonstrated by your lack of responses to emails and letters, and failing to provide any responses to the inexplicably biased survey. I will be writing again soon, but like the rest of the community, we are stopped in our tracks, aghast, shocked, and disappointed with recent draining of the lakes which has impacted the community, wildlife, and environment. This careless action, which was undertaken without consultation with the community, has reinforced the communities resolve against your development plans. When I say community, this is also includes Children and Teenagers who are very upset with the ongoing environmental vandalism and general lack of care for the land. This will be engrained in their minds for a long time. As stated before, it is apparent that both Acumen and Eastcourt Property Group lacks any empathy or care towards the community. Instead, it is evident the development is driven by profit only. Yet again, I will be writing to Council and State Minsters to highlight the above."	"Dear [Name] Thank you for your follow-up email. The project team have read your emails as feedback rather than questions that required a response. Having re-read it, I noticed that there was a question in there which I had missed – this related to a request for us to publicly share the register of feedback from the community. We will be sharing the outcome of the survey in a few weeks' time, via a newsletter that will be distributed to every household in the suburb of Jandakot. The contact register is more to do with interactions with individual property owners relating to issues, such as trees overhanging their property. Information about the draining of the lakes was posted on the Have Your Say Glen Iris Estate website on 4 August – click here to view the information https://www.haveyoursay-glenirisestate.com.au/latest-news/news_feed/lake-management In relation to the draining of the lakes, we are proactively managing this process now that the lakes are not being replenished via bores pumping groundwater into the lakes. By taking a proactive approach, we have been able to work with specialist fauna consultants to capture and relocate koi fish and long necked turtles before the lakes dry out in the summer. As the owners of the land, Eastcourt, through their project management team at Acumen, will continue to proactively manage the site. To date, this has included responding to resident requests to inspect and where appropriate lop tree branches overhanging properties to make them safe; working with City of Cockburn staff to address resident concerns about mosquitoes; and ensuring fire breaks are maintained. Our engagement with the community is focused around seeking their feedback about vision for a new residential community within Glen Iris, rather than management and maintenance of the privately owned site pending any future development. For that, we rely on the expert advice of our environmental consultants, and input from staff at the City of Cockburn in relation to our obligations as land owners. Kind regards [Name]"	General opposition	Environment		

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17.8.20	20.8.20	Email	REF146	"Dear [Name], Thank you for your response. As a professional Community Engagement Manager, you must be familiar with the basics of community communication, ie it is a proactive two-way process based on mutual trust and respect. Its not about hiding behind a websites and providing political spin statements. So that the community can understand more of your clients unsupported objectives, I have listed below a number of questions raised by the community, which I would appreciate your response on. Who are you speaking with in Government to support the change to the zoning? What consultants are you using to get the zoning changed? How are you going to change the golf course without the zoning being changed, and how is this going to be achieved? Why are you not responding the communities wishes for the golf course and pub/ restaurant to be reinstated? The "Have Your Say Glen Iris Estate website" should not be used as the only point of communication as its one-way only. How will you improve this so residents who are not tech minded receive information. You have previously stated that the City of Cockburn was given the opportunity to buy the land and they did a very thorough feasibility that showed it was not viable. The City of Cockburn says they do not have a feasibility nor any reference to one. Who is telling the truth? Who is your fauna relocation specialist? Who is your environmental consultant? You have stated Acumen Development Solutions have provided regular updates to City of Cockburn on these activities. Why has this transparent approach not occurred with the community? What are your traffic management proposals? Now that the golf course has been reduced to a desolate waste ground, this has effectively reduced the value of properties on the golf course estate. What compensation will the developer provide to owners and what is the timing? Finally, I would like to reemphasize mine and the communities lack of support for any infill redevelopment. "	"Dear [Name] Thank you for your email. As an owner of private land, Eastcourt (through its project management consultants Acumen Development Solutions) is currently undertaking voluntary consultation and engagement with the Glen Iris community well ahead of finalising any applications to rezone or lodging plans for development of the former Glen Iris Golf Course. We are not obliged to do any of this at this stage, but have elected to, so the community can have some early input into the development outcomes. In time, and only after community consultation, applications will be made by Eastcourt to City of Cockburn and the Western Australian Planning Commission in line with the Metropolitan Region Scheme, for rezoning and approvals to facilitate the development of a high quality residential development. This will all be done within the WA planning framework. I have attached an infographic which is available at Have Your Say Glen Iris Estate website that outlines the process we are working through. You will see from this infographic that the regulatory framework includes a requirement for City of Cockburn to publicly advertise Eastcourt's rezoning application for an amendment to the TPS, and invite public comment. Eastcourt has made the decision to go above and beyond this statutory requirement, opting to proactively engage with local residents who want to be part of the process to help shape the vision for the new community within Glen Iris. A 12 page newsletter will be in the letterboxes of every household within Jandakot tomorrow, detailing the findings of the community survey, providing further information about the project, and the opportunity for residents to nominate for the upcoming workshops. Kind regards [Name]"	General opposition			
21.8.20	21.8.20	Telephone	REF147	"- Disappointed and angry that we are taking a 'divide and conquer' approach with 3 precinct reference groups Response – each group will look at big picture plus location specific issues they choose to focus on; this is not the end of the engagement, there will be further opportunities for the whole community to provide input; - 'I am going to keep the very pretty crap you have put in my letterbox because I guarantee you in 5 years' time the new development will look nothing like that' - Developers will say anything now to get this over the line, but once rezoning is approved every tree will go and density will increase - No point objecting as Minister will sign it off anyway - What's the Plan B if it doesn't get rezoned? - Local Member is not returning my calls, refuses to discuss it - I'm far less angry than a lot of people I've spoken to - Someone at Eascourt suggested I look at Providence – I did and that really worried me - People are angrier about this than they were about Roe 8 - it's just there are less of us Says he will nominate for PRG as he is a realist and if it is going to be developed he would like input"	In blue as indicated + offered to set up a meeting between Mr [Name] and [Name]/ [Name].	General opposition	Consultation process		[Name] to call and arrange meeting.
21.8.20	26.8.20	Telephone	REF148	Voicemail - Querying boundaries for Precinct Reference Groups – wants to nominate but wants to make sure she is free on the right dates	LR suggested she look at boundary maps on haveyoursayglenirisestate.com.au or call me back and I can help	Consultation process			
21.8.20	7.9.20	Email	REF149	"Hi [Name], I have just finished reading your beautiful glossy Community Newsletter very impressive just what anyone does when trying to sell an unwanted idea. I may have missed something but aren't you jumping the gun as far as I am aware no applications to rezone have gone to the Cockburn Council or the Government or is it as many expect a back room deal has already been done and the Glen Iris residents will have to suck it up. "	"Hi [Name] Thank you for your email and the feedback you have provided which has been shared with the project team. You are correct that no development application for rezoning the land has yet been submitted to the City of Cockburn. The new owners of the site have chosen to engage with local residents so they can contribute to the development of the vision for the proposed residential community, instead of simply creating and submitting a plan. This engagement process is above and beyond what is required from a regulatory perspective. I have attached an infographic which explains the process the project team is currently working through. Kind regards, [Name]"	General opposition			

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21.8.20	7.9.20	Email	REF150	"Dear [Name], Good afternoon. Thank you for your email. As I expressed in my response to the Glen Iris golf course survey you, I strongly indicated that I did not recommend the development to proceed and that the golf course be retained due to many issues. Thus I shall not be participating as I sincerely believe the project will not proceed given the current economic conditions, local and state government support for status quo and associated views. If the development somehow proceeds I shall still be seeking financial compensation from the developers. "	"Dear [Name] Thank you for your email. Your feedback has been noted and shared with the project team. Kind regards, [Name]"	General opposition			
22.8.20	7.9.20	Email	REF151	"Hi [Name]. The newsletter that was sent out was bias and totally misleading! There would be not one resident whether they lived on the courses or not that would of thought that destroying a functioning golf course was the way forward. Secondly there was no clause stating that you had to play at the course to live and purchase property from the previous developers. Thirdly the course was originally developed in 1995, and in 25 years the course was thriving, how do I know? I worked [redacted] for years managing golf courses, just like Glen Iris. As you are aware the course is in a high density area and would thrive had the previous owner cared. All golf courses need maintenance and a budget. I've lived on the course for [Number] years and I have never once seen one promotion from the golf course to increase members/ players. They simply have been winding down trade to walk away with their pockets full. This situation will obviously end up in court and the decision to develop the course reversed. Just wait and see. You cannot simply expect everyone to walk away peacefully in this current world climate. Regards, [Name]."	"Hi [Name] Thank you for your email and feedback about the newsletter, which has been shared with the project team and documented. Whilst we acknowledge your comments, the manner in which the previous owners of the land chose to run their golf course business was a matter for them and not something that we are able to comment on. Kind regards, [Name] "	General opposition			
22.8.20	7.9.20	Email	REF152	"Morning [Name], Thank you for the invite to the Precinct Reference Group but I will have to decline due to the fact I believe the community has spoken and would like the Cockburn City Council to step up and allow the Golf Course to remain. Also I have noticed since the lake at the entrance to Glen Iris Golf Course Estate was emptied the excavator has left a mess, can this please be rectified by Eastcourt? "	"Hi [Name] Thanks for your email, which I have forwarded on to the project manager. He will take a look at the entrance next week. Kind regards, [Name]"	General opposition	Site maintenance.		
23.8.20	28.8.20	Email	REF153	"Dear [Name], Thank you for your response (LR email 20.8.20) Firstly, the community is extremely disappointed that your community newsletter no1 contains a misleading and fake statements throughout, including the one below and the response from Council. Also, the statement under "Golf at Glen Iris" and the Top 7 Reasons for oppositions is misleading. You have stated " very few respondents wanted to keep the course open". This is not based on fact. A majority of the community want the golf course retained as demonstrated under the responses in change.org petition which is showing 2629 persons against the development! (https://www.change.org/p/city-of-cockburn-mayor-and-councillors-say-no-to-the-residential-development-of-glen-iris-golf-course) Therefore, can you please provide all of the raw data that you have used to build up your analysis and summaries throughout the newsletter so you can demonstrated validity of your figures Finally, can you please respond to my other questions which have yet to be answered. "	"Hi [Name] Thank you for your email and for taking the time to provide feedback. On the matters you raise, we provide the following comments: We welcome the clarification provided by the City of Cockburn on their past discussions with the former owners of the Glen Iris Golf Course as it confirms they were aware the golf course was available to be purchased, long before Eastcourt were ever given the opportunity to buy the property. The Community Survey was written and analysed by Metrix Consulting, and they independently prepared the infographic as a summary of the survey outcomes. Neither Acumen nor Eastcourt had any input into the analysis or reporting of the survey results. The facts are based on the survey managed by Metrix, not a change.org petition you reference. We are genuine in wanting to engage with members of the community who have meaningful input for us to consider relating to the future development options of the former golf course land. We are continuing down this path with our upcoming precinct workshops to look at key elements of the future planning, as outlined in our recent community newsletter. You can choose to nominate to participate in those sessions, but they will be focussed on key issues and options to be considered by the Project Team in evolving the development outcomes for the project. Outside of that framework, we probably don't have a lot more to discuss with you at this stage. Kind regards [Name]"	General opposition			
25.8.20	7.9.20	Email	REF154	"Dear [Name] and [Name] I was looking at the "glenirishaveyoursay"" website and noticed that your Community Newsletter has been uploaded but there is no correction to that Newsletter regarding the City of Cockburn refuting your "Fast Fact" that the Council had declined the previous owners' invitation to purchase the golf course. Do you intend to publish a correction on your website? Also, I believe it would be incumbent upon Acumen to letterbox drop a correction so that residents (who have not registered or don't follow social media) are not misled. Lastly, by only having three groups of 20 representing approximately 1,400 residents, how can this be true community engagement and fair representation for such a large number of residents? Thank you. "	"Hi [Name] Thank you for your email. We welcome the clarification from the City of Cockburn regarding their past discussions with the former owners of the Glen Iris Golf Course. We don't believe any further statement from the project team is necessary. In relation to the Precinct Reference Groups, this is just one of a number activities we will be undertaking with the community over the coming months as we work through the engagement process. Kind regards, [Name]"	Cockburn Council's position re the development.	Consultation process		

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26.8.20	26.8.20 then called again and spoke with her 7.9.20	Telephone	REF155	"Three questions: - When can she buy a block of land in the new development? - How much will it cost? - How will we manage traffic? She has nominated for PRG. [Name] went along to the community rally on Saturday 5 Sept. She said it was not as well attended as she had expected (maybe 150 – 200 people); the woman organising it sat on a chair on the back of a ute and told everyone their properties have dropped in value and they have lost money ('scare tactics' according to [Name], who believes a quality development could lift property values); traffic congestion will be massive; here's a picture of a dead duck that had been run over while crossing the road; and generally 'seemed very opposed to everything'. It also appeared to [Name] that the opponents are a bit fractured and 'disagreeing amongst themselves'. [Name] has been telling her neighbours that they need to accept the land has been sold and get on board with helping to make sure the new development adds value and amenity. She has requested that if her nomination for the PRG is accepted, I text her the day before the meeting to remind her about it as she has memory issues. "		Traffic	Land sales		
31.8.20	7.9.20	Email	REF156	"Dear [Name], As a resident of The Glen Iris Estate and a member of the Jandakot Residents Association I just wanted to express my sadness and disappointment at the recent draining of the pond at the entrance to Glen Iris by the new owners, and also the puncturing of the linings in the remainder of the lakes on the estate, where the water is swiftly draining away. This sentiment is shared by many residents of Glen Iris. The wildlife of Glen Iris, particularly the ducks and their newly hatched chicks, depend on the water areas. It serves no purpose to the new owners to perform these acts at this time. Any planning permission for changes to the golf course must be many months away, if not years, so why would they do this? Water is a precious resource, especially in Australia, and to deliberately deprive the wildlife of Glen Iris, of what were substantial water resources, seems a reckless act and quite shameful. Regards, Concerned Resident"	"Thank you for your email and the feedback you have provided about the lakes at Glen Iris. I have provided some information below about the lakes, and how the project team has been carefully managing them now that the bore pumps and irrigation system are no longer operating. There are seven lakes at the Glen Iris Estate project site - one is a small unlined lake, while the other six are lined; all of them were created for the former golf course in the early 1990s. As the bore pumps and irrigation system are no longer operating, these artificial lakes will start to dry up when the weather gets warmer. Two of the seven lakes have recently been drained to safely remove and relocate 45 koi fish and two southwest snake-necked turtles before they dry up. The draining of these lakes and the koi and turtle relocation were completed by a licensed fauna specialist, monitored by Emerge Associates. The Project Team is conscious that waterbirds such as ducks may breed around these lakes during the 2020 breeding season. Accordingly, the remaining lakes will not be completely drained until waterbird nestlings have fledged, which means they can fly. This typically occurs between 45 and 60 days after being born. It is important to note that water birds are accustomed to moving between wetlands so when the lakes are drained, they will naturally fly off to other locations."	Flora & fauna			
31.8.20		Email	REF157	"Hi [Name]a Further to my emails to you on Friday regarding the welfare of the several sets of ducklings that are currently living on the golf course whilst their water habitat is being drained. I wanted to give you a further update and forward to you these pics taken on Friday afternoon which show a little family who had ventured onto a residents property after swimming in their pool. The ducklings are very young and cannot and won't be able to fly for several more weeks! They appear to be wandering around looking for other suitable water sources, which I have never seen before in my [Number] years of living in the estate. Furthermore, sadly a duck was hit by a vehicle and run over on Dean Rd over the weekend also, as there are still several pairs of ducks foraging in and around the now drained pond on Dean Road, near the clubhouse. Due to rainfall over the past month there is some dirty stagnant water sitting in the bottom of the pond that the ducks still attempt to drink from. Again, can you please advise me what course of action is being taken to ensure their safety. As I mentioned before there is possibly more ducklings to be hatched in the coming weeks as I have seen some very large obviously pregnant female ducks. What are your environmental consultants and fauna relocation experts doing about this situation especially when it won't be very long before the lakes are empty? The updates provided on your website do not cover or provide any explanation for what is happening with the ducks or their ducklings at all. The residents of glen iris are well aware of them and are very concerned for their safety and welfare and therefore [Name]a I am urging you to approach your experts and let us know what is their plan of action for these sweet helpless ducks. Kind regards, [Name]"		Flora & fauna			
2.9.20	2.9.20	Email	REF158	"[redacted] Hi [Name]a I have had a number of complaints about the lack of maintenance of the verge garden, verges and tree branches near the entrance to the old golf course club house and at the entrance itself. See images below highlighted in blue. The fence line on Prinsep Road is also a safety hazard and needs to be removed or made safe so that pedestrians are not injured by the fence. Can you please advise what will be done to address these issues and when this is expected to be done. "	"Hi [Name], I have spoken to our Project Director, [Name] [Name], and his is making arrangements to have maintenance, repair and tidy up works undertaken. [Name] (who is copied in on this email) will come back to you and the City of Cockburn team to provide an update once the works are locked in. Thanks so much for sending the images through with the details. Kind regards, [Name]a "	Site maintenance			

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3.9.20	3.9.20	Email	REF159	"Hi [Name], How does the planned new housing estate (By) pass the jandakot water mound restrictions ???? As far as i am aware the newTreeby estate was given the green light by the water corporation ... Seems very unfair that us other local residents / ratepayers (who dont even have a ""R"" code ruling for the last 4 years) sitting on our 5 acre blocks are still left in limbo as to any future development(s) that we can do. Seems to be happening all around us, ever creeping closer and closer, but yet still no answers."	"Thank you for your enquiry, which I passed on to the project manager. He has provided the following information: The Glen Iris land is partially covered by the Jandakot Groundwater Mound (JGM) area, and the land is already zoned Urban in the Metropolitan Region Scheme planning framework. Given the site is on the edges of the JGM, it is only a P3 classified area and "Residential" use is permitted within the P3 classification zone. I hope that explains the relationship between the proposed development site and the Jandakot Groundwater Mound. Kind regards, [Name]"	Information request			
3.9.20		Email	REF160	"[Name]a Shearman's email dated 3.9.20; Good morning, Jandakot Residents and Ratepayers are invited to register an Expression of Interest to participate in the forthcoming Precinct Reference Groups for the Glen Iris Estate Project. The deadline for Expressions of Interest has been extended until 9 September 2020. The Project Team want to ensure as many people as possible are aware of the opportunity to participate, so I have attached a PDF of the EOI call-out which you may like to post on the JRRA Facebook page. If you require any further details, please let me know. The following was received in reply; Dear [Name], [Name]a and [Name] Re: Precinct Reference Groups The subject of emails dated 3rd and 10th September 2020 (initially to the JRRA and subsequently forwarded to [Name] Stewart by [Name]) was raised at the last JRRA committee meeting with the question raised as to why committee members of the JRRA did not seek participation for the Precinct Reference Groups (PRG). This is not the way I, nor the Secretary, interpretated the email, ie that you were seeking participation from JRRA committee members. We both came to this conclusion because of the PDF of the EOI call-out attached to that email whereby you stated 'the JRRA may like to post on the JRRA Facebook page'. As you are well aware, the JRRA Facebook page is an open Facebook and if you were seeking additional interest for the PRG's, then you would have been entitled, as all others are, to post this yourself. It would not be incumbent on the JRRA to post this at your request when you know that the residents of Glen Iris are opposed to this development. Furthermore, [Name], you have stated that I supposedly said to those present at our meeting on the green that the JRRA had been excluded from participating in the process. That is categorically untrue. Perhaps next time you have a representative of yours attending one of our rally's they might make themselves known and introduce themselves and, if necessary, seek clarification of issues raised. On the point of representation, [Name] Smith, Secretary of the JRRA, sought participation, albeit late, initially in her own right, but was advised that as her husband had been accepted, she could not be considered as a participant for the PRG. That is understandable not wanting two people from the same household. When that was not possible, she then sought attendance as a representative of the JRRA in a silent capacity, agreeing not to participate in any discussion. This was also denied due to apparently reaching the maximum of 26 people. Given that she was not going to participate, but only observe, I find it quite extraordinary that, if indeed your initial email was inviting JRRA committee members to participate, that she was not permitted to attend even when agreeing to keep silent. I trust the above explains and clarifies the situation. "		Consultation process			
4.9.20		Telephone	REF161	[Name] left voicemail Fri 4 Sept – rents in area, wants to know if development definitely going ahead as considering whether to renew lease – tel number on voicenail was indistinct [redacted]		Information request			
7.9.20	7.9.20	Telephone	REF162	"Played at GI golf course as a teenager, got a hole in one – wants to know what happened to the shields/honour boards etc? Interested in getting a photo so he can prove to his grandkids that he did it. "	Response – we're checking (I'll update you when I know)	Information request			

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15.9.20	16.9.20	Email	REF163	"Hi [Name], We are a business located in the Glen Iris shopping centre. Heard a lot about Glen Irish golf course sold out. wanted to know what the future holds for Glen Irish shopping centre. As there is 54 hectare land being developed in coming years, is the shopping center considered part of development ? Also want to know if our business will be affected in coming years, while construction will be taking place. Please if you can guide what changes are happening. Thanks, [Name] & [Name]"	"Hi [Name] and [Name] Thank you for getting in touch with your enquiry about the proposed residential development at Glen Iris. I've attached a copy of the project newsletter which will provide you with some more background, but for further information I'd recommend you go to https://www.haveyoursayglenirisestate.com.au/ As you mention, the family that owned Glen Iris golf course has sold the land, and it has been purchased by a developer (Eastcourt Property Group). The developer is proposing to create a high quality residential community on the former golf course site, and will be applying for the land to be rezoned to facilitate this. This is a detailed regulatory process that the new owners will need to work through before any redevelopment can take place. At the moment, the new owners are consulting with residents in the existing Glen Iris estate to understand their priorities for any proposed development. The Glen Iris Shopping Centre is not part of the project area, and will be unaffected by the project – other than potentially gaining a larger customer base due to the development creating an additional 600-800 households. I hope that answers your question. Kind regards, [Name]"	Information request			
16.9.20	16.9.20	Telephone	REF164	"There is a cape lilac tree overhanging [Name]'s al fresco. It's infested with spitfires for about 6 months a year and like the whole tree removed if possible. He also discussed on the phone how he is not opposed to the development – everyone needs to accept reality and work with developers to get best possible outcome. "	[Name] has been advised and will organise.	Trees			
16.9.20		Telephone	REF165	"Call started with 'how much is the land for sale for?" – I thought he meant a block, said we were way off that point, whole process to go through etc; he said I misunderstood, how much do we want for the whole site? I said the current owners are not looking to sell – he said everything is for sale for the right price. I didn't respond. He started talking about the new owners paid about $27m for the site – was trying to get me to confirm – I didn't respond (his tactic throughout the call was to ask questions in a very hostile manger then leave lots of pauses for me to arc up) He said we have a fight on our hands – I didn't respond– he said there was a rally with 200 people - then I said sorry, I may have misunderstood – was that a question? He said no, just an observation – I said okay; then he asked if I went to the rally – I said no. Did I agree we have a fight on our hands – I said we understood there are a number of residents who would have preferred that the golf course remain a golf course, that we understand that, but that we are also hearing other perspectives from community members He asked about what we would do to maintain fire breaks – I said the team recently met with City of Cockburn to discuss this, and we will be putting together some information about it and uploading it to our website – he asked if we would also be sharing that with the JRAA – I said we would try, as we have previously, by sending through info for them to share on their Facebook page… I asked if he wanted me to take notes, as usually I provide all feedback to the project team, but generally it is attributable feedback and given that he didn't want to give me his name or let me know where he lives – he said I didn't need to take notes. His last comment was that he was glad I had answered the phone as he had heard that I never do.. In all honesty, I wondered at one point whether it was an unscrupulous journalist, looking for me to make a misstep, but why would they bother?! It was the most difficult and unpleasant call I have had so far – may even have been [Name] [redacted], that was the tone of the call. I don't think I did any harm, but I didn't make a new friend and I expect there will be some negative reporting of it on the JRAA facebook page."		General opposition	Site maintenance.		
17.9.20	17.9.20	Email	REF166	"Hi [Name] No one has turned up today to deal with that 'cape lilac' issue/tree. Can you give me an update. Cheers"	"Hi [Name] The tree loppers are on site again today - it may be they were just working in a different area yesterday. The PM told me they are dealing with the cape lilac this week, so hopefully it will be gone by tonight. If not, let me know. [Name] Hi [Name], another update from the Project Manager – seems the 'tree guys' have a bit of work to get through! Rest assured you and your Cape Lilac are on the list. The tree guys will be on-site early to mid week. Last week they did the external boundary works needs to facilitate the verge mowings. They have some other jobs to attend to early next week, then will be back on site at Glen Iris."	Trees			
17.9.20		Email	REF167	"Hi [Name], I was walking alongside the golf course on Princep Rd and noticed the barbed wire from the fence is low to the ground in a number of places. This is dangerous as children can reach this. Any chance you can get this seen to?"	"Hi [Name] I'll let the project manager know to get it checked out. Thanks for letting us know. Kind regards, [Name]"	Site maintenance			

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	17.9.20	Email	REF168	"Hi [Name] I'm very sorry, but I am no longer available for the first of these important meetings as I have been called away for other commitments from 21 – 25 September. I understand that I needed to be available for all 3 meetings, and have a proxy who would happily fill in for this first meeting if this is permissible. [redacted] He was away travelling when applications where called. He has a similar mindset as we do in that he would like to be involved with the re-arrangement and developing area. Apologies for not being available. "	"Hi [Name] I'm sorry to hear we won't see you at next week's meeting, but more than happy for [Name] to represent you next week, and then either you can take his place or depending on numbers and [Name]'s interest, you could both attend the 2nd and 3rd meetings. Would you be able to pass on the attached nomination form and Terms of Reference to [Name] and ask him to return it to me? I'll make a note that he is definitely attending next week, but if we could have the completed forms as well that would be great. Thanks for your interest [Name]. Kind regards, [Name]"	Consultation process			
19.9.20	22.9.20	Email	REF169	"Hi [Name] I hear you may be low on numbers for your focus group, if possible I'd like to be involved. Thanks, [Name]"	"Hi [Name] Thanks for your email and interest in the Reference Group. We did receive much lower than anticipated interest in participating the workshops, so instead of having three groups of 20 people each, we have combined them into one single group of 26 people – which enabled us to cater for everyone who nominated. Unfortunately we are now at capacity and can't accept any late nominations. However, we will be sharing a summary of the meeting via https://www.haveyoursayglenirisestate.com.au/ , and obviously I remain available via email or phone for any questions you might have or feedback you would like passed on to the project team. Kind regards, [Name] (7.10.20) Hi [Name] Quick update - we are hoping to set up a second group if we can get sufficient numbers, so if you are still interested in participating, could you read the attached Terms of Reference and complete the attached Nomination form, and email the form back to me by 12 October 2020? Thanks [Name] – hope to hear from you soon! [Name]"	Consultation process			
20.9.20	22.9.20	Email	REF170	"Hi [Name]. PS to last message. I accept that I can't be considered as a homeowner participant; however, on the proviso that I don't participate in any discussion, may I attend as a (silent) representative of the Jandakot Residents and Ratepayers Association? Thank you. "	"Hi [Name] Thanks for following up. Unfortunately we are right at the limit of our capacity now for Wednesday's meeting. We will be sharing a summary of the meeting via Have Your Say Glen Iris Estate, and obviously [Name] will be able to provide you with information as well. I will also continue to be available via email or phone for any questions you might have or feedback you would like passed on to the project team. Kind regards, [Name]"	Consultation process			
22.9.20	22.9.20	Email	REF171	"Good afternoon, Hopefully you can direct this to the right person. I am a resident of [Address] My property directly backs on to what was the [redacted]. I have noticed the limestone retaining wall between my property and the golf course has some holes in it. As you are in the business of building and understand structural integrity it might be worth having a look at yourself. "	"Hi [Name] Thanks for getting in touch. I have spoken to the project manager about this, and he has confirmed that retaining walls are within the boundary of the properties being retained (i.e. the high side), so the integrity of the wall would be the responsibility of that owner. It may be that in your situation on Woodlands Way that the body corporate of the strata is responsible for the walls, depending on the nature of the strata plan and body corporate structure. I hope this helps [Name] – maybe follow up with the strata company if you are concerned? Kind regards, [Name]"	Site maintenance			
22.9.20	22.9.20	Telephone	REF172	"Email sent to [Name] in response to [Name]'s telephone call. Hi [Name] I've had a call from someone who played at The Lakes (as it was then) as a teenager, and got a hole in one. He was asking what happened to the honours board at the club house when the land was sold. It's no longer there, and I wondered whether the golf club had a chance to remove it? If not, I'll get Acumen's project manager to get in touch with the previous owners to see if they know it's whereabouts. The person enquiring is [Name] [redacted] – he wants to prove to his grandchildren that he got a hole in one back in the day! Thanks for any assistance you can give in relation to this. Kind regards, [Name]"		Information request			

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22.9.20	22.9.20	Email	REF173	"Dear [Name] and [Name]a Please can you investigate and let me know who has put this (a Google business drop pin saying ""Glen Iris future housing development"") on google maps given that no approval to rezone has occurred? Thank you. "	"Hi [Name] The short answer is – we have no idea! My understanding of how this works is that someone has to actively add the tag to Google maps, and it's not something any of us have done. I checked in with the marketing person at Acumen to make sure I was correct in my understanding of how it works, and she emailed me the following explanation (apologies if you already know all of this [Name]!): You need to log the location yourself, however anyone can log a business i.e. you could log a business at my home address for example. The process is, you would need to login into your google account and log a business, Google will then send you an email to verify the business location (if you google maps Glen Iris Future Housing Development the business is set under Accommodation), by the looks of it, it looks like someone has done this, obviously none of us. I have reported it to Google and whilst I can still see it on my Google maps I have checked with Gia and Linda in our office and it isn't coming up for them. Generally what happens is that whoever set this account up will get an email saying someone has reported this business once it's been reported. If it is still showing for any of you, I would just report this to Google and hopefully it should be removed quickly. So we have reported it to Google and it should get removed by them; you could do the same if you want – not sure if the more people that report it the more likely it is to be removed, but it can't hurt. The upshot is that it was not anything that we did, so the short answer is we have no idea who put it on Google maps, but we have reported it to Google. Kind regards, [Name]"	Information request			
24.9.20	Phone		REF174	Grass needs mowing on the golf course backing onto her back fence. Her neighbours are in the same boat. She said weeds are now knee high.	[Name] sent her a text confirming it will be one by end of Oct and any problems to please call her.	Site maintenance			
24.9.20	16.10.20	Email	REF175	"Hi [Name], I have recently bought a house that [redacted] onto the golf course. I'm not sure if your the right person to ask but it's a start. Can you advise if someone is slashing the grassed areas that border the homes along the golf course, the grass is growing tall with a mixture of weeds along the fence line. "	"Hi [Name] So sorry to take so long to get back to you – hopefully you have noticed some tidying up happening on site this week. Our bushfire management plan has now been signed off with City of Cockburn, and work has started on clearing up the site ready for the 1 November deadline for fire breaks etc. We have a team on site that started working on the external verges and around the internal boundaries/property interface areas earlier this week. Once that is done the team will focus on the mowing of the internal areas of the land. There may also need to be some line-trimming work completed in those areas that can't be accessed by mowers. We anticipate the works to be fully completed within 2 weeks to have the site ready before the 1 November deadline. Thanks [Name], and apologies again in not responding sooner. Kind regards, [Name]"	Site maintenance			

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25.9.20	2.10.20	Email	REF176	"Dear all Residents at Glen Iris have made contact regarding allergies being created by the long (up to 1m) tall grass/weeds. The grass is now reaching its seasonal maturity (see photos) with pollen and seed production. Acumen's environmental consultants, Emerge Associates, should be able to advise you on this matter. Many residents around the golf course have contacted my wife, [redacted], voicing some really heart-breaking health concerns - residents who have all chosen a lifestyle suited to their later years - thus we have frail and aged residents, some with serious medical conditions, including lung cancer, exacerbated by the airborne plant products from the golf course grass/weeds which are creating more allergy-related medical complications. <Mayo Clinic - 4 August 2020> "Allergy symptoms which depend on the substance involved can affect your airways, sinuses and nasal passages, skin and digestive system. Allergic reactions can range from mild to severe, in some cases allergies can trigger a life threatening reaction known as anaphylaxis." "Anaphylaxis is defined by a number of signs and symptoms alone or in combination. Most cases are mild but any anaphylaxis has the potential to become life threatening." <www.worldallergy.org> I have lived in Glen Iris for over [Number] years and have not suffered acute hay fever until this year. Not only do those with allergies have to contend with the seeds from the London Plane trees, we are now also fighting plant products from the golf course, plus normal nocturnal spores production from fungi which can be higher than daytime pollutants and become earthbound during early morning temperature inversions. At the first Precinct Reference Group meeting held on 23 September 2020, in his introduction, [Name] reported the grass cuttings would not damage the protected Banksia. This was in response to early concerns about the fire hazard. [Name] continued that the grass would be cut to 50mm high which, unless it is removed, will now present a 100mm pile of dry grass as a fire hazard. People are obviously suffering from the state of the golf course and a proper program of management, including timing, must be initiated to address the created health hazard. We are aware from City of Cockburn's advice that this is private property, but private landowners have a duty of care to cause no harm and the golf course condition, including grass, is affecting many others. On another matter, your "haveyoursaygleniris" website states in your September 2020 latest news "A fauna assessment has been completed by environment consultants at Emerge Associates" yet when this matter was raised [Name] said one had not been completed. This is very disconcerting as information is being uploaded on the website which is clearly not correct. Furthermore, in Acumen's Community Newsletter it stated that the City of Cockburn had declined to purchase the golf course (from the previous owners). The City of Cockburn immediately refuted this information in a Media Release. Acumen and the PR consultants were contacted with a request to correct this information which was refused. This lacks truth, integrity and transparency as now, on two known occasions, Acumen's information has been 100% incorrect and/or misleading. On another matter, [Name], in his opening introduction, reported the golf course ponds have or will be drained to stop people drowning but when questioned about the need for these ponds to the now approaching protected black Carnaby's cockatoos returning, which are observed to roost at Glen Iris next to these ponds, he was unable to answer and would refer it to their environmental consultants. If Eastcourt/Acumen truly wishes to engage in an open and transparent way with the residents in Glen Iris and have any serious concerns about the health risks associated with the planned development, would they please initiate some constructive action."	"Dear [Name], Thank you for your email on 25/09/20, which outlined some queries and concerns about the Glen Iris Estate site in Jandakot. We are committed to keeping the community updated on the project and welcome the opportunity to clarify areas of interest to residents. To follow is some information in response to the queries you raised: Grass and site management We have submitted a seasonal fire management plan to the City of Cockburn. This will be implemented over the coming weeks. Works will include mowing all grass and weeds across the project site to a height of 50mm. This will be maintained annually from start of November to mid April. Outside of the designated bushfire season, we will continue to manage grass and weeds within 20m of adjoining residents' property boundaries. Our contractors will commence this year's seasonal fire management works in the coming week and will have this completed before the end of October 2020. Environmental Assessments Our environmental consultants have completed several visits to the Glen Iris Estate site. They regularly provide the Project Team with reports and assessments on fauna and other aspects we ask them to review. The item you refer to on https://www.haveyoursaygleniriseestate.com.au specifically relates to the aquatic fauna in the irrigation ponds we have been managing recently. The question raised at the first Precinct Reference Group meeting was about the detailed Fauna and Flora Assessment Report required to support the Town Planning Scheme amendment and Local Structure Plan amendment. As outlined at the meeting, we have not completed the studies needed for this report. [Name], given your depth of interest in environmental matters around Glen Iris it would be great to arrange a time to sit down with you and discuss your knowledge of the site from this aspect. I would also like to bring along Emerge Associates' Senior Environmental Consultant [Name] Atkinson to hear your insights and discuss any other queries you may have about the environmental management approach. If you would be open to this, please let me know, and we can confirm a time suitable for our diaries. Golf Course Statement We welcomed the City of Cockburn's clarification on its discussions with the previous owners of the Glen Iris Estate site. We also appreciate the report the City tabled at the Council meeting on 10 September 2020. It summarised the history of the development and clearly outlined processes that need to be undertaken for rezoning and future development to be approved. [Name], we look forward to your continued participation in the Community Reference Group workshops over the coming months, and we are happy to provide any further updates on matters you wish to raise. Yours sincerely, [Name] [Name]"	Cockburn Council's position re the development.	Site maintenance.		
30.9.20	16.10.20	Email	REF177	"Good afternoon [Name] My son & I were walking our dog last week down Berrigan Drive when a Southwest Snake-necked Turtle came out of the grass and tried crossing the road. My son picked him up and put him back in the long grass but he still headed towards the road, so we put him over the fence back into the golf course grounds. As you have turned off the water and the lakes are drying up, he will be endeavouring to find water somewhere. I have just been reading the news feed on Have your say Glen Iris estate dated 17 July where 2 turtles and numerous of Koi fish have been relocated. We encountered this turtle only last week so encourage you to visit the golf course and find any other wildlife that is endangered due to the water being turned off, and relocate asap before the hot weather arrives. "	"Hi Linda Apologies for the time it has taken for me to get back to you – I wanted to get some information from our environmental scientist about the turtles before I emailed you, and he had a sudden death in the family and was on bereavement leave for a while. Anyway – the information I have will hopefully reassure you that the turtle is likely to be a female exhibiting normal seasonal nesting behaviour: "Female Chelodina colliei southwestern snake-necked turtle will leave wetlands to find nesting sites in spring and summer months. They can roam up to a kilometre to find suitable nesting site but certainly 100s of metres is not unusual. Only females leave wetlands to do this as males remain in wetland. The predation of females by foxes and cars etc is the reasons that the species is considered to be near threatened." In addition, five of the 7 irrigation lakes still have some water in them, this includes the unlined lake at the southern end of the site. The large lake at the northern end is still more than 2/3 full, and the others are probably between 1/4 to half full, so the turtles have plenty of water at the moment. We'll continue to monitor the situation as the lakes dry up over summer. Thanks for letting us know Linda. [Name] "	Flora & fauna			

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2.10.20	2.10.20	Email	REF178	"Dear [Name] Thank you for your email dated 2/10/2020 and update plus the continuing opportunity to clarify areas of interest to residents. Re your email: Grass and Site Management: I spoke with Mr. Higgins A/District Officer South Coastal (FESA) who advised the fire management would commence 1 November, not in the next few weeks, as the grass will still be green. He commented that it would be slashed and the cut grass removed so as not to present up to 100mm for combustion. We also discussed the other debris and grass trees which are also very inflammatory close to homes; plus heavy vehicle traction in the soft sand based upon past incidences. He pointed out the problem with dust and pollen while slashing which you have not addressed. We have many aged, sick people around the golf course and it is assumed you will address this problem promptly. As per email from Mr. Higgins, [Name] Catherwood, Manager Strategic Planning at the City of Cockburn, should be point of contact. Environmental Assessments: "A fauna assessment has been completed by environmental consultants at Emerge Associates" – Project Sheet September 2020. As you suggest in your current email, several visits would be required to complete a professional survey. If you have completed the 'fauna" assessment by Emerge Associates they would know that fish are fauna (which are all the animals present in a particular region or time which can include fossil assemblages from the pre-Cambrian, specifically from the early stromatolites. Fish are later from the Devonian, part of the Palaeozoic which was also known as the Age of Fishes. I have interest in environmental matters around Glen Iris. As the golf course has been a sanctuary since 1965 and we have lived here for over 20 years many studies have been initiated regarding fauna (no fish) and flora. Due to diminishing landscape (due to large block sales on Dean Road) and the planned 42ha clearance at Jandakot airport, the habitat at Glen Iris has emerged as a study sanctuary. I have spoken to my learned qualified associates who consider contact would be a conflict of interest so I must therefore decline your kind offer. In addition, some Glen Iris data is inclusive with ongoing unpublished research projects. Golf Course Statement: Thank you, we are still in discussion and meetings. Thank you for your reply to some of my questions and I will take the opportunity for further updates on matters. "		Site maintenance	Environment		
2.10.20	7.10.20	Email	REF179	"Dear all I received an email a few days ago from a very distressed resident who took this video. (First 15 seconds a bit blurred but keep watching). The mother was nowhere to be seen - tiny ducklings left to fend for themselves and, as you can see, nowhere near water, close to the road - too young to fly! She even had to take an injured duckling to Murdoch. Probably all dead today! Is this the level of your fauna care? Whilst not endangered, all native animals are protected by law. This is shameful that you have drained ponds prematurely to the detriment to these ducklings when a few more weeks would have allowed these babies protection from predators. Yes, it's private land (as I keep being reminded) but don't private landowners have a duty of care and moral obligation to do no harm. On behalf of the resident who emailed me and sent me this video I told her I would make her voice heard. Shameful and heartbreaking! Regards "	"Hi [Name] Thank you for your email, which has been shared with the project team. I've attached our fact sheet which outlines the rationale behind the careful management of the draining of lakes, as well as information from the DBCA relating to the duck breeding season, which you may wish to share with the resident who sent you the video. Kind regards, [Name]"	Flora & fauna			
3.10.20	5.10.20	Email	REF180	"Hi [Name] Do you have a date yet for the October workshop? I would just like to diarise it to ensure I will be able to attend. At the September workshop there was a map on each table showing the various land parcels that made up the golf course. Is it possible to get a copy of that? As a civil engineer with extensive experience in transportation matters, I would like to doodle some potential road/laneway/access ideas for your consideration. "	"Hi [Name] Thanks for getting in touch. The date for the next meeting is Wednesday 21 October – we will be emailing everyone by the end of this week with more details. Kind regards, [Name]"	Consultation process			
5.10.20	5.10.20	Email	REF181	"Hi [Name] Thanks for your response. Can you please respond to the question in my original email (below) regarding the map. Thanks. "	"Sorry [Name]! I've cc'd [Name] on this email – hopefully he can provide you with a plan to 'doodle' on! (6.10.20) Hi [Name] Please find attached a copy of the Context Plan that was provided at the Reference Group workshop in mid-September. I look forward to discussing your thoughts on access, traffic, etc and sharing that with our engineering and traffic consultants. Regards, [Name] [Name]"	Information request			

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7.10.20	7.10.20	Email	REF182	"It is so disappointing to see how your company lacks integrity in so many ways. But just for the record regarding low number of nominations for the workshops - I did send my nomination form in before due date and never heard anything from you. "	"Hi [Name] Thank you for your email, and I'm sorry to hear your nomination form didn't reach us – I have checked my inbox and junk mail and have no record of having received it. If you are still interested in participating please forward the form to me at this email address. Kind regards, [Name]"	Consultation process			
7.10.20	7.10.20	Email	REF183	Emailed with pictures of a tree that needs lopping. [Name] advised [Name].		Trees			
7.10.20	7.10.20	Telephone	REF184	"Hi [Name] Lovely to speak to you earlier today As promised, here's the nomination form for the reference group – if you could complete it and get it back to me by 12 Oct, that would be great. I've also attached the Terms of Reference for your information. Thanks [Name], hope to hear from you soon! [Name]"		Consultation process			
7.10.20		Email	REF185	"Hi [Name] I wanted to reach out to you about nominating for a second reference group we are hoping to set up if we can get sufficient numbers. [Name] may have mentioned to you that participants at the first meeting were keen to encourage their neighbours and friends to nominate if we were able to run a second group. Fortunately, we kept the original venue bookings to cater for three separate groups just in case, so we still have capacity to run a second group. Would you be interested in nominating? Obviously you would be there as a representative of JRRA rather than as a private individual, and you could not be in the same group as [Name] as we can only accept one representative per household. Also, we would ask you to fully participate in discussions rather than attend as a 'silent observer' – the purpose of the group is to explore topics and share ideas and feedback with the project team, and people may feel inhibited in doing that if someone is there in a 'silent observer' capacity. I've attached the Terms of Reference and Nomination Form. If you are still keen to participate, please review the Terms of Reference and complete and return the form to me by 12 October. Thanks [Name], I look forward to hearing from you. Kind regards, [Name]"		Consultation process			

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7.10.20	8.10.20	Email	REF186	"Hi [Name], Thank you for your email below. Having read the details I would like to highlight some concerns of mine in relation to the contents of your email that specifically relate to the First Reference Group workshop. My concerns stem from the view that, as a participant, I believe, I am expected by Acumen to represent the views of other residents in the Glen Iris Golf Course Estate. If that is Acumen's view, then as a participant I must take steps to ensure that any information that is distributed by Acumen regarding the workshop(s) accurately reflects matters discussed, so as to ensure that a clear and honest picture of the workshop discussions is conveyed to all external parties that receive it. In executing my duties as a participant, I would like to raise the following concerns about your email - the first that provides any form of summary of the workshop discussions to external parties. It would be useful for me to state these concerns now, so that all participants as well as Acumen and Metrix can agree on the vital points from the outset. My immediate concern is that the wording of any summary of the meeting(s) will need to be agreed to by the participants before Acumen distribute the contents. It will not be appropriate, given the existing high level of opposition to the development coupled with the lack of trust in Acumen that currently exists within the Community, for Acumen to unilaterally decide the wording of any summary of the discussion conducted at the workshop(s). I note this, given the recent letter that the City of Cockburn Council wrote to Acumen (that was widely circulated to external parties) where it clarified the wording used by Acumen in describing the Council's discussion with the previous land owners. The point clarified was definitley quite different to that which Acumen's wording implied. However, Acumen chose not to issue a retraction albeit having been asked to do so. Accordingly, please circulate the draft summary to the participants for comment before the final wording is uploaded to the Have Your Say Glen Iris Estate website. Such a request is not unreasonable given the circumstances. I have two other concerns in the wording in your email below: 1. How can you write that "feedback from the participants at the first workshop was that it was helpful and informative" when indeed the participants (certainly the ones that I spoke to) left feeling underwhelmed and not entirely listened to, nor was any new information about the Developer's intention shared?; and 2. How can you write that "some (of the participants) expressed disappointment that Acumen had not received a higher degree of interest" when I recall that it was indeed Acumen expressing that disappointment and it was Acumen who would like to set up a second group? I do recall giving my feedback on the night when it was stated that people were not interested in participating and made it sound like the residents didn't care, when in fact they do care, but are extremely angry with the whole situation. As I mentioned on the night, the residents that I spoke to were very angry with the Golf Course being sold and developers now coming in to destroy what they first of all paid for and secondly, rip up the beautiful surroundings of Glen Iris to make way for houses. It is not out of disinterest but of sheer anger and frustration that they did not want to liaise with Acumen and the workshops. I left feeling, what the developers say and do can be two completely different senarios and feeling very concerned. You can see from this email that I take my role as a participant in the Reference Group workshop(s) seriously and am simply looking to establish agreement on good process control measures such that the participants and outcomes from the workshop(s) are accurately quoted. I look forward to your timely response and confirmation of the most vital point above regarding participant comment on written summaries before those summaries are issued to a wider audience"	"Hi [Name] Thanks for your email and for raising your concerns. Hopefully I can provide some clarity around the questions you have asked. The first and probably most important point to make is that the summary is prepared by Metrix Consulting, the workshop facilitators, not by Acumen or Eastcourt. It is a summary of the key topics that the group agreed they wanted to discuss in more detail at the next workshop. It is not minutes of a meeting – as you may have noticed, there was no official 'minute taker' – the only documenting that was done was done by reference group participants and the Metrix facilitators as they workshopped topics and made notes on butchers paper. The summary that Metrix is preparing is based on the butchers paper and post it notes they collected at the end of the meeting. In relation to the other two points you have raised, the email that was sent out accurately reflected conversations that both [Name] and I had with individual reference group members at the end of the meeting. At least two people made a point of coming up to me personally to thank the project team for holding the meeting, and to say how helpful it had been. I don't think it is contentious to say that some people found the meeting helpful. Secondly, two reference group members spoke in front of the whole group and expressed disappointment that we hadn't received more nominations. One gentleman expressed surprise, and another woman expressed disappointment and asked if we would consider setting up a second group if we got more interest – she wanted specifically to speak to her neighbour and encourage her to get involved as she had found it useful. Again, the email that was distributed was an accurate and honest reflection of these comments from reference group members. [Name], we are fully aware that there are members of the community who are strongly opposed to the proposed rezoning, and we respect their right to hold and express those views. However, as noted in the nomination form for the reference groups, and reiterated by the facilitator at the start of the workshop, the purpose of the group is to seek input on key areas that are of interest to the community should the development be given approval. That is what Metrix is reporting on in its summary of the workshop – not discussions about whether or not the development should proceed. I hope that provides some clarity around the issues you have raised Kind regards, [Name]"	Consultation process			
9.10.20	9.10.20	Email	REF187	"Dear [Name] Further to your email dated 7/10/2020 below is my nomination form. Please confirm that my comment made on page two is acceptable to you. Thank you. "	"Hi [Name] Thanks for sending this through. Yes, your comment around confidentiality is fine – the Code of Conduct is more to do with respecting individual's privacy (eg if a community member shares specific details relating to their property or personal situation); it doesn't mean that members can't share information about the discussions relating to the project. We are more than happy – indeed we would encourage - members to share information about the project and topic discussions from the workshops with their friends and neighbours. We will be in touch next week about progress in setting up a second group. Kind regards, [Name]"	Consultation process			
9.10.20	15.10.20	Email	REF188	"Thanks for that [Name], (SUMMARY OF METRIX PRG MEETING REPORT) I will try to get to the next meeting. One question I do want to ask is: What is the zoning status of the subdivision ? People are saying it has not been rezoned from "special use" - is that the case ? "	"Hi [Name] Thanks for getting in touch. Hopefully you have just received an email about next week's meeting – hope you can join us. Yes, you are right – the site will require rezoning before any residential development can go ahead. That is part of the process that the new owners (Eascourt) are going through. I've attached an infographic that shows the process in simple terms. Our town planner also covered this during our first Reference Group meeting in September – he will be there next week, so while we can't use up time during the meeting to cover ground we've already covered, you're welcome to have a chat with him during the tea break if you have questions. Let me know and I'll make sure I introduce you! Thanks [Name]. [Name] "	Information request			

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11.10.20	15.10.20	Email	REF189	"Hi [Name], I am writing to ask you when the tree loppers are due on site as it is some weeks since you told me they would be back. I am getting extremely agitated and nervous about my property now that the summer is approaching and so is the fire season. If the tree loppers have been on site and decided to do nothing then please let me know soonest. The golf course is in such a mess and the grass is now overgrown beyond endurance and in a few weeks will be a severe fire hazard to the adjacent properties. When it was a golf course it was properly maintained on a regular basis and the gras cut short and watered with the irrigation. Now Eastcourt in their wisdom have dismantled the irrigation we are going to be a dry tinder box with an accident waiting to happen. When Eastcourt purchased the land I assumed they would have at least kept it in a good state of repair until such time they commenced building. If this were my neighbours garden I would be complaining to Cockburn Council as they and Eastcourt have a duty of care to keep the property in a tidy state of repair. Please let me know if and when the fire hazard will be removed so that I can have some peace of mind without constantly worrying. Best regards, [Name]"	"Hi [Name] Thanks for getting in touch. The tree loppers have been on site in the past week, and have now completed the tree pruning/removal that has been requested by individual residents concerned about overhanging branches etc. They then cleared away the debris, which enabled the site maintenance team to access the edges of the site where it interfaces with properties, and commence mowing and implementing our bushfire management plan that has been signed off by the City of Cockburn. The external verges of the site have already been mowed; the edges and interface areas are being worked on now. Once that is done the team will focus on the mowing of the internal areas of the land. There may also need to be some line-trimming work completed in those areas that can't be accessed by mowers. We anticipate the works to be fully completed within 2 weeks to have the site ready before the 1 November deadline. The bushfire management plan agreed with City of Cockburn requires the grass to be kept to around 50mm height, so there will be a program of ongoing maintenance during summer to keep it to that level. Kind regards, [Name]"	Trees	Site maintenance.		
12.10.20	15.10.20	Email	REF190	Hi [Name]- Me again. The first meeting has left me with more questions than answers- so it could be an interesting second meeting. This is possibly a question that your technical people can answer because our house insurance people can't. This is also a concern of other residents . Who has ownership of the retaining wall/ walls .? . Who is going to be liable for any damage/cracks etc. to our properties when bulldozers/heavy trucks/compacters are doing there job? Is Acumen/Eastcourt going to do any dilapidation surveys?. Funnily enough I do take my position within the group extremely serious and I am fortunate to be able to spent many hours talking to people on the estate. You would be surprised to hear what people say to me in confidence compared to what they say at the meeting or just remain silent. I think the word intimidated/trust cropped up a number of times. Cheers, [Name].	"Hi [Name] Thanks for getting in touch. I've provided some info below which hopefully will help put your mind (and those of your friends and neighbours) at rest about there being a very clear process that will be followed should redevelopment go ahead. Closer to the time of construction works commencing on site at Glen Iris, the appointed civil contractor will be required to complete dilapidation surveys on any adjoining properties that they believe may be impacted by any of the intended works. They will employ a professional organisation who will arrange to inspect each property and fully document the existing condition of any home, retaining walls, and other structures to set a baseline of information. If as a result of the construction works any adjoining resident believes there is a change in the condition of their home then they can ask for a post-construction re-inspection and if any conditions have changed as a result of the works, then the contractor and their insurance company will be responsible for those repairs. This is common practise in the land development and civil construction industry. In the vast majority of instances the retaining wall is positioned inside the boundary of the property that it retains, and is therefore owned by and the responsibility of that property. Again, closer to the commencement of development works, detailed boundary surveys will be completed to ascertain the boundaries and locations of existing retaining walls. Thanks [Name] – hope to see you next Wednesday."	Information request	Consultation process		
14.10.20	15.10.20	Email	REF191	"Hi [Name] On further reflection I believe it would be a conflict of interest for me to participate as a representative of the JRRA so would request that you remove my name. However, I would ask you to clarify to participants at the next focus group what you have told me about your confidentiality clause because I know quite a few residents who are participants and on asking each one of them how the focus group went they have said without equivocation "we are bound by a confidentiality clause and not permitted to disclose anything". Thank you. "	"Hi [Name] That's disappointing, but thank you for letting me know. I have passed on your feedback about the confidentiality clause to the workshop facilitator (Metrix Consulting) so they can clarify the intent of the clause for everyone at the start of next week's meeting. You raised a useful point, which interestingly no-one has ever raised in other Reference Groups I have been involved with (the Code of Conduct is fairly standard across Government and Local Government consultation programs). I can see how the intent could be misinterpreted so I will make sure the clause is rephrased on any future projects I work on to remove any ambiguity – so thank you for that insight! Kind regards, [Name]"	Consultation process			
15.10.20		Email	REF192	"Dear [Name] It is one thing seeing fancy plans/reports/consultants views on the Glen Iris development. With that in mind we would like to invite you over to our home to show you in real life what the proposed development will do to our dreams. Contact us by email as I am terrible at not carrying my phone around. "		General opposition			
16.10.20	16.10.20	Email	REF193	"FOLLOW ON FROM EMAIL CORRESPONDENCE DATED 30.9.20 Good morning [Name], Just wondering why you won't relocate him/her as if we hadn't been walking past that day he/she would definitely have been hit by a car. Your information says the species is considered to be near threatened, which leaves me wondering why you wouldn't endeavour to relocate them rather than monitoring them. Regards, [Name]"	"We will relocate them– we went out to a house on Hartwell Parade a few weeks ago where one had set up home (according to the wildlife contractor, it looked as if it had been living around that property for a while) and relocated a turtle. So yes, when we they are in a fixed location we will send the wildlife person in to collect and relocate them. "	Flora & fauna			

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16.10.20	19.10.20	Email	REF194	"Hi Lousie, Thanks for getting back to me LR's email of 15.10.20). They have picked up dead branches and mown the grass which is great and looks a lot better. However, the tree loppers have done nothing regards cutting back the trees that still presents a fire hazard. You say that they have pruned back what the residents asked for. I asked for as you know to have the trees right out my back yard cut back away from my house and any threats of fire burning my house down. I doubt that they have looked at them or they would have recognised the potential fire hazard should they catch light. Also the tall trees are now starting to overhang my property and should large branches fall in a high wind will certainly cause damage that my building insurance will not cover. I am still worried for my property and if the tree loppers think it is not a concern I would suggest someone from Eastcourt visits the site and inspect and address my concern. I am not satisfied in the least [Name] and will remain anxious and concerned until the matter is resolved. I await your thoughts on the matter. Best regards, [Name]"	"Hi [Name] I have followed up with the project manager, and he advised he inspected the site personally and actually spoke to the neighbours at [redacted] (and left them his card) as they were gardening in their backyard at the time. He advised that the trees directly behind your property are growing quite a distance away from your boundary, especially in comparison to many other areas around the course. The tree loppers also inspected these trees and don't believe there is any immediate danger from the trees. They did identify a tree closer to [Address] that is growing on a lean, and that has been identified for removal in this immediate area. [Name], I hope this advice from professional arborists will reassure you that the trees pose no immediate risk to your property. Kind regards, [Name]"	Trees	Site maintenance.		
19.10.20	19.10.20	Email	REF195	"Hi [Name], Thanks for getting back to me so quickly, much appreciated. I am afraid I disagree with your Project manager's decision on the trees. Speaking to my neighbour at [Address] is not the answer as he should have come back and spoke with me personally about my concern. Also other peoples boundaries and trees do not concern me nor do they make it any better that I should live with the risk. And by the way the trees your PM are referring to are leaning more over my property than number [redacted]. Should a strong wind from the North East blow and there is a fire it is my house that goes up with the trees. Shame he has taken this approach. It looks like I have come up against a brick with Eastcourt and I have now no alternative to take the matter up with Cockburn Council who I pay my rates to and also my local MP. I will not rest [Name] until the fire hazard is removed from my property. Thank you personally for all your help. Best regards, [Name]"	"Hi [Name] I've spoken again to the project manager and he is happy to meet with you at 8am tomorrow (Tues) morning on site if you think that would be helpful I would need to let him know this afternoon so he can organise his day tomorrow. Thanks [Name]. [Name] ---------- (20.10.20) Hi [Name] All went well with [Name] today – he is being alarmist in terms of the potential impact of the trees, but the trees he wants taken out are predominantly small, so I have instructed the tree guys to go ahead with it today. He is a realist in terms of development and had been asking the former owners to take out the trees for several years. Regards [Name]"	Trees	Site maintenance.		
21.10.20		Email	REF196	"Dear [Name], Thank you again, for your consideration and input in our last conversation. I hope your keeping well. I am writing to advise you that I will not be able to attend any meetings with regards to Glen Iris Development. I will, if you don't mind write to you and the developers in this email; with regards to what I had in mind and hopefully you may consider some ideas. I am a writer so please bear with me as I try to express my views. We live in a world dominated by greed as such developments happen and residents are not always informed. However it is to your developers credit that they have come outside of the box to consider what residents have to say. The world does not belong to us alone, it also belongs to all the God created creatures that live within it. As such we have a responsibility not only to house ourselves but also to ensure that the creatures continue to have their own dwelling places. Every morning I wake up to the most beautiful sound of all, birds singing. They wake to greet each day in thanks to their creator. They seed the plants and give the Bees their task each day and so it is; the beauty of nature. Imagine for a moment; A garden centered in the estate with a pond given back to the ducks. Where trees house birds that flourish within. Shaded areas with park benches and picnic spots with water fountains, Rose gardens and Toilet facilities but without BBQ amenities. Dotted around the estate, small walkways that lead to Secret Gardens, Some with small playgrounds while others are resting points where residents can find retreat from life's pressures. There is an example found in South Fremantle. My children used to call it the "Fairy Garden" it is a very small area on Marine Terrace. You might like to view it. Each garden could have its own theme. In keeping with Glen Iris current design that blocks and houses reflect and remain in continuity with existing housing, without diversions. Where possible that houses have white picket fences that face onto walkways to give an overall aesthetic appeal to surrounds. If these views could please be considered, along with exit and entry points considered to reduce traffic flow in and out of the estate. I thank you and the developers in putting my view across and I am sure that they will do all possible to maintain harmony with residents housing and nature. Many thanks [Name] and kindest regards. "		General opposition	Consultation process		

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21.10.20		Email	REF197	"Hi [Name]a I stopped in at the Par Court house today as I haven't seen the ducks there for a few days. The property owner told me the ducks are still there, usually early morning and then again in the afternoon but now not spending all day there, they come and go so I'm wondering if they may now have a nest somewhere nearby, perhaps even at one of the lakes on the course? Not sure what the latest developments are with you reaching out to the rescue WASR, but I'm wondering if we should possibly hold off for a while and see what develops in the coming weeks, ie if they have ducklings somewhere and perhaps whether they may just stop coming to the house. It would be sad if we moved them whilst they have babies to look after. Please email me back or give me a call to discuss if would prefer. Kind regards [Name]"		Flora & fauna			
22.10.20	22.10.20	Email	REF198	"Hi Good morning, The tree loppers are on site and they have done a great job of thinning out the trees and reducing the fuel load. I asked them about topping of the trees and they said their cherry picker could not reach and they would need a bigger one. The guy said he would mention it to you [Name]. Anyway you have made an old man happy that the main fire hazard threat is gone and for this I thank you both. Cheers [Name] "		Trees			
23.10.20	23.10.20	Email	REF199	"Hi [Name] and [Name] Please find the below which was sent to City of Cockburn this morning. I am sending this for transparency and feedback Hi everyone On Wednesday evening I attended a focus group at Arc hosted by Acumen and their various consultants regarding the proposed development of the Glen Iris estate. You'll no doubt know Acumen and their project teams are assisting Eastcourt with their planned development of the estate. Immediate observations are that the team are obviously professionals at what they do, experts in spinning a story for their desired outcome, let's not pretend otherwise. Once this project is completed they will be onto the next without a second thought of the residents of Glen Iris no matter what the outcome. One thing I observed and was very apparent is that anything positive said by the residents as we participated in their various activities was noted and eagerly scribbled down by the facilitators. Something I did make very clear and would also like to make clear to you is that no resident that attended the session is in support of the development, they were there to at least have a say in how they think it should look, this was mentioned by a number of the attendees when given the opportunity. My reason for writing to you is that it was clear that these sessions and the comments will be used to support Eastcourts rezoning application, in my mind these sessions are being held the wrong way around, surely after the rezoning process has been completed these sessions would be held (should it be approved). It could be seen as a waste of everyone's time and money to all provide input to something which very well may not happen. I am sure you'll agree the timing of these sessions is a very strategic move by Acumen, they and we all know that public consultation is needed for their application in whatever form that may be so they can 'tick the box' and say "we consulted with the local community". The facilitators were all very positive and welcoming however were very presumptuous, a bit cocky, oozing in confidence, and that the rezoning is a mere formality which we know IT IS NOT! I understand that the sessions have nothing to do at this stage with City of Cockburn, however I am very confident in saying the other attendees at these session do not support this development and I want to make City of Cockburn aware that any 'spin' that is put around our feedback through these sessions not the real true view of any of the residents, given a "yes or no" choice no resident supports the development. I would not like to think that anyone at City of Cockburn thinks that any application that is received is supported by anyone from the Glen Iris estate even a small number despite what 'salesman pitch' or spin is written on any rezoning application. For your information we asked Acumen that any application that is lodged is prior reviewed by the attendees of the focus groups given that we are being asked for comment which was taken as an action by Acumen from the session. I just wanted this feedback recorded and acknowledged, I am very very confident I speak for all that attended the session. We would like it known that we are not a splinter group plotting against the other residents, none of us want the project to proceed, we are dammed if we do attend and dammed if we didn't. "	"Hi [Name] Thank you for the advice of your email sent to City of Cockburn. [Name] [Name] has confirmed for me this included all Elected Members and the Acting Director of Planning. Obviously, we're disappointed that you feel it is necessary to do this. For the record, the Project Team does not assume that Reference Group (RG) members are in support of the proposed residential development – rather, their participation is driven by a desire to have a better understanding of the project and provide input to ensure the best possible outcome should the rezoning and local structure plan be approved. This was something that we openly discussed in the first meeting of the RG, and perhaps because you were not in attendance that has been misunderstood. [Name] [Name] in particular, made the point at that first session that we respect the fact that residents can both participate in the RG process whilst maintaining their baseline position of not wanting any change away from the current situation. I take exception to some of the tone of your comments in the email to the City. The upfront consultation process is regarded as the preferred industry standard by Local and State Government for rezoning and structure plan applications. We are not 'spinning a story' to the RG – I am not sure how much more we can do to be transparent beyond providing the RG access to the seven specialist consultants working on the project to discuss ideas and concerns directly with residents. The facilitators/moderators of the sessions are making notes, but only so that members' priorities and suggestions in relation to each of the priority topics set by the RG in the first workshop, were fully captured and can be factored into our future planning and design processes. These are documented and openly shared back with the RG, as well as the broader community through the project website. It is true that objections in-principle to the rezoning and change of use are not being recorded – this is because, as the RG EOI form made clear, the retention of the site as a golf course is outside of the scope of the RG and is not a topic for discussion in this forum. As far as you comment regarding the presenters being 'very presumptuous, a bit cocky, oozing in confidence, and that the rezoning is a mere formality which we know IT IS NOT!' - at the first meeting, [Name] Hajigabriel (from Rowe Group, the town planners) outlined in considerable detail the extensive and robust planning approvals process which the project is subject to. The engagement we are currently undertaking is in advance of that process, but once the application is submitted to the City of Cockburn they will assess it and advertise it for public comment. That will be a further opportunity for the community to express their views. We have been very transparent with the community about the planning process that applies to this project, and the fact that the rezoning is by no means a 'mere formality' despite continual inferences about this by the JRRA and other groups. I shared your email with the RG facilitators earlier today and they were surprised at your stance given "[Name] seemed pretty engaged in the process on the night with plenty of good ideas contributed to the table discussions". I hope that you will continue to participate in the RG in the way that is intended to function, however that is of course your decision. Regards, [Name] [Name] Principal"	Consultation process			

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23.10.20	26.10.20	Email	REF200	"Hi [Name], I'm writing about the discussion one of the residents raised on Wednesday night and including myself about the possible asbestos in the golf course. To say I am quite alarmed is an understatement. I believe it can be quite dangerous once digging commences. Are you or [Name] able to please inform us the residents how this will be dealt with. I am very concerned. "	"Hi [Name] Thanks for your email and for raising your concerns. While I can understand your concern, we don't need to get ahead of ourselves. Firstly, we have not found any evidence of asbestos on site, and the property is not included on any register of known contaminated sites administered by the Department of Water and Environmental Regulation (DWER). Secondly, if it asbestos is buried on-site, while it remains in an undisturbed state it does not pose any current danger. The only recent mention of asbestos has been anecdotal (from the JRRA), and as per our recent response letter to JRRA, we would really encourage the Association to provide us with more information if they have it, so we can investigate further. For example, I think at the meeting you mentioned speaking to someone who had been involved in the demolition of the former Tavern and Clubhouse buildings – as we mentioned to you, it would be helpful if we could have that person's contact details so our consultants can find out more about their knowledge of the disposal of materials at that time. Notwithstanding that, we will in time be undertaking more investigations as part of the future development planning, which may identify any material such as asbestos if it was present on site. Should those investigations find asbestos there are clearly outlined procedures and specialist licensed asbestos removalists to manage it, and it would be dealt with in accordance with all relevant regulations. Kind regards, [Name] "	Information request			
25.10.20	26.10.20	Email	REF201	"""Dear [Name] and [Name] The American Dale Carnegie style of presentation, coupled with the table changing musical chairs, was confusing for some of our more mature selected Australian participants. There was a lack of visible writing material for participants to take notes and there is still concern regards the onerous "code of conduct" regulations from the Terms of Reference: - :- maintaining confidentiality as required. The "as required""" was meant to have been clarified on the night but, as I mentioned to you during the evening, it was not satisfactorily addressed, and participants are still of the opinion that maintaining confidentiality cannot be breached. :-DO NOT "take photographs or video or electronically record proceedings in any way". Information available was lots of pictures of Perth's older, well-established suburbs, complete with very old mature trees, aerial shots of the golf course, with are are not supposed to mention, plus lots of August 2020 Community Newsletters with all the reference data on the first page. The Landscape and Environmental consultants verified that our trees would not look anything like theirs and did not mention the schools, or traffic lights on Berrigan Drive. The "Team" reiterated the Terms of Reference which state "this is a forum to facilitate communication" etc. Why can't the selected representatives use modern equipment (mobile phones) to reproduce data from meetings to use for discussions with residents whom they are supposed to represent (approx) 2,500). Is this "allowed" or is there some sinister motive for denial which then makes the entire proceedings questionable? """	"Dear [Name] Your email below suggests to us that you are not satisfied with the Reference Group set-up and process. The Terms of Reference and Code of Conduct for the Reference Group were provided for any prospective participant to fully review well in advance of these meetings, and these have been consistently applied by Metrix as the facilitators. The feedback from the Reference Group sessions so far, is that they are really helping many participants to better understand the rezoning and planning process, and the sessions have enabled participants to actively contribute their views on key elements of the proposed development for the Project Team to consider in the concept planning. Metrix has produced a summary of the outcomes of the first workshop, and will do the same for the second, and these are being shared with PRG members and the wider community. As we have previously stated, we don't have any expectation for Reference Group participants to support the proposed development at Glen Iris, but we do ask that they participate in accordance with the framework provided. It is entirely your decision as to whether you wish to continue as part of the Reference Group, which will continue to operate under the Terms of Reference and Code of Conduct agreed to at the outset by all parties. Regards, [Name] [Name] Principal"	Consultation process			
26.10.20	4.11.20	Email	REF202	"Hello [Name] I'm inquiring about the land at glen iris . Is there a time frame for release , block size & pricing. Any information would be appreciated. "	"We are a long way off land sales – the site needs to go through a rezoning process before the land can be developed as a residential community, and that is a lengthy and rigorous planning process that could take up to 2 years. If you check in regularly with https://www.haveyoursaygleniriseestate.com.au you will be able to keep up to date with the project and the consultation and planning process we are working through. Thanks for your interest [Name]. [Name]"	Land sales			
29.10.20		Email	REF203	"Hi [Name], Thought I would take this picture to show you how sad it is seeing the week old ducklings struggling to find food- green grass- they are now having to go through holes in the fence- cross a road to get to grass. I know it means little to you- just get the job done and roll in the profits. Have you got any further on the request to send out the emails of the reference group-can you remember the name of the guy that requested it. [Name]"		Flora & fauna			

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29.10.20		Email	REF204	"Hi [Name] , There are a few comments in the recent resident association Newsletter I would like to ask you about. See attached. 1- Is it now 950 houses? 2- What is your response for the asbestos? I heard at the meeting that you have tried to find it and have asked for any information on the location. 3 - Should residents get a vibration report? Thanks [Name]"	"Hi [Name] Thanks for getting in touch – answers below! No, it's not 950 houses. It is still 600-800 as per our newsletter – that has always been our position and continues to be. I think this was raised at the last workshop as well, and both [Name] and [Name] (from memory) restated the 600-800 figure, but for some reason 950 continues to be cited by some community members. We'll keep trying to get the message across! On the asbestos - Our environmental due diligence reports and preliminary investigations completed to date have not identified any specific asbestos on the land, but they have included statements that there is a possibility of asbestos containing material being on-site given the era of the original buildings from the Lakes Tavern and Golf Clubhouse, particularly if the demolition of the former structures was undertaken incorrectly. This is not an issue that would be limited to the former buildings and the site, but similar risks could apply to any buildings constructed during the era when products containing asbestos were used. However, there is currently no information to indicate that this was the case, rather, the preliminary site investigations which have been completed identified no evidence of asbestos containing material. More recently, we have been advised by the JRRA of some concerns of anecdotal claims that asbestos materials from the former buildings on site were buried on the land. We have written to the JRRA asking them to provide more details or contact details of people that claim to have this knowledge so we can have our environmental consultants investigate this further. We are awaiting a response from the JRRA. Vibration report – it is standard practice in civil construction projects for the contractor to offer property condition surveys to all properties within an agreed distance of the active works site. Usually the process is for the surveyors to letterbox drop every property within the agreed catchment area, offering a survey at the developer/land owner's expense (so at no cost to the resident). With residential land developments, it is often done in stages as each stage of the sub-division comes under construction. Hopefully this info is helpful [Name]. Let me know if you have any further questions. Kind regards, [Name]"	Information request			
1.11.20		Email	REF205	"Dear [Name], Rumours are spreading fast around the estate, that Eastcourt property Group spent a considerable amount of time, effort, lobbying, and dollars in fiercely opposing the Melville Wave Park project as it would have ruined the views, amenity, environment for a distraught junior family member, apparently. What a nice gesture for the ruling family. However, here we are, and the jackboot is on the other foot; Eastcourt Property Group are charging ahead with the plans to destruct our amenity, environment and green space without blinking. Some, well, most of the community have cried "double standards", "hypocrisy" or the more subtle "two faced" But more importantly, these so called workshops that are being held are attracting a mere 22-29 of the residents out of 750 homes on the existing estate. This is an appalling circa 3.5% of the community and does not represent a true, fair and balanced approach to community engagement. I also understand from various murmurings that none of the attendees support your infill plans. Seems you are wasting everyone's time. So, to prevent any further reputational damage, isn't time you finalised your bill, handed back the keys, and left town? I am sure Council or an operator, with the support of the JRRA, will step in with ease to restore the land and community support. "		General opposition			
2.11.20		Email	REF206	"Hi [Name], I wanted to just express my sincere thanks for these updates. Due to me still having to isolate with no immunity I could not attend any of the workshops but I would absolutely have LOVED to! (Could not send my husband alone as he suffers from a memory impairment and I have to accompany him everywhere) I appreciate all the effort going into this and keeping us appraised. Have a stunning day! "		Consultation process			
2.11.20		Email	REF207	"Hi [Name], That is fine to pass my details on Could be sorry I said that but what the heck Just want to say what a great job you are all doing with this project I came away last after the last meeting looking forward to the changes My only comment is that I think there are still too many people attending that are just there for their own needs and not thinking of the community outcome "		Consultation process			
3.11.20		Email	REF208	"Hi [Name], I live opposite [redacted], and there has been an awful smell at the front of my house for a few days now. I have had a good look around for any dead animals and can't see any. I suspect it is coming off the lake, as it is most obvious when the breeze is coming from that direction. (you have drained this lake). I would appreciate if someone can have a look at this problem please. "	"Hi [Name] Thanks for getting in touch – I'll let the project manager know so he can get someone to take a look. Kind regards [Name]"	Site maintenance			

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5.11.20	10.11.20	Email	REF209	"Hi [Name], As expected, the stench from the drained lake has returned following last night's rain. Please advise what you propose to do about this unacceptable situation- depending on your response, I will be referring this problem to Cockburn Council and the appropriate State Government departments."	"Hi [Name] Thanks for following up – I've spoken to [Name] (the project manager) about your concerns, and he suggested he could come and meet you to talk it through? Basically they pierced the liner last Friday in order to speed up the drainage and enable the mud to dry out, but as you indicated, the unseasonal rain has slowed down the process. Once the mud has dried out, they will get a bobcat in to remove the liner and sediment, so that this is not a recurring issue every time it rains. However – I'm sure [Name] can explain it in more detail than me! Would you be free on Thursday morning to catch up with him? If so, let me know your address (if you are happy for him to meet you at your house – if not, let me know where you would like to meet), and I will let [Name] know. I've cc'd him on this email as well. Thanks [Name]. [Name] "	Site maintenance			
5.11.20	6.11.20	Email	REF210	"Dear [Name] My wife and I have lived in the Glen Iris Golf Course Estate for [Number] years. In that time I have been [redacted] and, despite neither of us playing golf, we have become known through our "meet the neighbours" and "summertime street parties". Thus my written comments have reflected the very real concerns of many mature aged residents who see their retirement lifestyle changing. Of course there is opposition, coupled with fear and some apprehension for the future. Based upon my ability to represent some of the 2,500 residents I "was able to read" the terms and one-way conditions which had to be accepted in order to represent residents. The stringent one-way regulations quoted by Acumen, coupled with the marked response envelopes were not conducive to good relations and this is no doubt the reason for the poor response to be part of your Precinct Reference Groups - ie 26 participants - therefore 26 people representing 2,500, equates to 1.04% for your community consultation. Even with your (hopeful) participation of 60 people, this still only equates to 2.4%. However, I feel sure that when you tick the box for community consultation, you will be able to put 100% participation, which would appear to be deceptive. People were intimidated by the "confidentiality as required" clause which was ambiguous and my correspondence reflect this in emails to Acumen. As a so-called representative participant I should not receive a personal attack from [Name] (email dated 26/10/20 (pasted below) and copied to you) which states "your email below suggests to us that you are not satisfied with the Reference Group" etc "It is entirely your decision as to whether you wish to continue" etc ""Dear [Name] Your email below suggests to us that you are not satisfied with the Reference Group set-up and process. The Terms of Reference and Code of Conduct for the Reference Group were provided for any prospective participant to fully review well in advance of these meetings, and these have been consistently applied by Metrix as the facilitators. The feedback from the Reference Group sessions so far, is that they are really helping many participants to better understand the rezoning and planning process, and the sessions have enabled participants to actively contribute their views on key elements of the proposed development for the Project Team to consider in the concept planning. Metrix has produced a summary of the outcomes of the first workshop, and will do the same for the second, and these are being shared with PRG members and the wider community. As we have previously stated, we don't have any expectation for Reference Group participants to support the proposed development at Glen Iris, but we do ask that they participate in accordance with the framework provided. It is entirely your decision as to whether you wish to continue as part of the Reference Group, which will continue to operate under the Terms of Reference and Code of Conduct agreed to at the outset by all parties. Regards, [Name] [Name] Principal" This was my reply, also copied to you: *Continues in next page*	"Hi [Name] Thanks for getting in touch. I'll address the points you have raised in the order in which you have raised them. Reference Group - '26 people representing 2,500, equates to 1.04% for your community consultation' As you will recall, we had hoped to have 3 reference groups each consisting of 20 people. Our aim (via the EOI process) was to have each group represent a broad demographic of Glen Iris residents, so that the project team could hear the concerns and priorities of a diverse cross section of people. It was not an issue of numbers, more an issue of a range of households being represented – so retirees, young families, professional couples with no children, single people etc. The reference groups were never intended to be the only way community members could share their views with the project team; they can also email or call me, and their comments and feedback is documented and passed on to the project team. We are also only part way through the process, and there will be further opportunities and mechanisms for the community to provide input Confidentiality clause This has been addressed in several ways - with you and your wife [Name] via an email, by the facilitator at the start of the last reference group meeting, in a project update to community members who are registered on Have Your Say Glen Iris Estate, and in Latest News on Have Your Say Glen Iris Estate. I am not sure what more we can say on this topic [Name], but I am happy to provide again the clarification we have made on this, which is as follows: Clarification of 'confidentiality' clause in Reference Group code of conduct We have had feedback from two community members (one of whom is on the Reference Group) that there is a perception that the confidentiality clause in the Reference Group code of conduct prohibits members from sharing information from the sessions with their friends and neighbours. While this clause is standard in State Government Reference Groups, it is clear that in this particular situation it has caused confusion. We have clarified the intent of the clause with those two community members (both via email and verbally at the most recent reference group session), and we are sharing the text of that email below to clarify this situation once and for all: "The Code of Conduct is more to do with respecting individual's privacy (eg if a community member shares specific details relating to their property or personal situation); it doesn't mean that members can't share information about the discussions relating to the project. We are more than happy – indeed we would encourage - members to share information about the project and topic discussions from the workshops with their friends and neighbours." "Reply to my last email dated 22/10/2020" Apologies if you had been expecting a response to this email prior to our next Reference Group meeting [Name] – I had misunderstood your intention when you said "It is anticipated that a reply will be available at the next ARC meeting" to mean that you wanted us to address this questions at the next PRG. As you know, we have asked all PRG members to email us with questions by Weds 11 Nov so that we can address them at our next workshop, and our intention was to include your questions with any others that we receive as part of that process. I hope this clarifies the key points from your latest email. Kind regards, [Name]"	Consultation process			

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5.11.20	6.11.20	Email	REF210	This was my reply, also copied to you: "Dear [Name] Whilst I have been forthright in my communication with you, it has not been disrespectful and certainly not intended to be personal. I have stressed that my comments reflect views from the residents I am supposed to represent in the PRG exercise. Ref you email. Yes, I am able to read "the Terms of Reference and Code of Conduct for the PRG which were provided for any prospective participant to fully review well in advance of these meetings and these have been consistently applied by Matrix as facilitators". This is true, however, you should also agree that had I not ticked the box to agree to these terms, I would not have been permitted as a participant. You are obviously not aware that your Community Engagement Manager, public relations department sent an email (15/10/20) about the confidentiality clause, which included "I can see how the intent could be misrepresented so I will make sure the clause is rephrased on any future projects I work on to remove any ambiguity - so thank you for that insight". Also, [Name] stated that clarification would be made at the second PRG, which was not adequately and clearly addressed. Based upon your own organisation recognising the potential misrepresentation, I contacted you for clarification, not expecting a reply, which "suggests to us that you are not satisfied with the Reference Group set-up and process". As you point out," the feedback from the sessions so far, is that they are really helping many participants to better understand the rezoning etc". I had an interesting chat with Mr. [Name] McNish (GTA Consultants) who was courteous, very professional and extremely helpful. Two of us asked him about the traffic, specifically, three questions: 1. With 780 residents, how many cars are currently in the Glen Iris Estate? Using his calculator, he replied 5,000. 2. How many cars would the new development be expected to generate? Based on his information, he replied 5,000. 3. We then verified that 10,000 cars can be expected within Glen Iris and he agreed. I trust that this information will be included for the "Project Team to consider in the concept planning". Finally, despite your comments, I would be delighted to continue as part of the Reference Group.Regards [Name]" Based upon this non-constructive reply from [Name] I assume there will not be a meaningful reply to my last email dated 22/10/2020 - below) which was submitted in good faith to be given to the relevant 'Team Member' - not Acumen. The questions reflected very real concerns from residents. To date I have not received a reply from you, or anyone else. Therefore, as you have requested questions to be submitted by 11/11/2020, to be answered at the 3rd PRG, my questions are contained in the attached in the hope that they will now be addressed. In conclusion, I have a couple of questions, the first of which must be referred to Metrix, not Acumen, as it is of very great concern to the majority of residents. I specifically asked Mr. [Name] MacNish from GTA Consultants questions regarding traffic and roads. He was professional and very helpful explaining the roads were a concern and would probably run down the centre of the golf course. The big question on how much traffic was currently in Glen Iris was answered 5,000 cars with another 5,000 to be expected with any infill. As these figures will be quoted, I would like Metrix to reply as [Name]'s numbers may refer to possible future estimates and may not be relevant for the next few years. Please give Metrix the opportunity to quantify as the current figures do not appear applicable unless they are traffic movements. Second question referred to the quendas which are pets to many residents. The September Acumen Project information Sheet states, line 4 "A fauna assessment has been completed by Emerge Consultants". Without quoting chapter and verse, residents know that "quenda do not relocate well and invariably die due to predators etc"; thus if residents can be assured, based on evidence of survival of animals from Eastcourt's Wellard development, all will be well. The question of the Priority 1 grasshoppers was from a learned academic resident who was checking out Emerge! and their reported completed fauna assessment. I trust this will partly explain the reasoning behind the questions and why they should be answered in a factual way for distribution of those concerned residents. [Name], thank you for your professionalism and courtesy.					

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6.11.20	6.11.20	Email	REF211	[Name]- you must have got lots of correspondence by now of the putrid lake- I also notice this morning that they are now drilling our lake so we can expect the "beautiful aromas" as well. How would you like to live with it.? What are Eastcourt/acumen going to do about it- to me if it looks like a done deal-smells like a done deal- IT IS A DONE DEAL!! [Name]	"Hi [Name] One resident has contacted us - here is our response (sent yesterday): The project manager was on site this morning and had a look at the lake, and he agreed with your assessment. He's advised me "I inspected the basin this morning – this has a small amount of water left in it, and while there was no obvious smell this morning, when it heats up the wet mud may have an odour. Best thing we can do is actually puncture the lining to ensure the last remaining water drains away from this basin ASAP … once the mud dries it shouldn't be a source of odour during upcoming summer. We'll try and get this work done by the contractor by early next week." Kind regards, [Name]"	Site maintenance			
8.11.20	10.11.20	Email	REF212	"Hi [Name] This morning I went for my routine daily walk with my dog. As soon as I opened my garage door I was greeted by the sight of around 15-20 ducks herded together walking up my neighbours driveway. My first thought of course is they have no water because Eastcourt had arranged for the lakes to be drained. I hurried along on my walk ready to return to put a sprinkler on for them on the front lawn so they could get some much needed water, when I returned they were gone, no doubt looking for water somewhere else. This is sadly not an uncommon occurrence in the estate, many many people are deeply distressed by the amount of sightings of confused groups of ducks with their young looking for any available water source. There have been many near misses with cars as well as ducks killed as these confused ducks look for a sanctuary which has been needlessly taken away. As I have mentioned before, what Eastcourt has done here to date is downright disgusting, the draining of the lakes was not needed to be done, it was a calculated move by a heartless developer looking to kill off the wildlife, no question at all in my mind. The poor excuses of drownings in the lakes and mosquitoes does not wash, it has been confirmed that the mosquito larvae can be sprayed as it was done every year to stop large numbers spreading. I would personally be a human dartboard for the mosquitoes if it meant the ducks had a home for themselves and their young, especially as the weather warms up. There is a noticeable change too in the bird numbers in the estate, each evening there was always a deafening but pleasant sound of multiple breeds of birds in the trees, this year it is silent. Attached are many examples of displaced ducks in the estate. I would like this put on the agenda for the next meeting please, it is important that this is discussed if the community are being consulted with. The consultation sessions we attend should not all be about looking a pretty pictures and Acumen collating our answers to loaded questions, it is about the core concerns of the community, this being one. Is there anyone in Acumen of Eastcourt with a heart? Anyone with the slightest bit of compassion for the wildlife they are destroying?? Can they not refill the lakes with water? "	"Thanks [Name] – I have added this to the list of questions I am collating from PRG members for our next meeting. In the meantime, please see attached a factsheet about this issue (which you may already be aware of), together with some photos of four of the lakes taken on 9 November, showing they are still holding plenty of water. Kind regards, [Name]"	Flora & fauna			

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9.11.20	10.11.20	Email	REF213	"Good evening [Name], Regarding the broadcast on 6PR882 on the 28 October 2020 titled "Both sides of the debate: Glen Iris Golf Estate". There were several misleading statements made by your Spokesman throughout, as follows: Golf course was closed before you brought it..... Fact - The sign at the gate stated they closed due to Covid 19? It did not say it was closed for forever. Fact - Eastcourt Property Group purchased a fully operational Golf Course. "Provide a lot of new amenities / "Open Up the heart of the community" – We already have a bar, restaurant, and shop. The community (and the attendees of the focus group) have no desire to increase this quota. The community want to retain the existing amenity (which is slowly being eroded by your inactions) which is the existing trees, bushes, fauna, wildlife, walking trails, vista, and green open spaces. There is no community desire any infill. "The supposed wetlands.....seven man made irrigation basins" - Whilst they were utilised for providing irrigation, they also had a secondary and long established use of providing a dependable habitat for rare and endangered species. It is not unusual for golfing estates, parks and open spaces, with manmade irrigation basins and lakes, to provide a source of food and shelter for wildlife. This is further demonstrated in a recent report in www.golfAustralia.com.au. "Further proof that golf courses are environmentally beneficial"....! In particular: "The researchers demonstrated that properly managed golf courses provide the greatest amount of cooling among land uses, are more supportive of pollinators than urban residential or industrial areas, and retain more nutrients from stormwater runoff than suburban or urban residential areas. In general, this demonstrates that golf courses enhance surrounding communities in much the same way as city parks or open green spaces" So, [Name]'s statement that they are just manmade irrigation lakes is meaningless and does not recognise the environmental importance that they represent. "325KL of water poured onto the land annually" There is some doubt in the community regarding the stated water consumption level .To establish the accuracy of this statement, Eastcourt Property Group are kindly requested to provide evidence of this water usage for the last five years (golf course and clubhouse). Finally, I note you have not provided a response to my email of 1 November 2020. "	"Hi [Name] Thank you for your email below, and your earlier email (attached), which (with the exception of the question in your most recent email, relating to water usage and answered below), we have taken as comments/feedback. In response to your request for records showing water usage for the past five years (golf course and club house), Eastcourt was not the owner of the golf course and club house during that period and so we do not have those records. Kind regards, [Name]"	General opposition			
9.11.20	10.11.20	Email	REF214	"hi [Name] thanks for this feedback. i have some comments: 1. the summary as represented is not in alignment with the key issues presented by participants at the first two workshops. the summary incorporates only those inputs that harmonize with the developer's agenda and profit imperative 2. the framing as depicted currently is incoherent with the win-win principles espoused by your team. 3. the framing has no alignment with the views of the residents with properties directly adjacent to the golf course. 4. the concerns i raised (per above) following workshop 1 were not addressed in workshop 2.. despite the assurances i received at the commencement of workshop 2. "	"Hi [Name] Thanks for getting in touch and providing your comments. As outlined in the Terms of Reference (attached), the role of the PRG is to: Assist in identifying, discussing and advising on areas of interest to the community associated with the proposed redevelopment. Receive information from Acumen Development Solutions and its specialist consultants for consideration with the wider community. Provide representative community input into the vision for the proposed redevelopment. Workshop specific topics and areas of interest relating to each individual precinct, to assist the project team in creating a community that reflects the priorities of existing Glen Iris residents. The workshop process has been specifically designed to focus around the areas that are of interest to PRG members – session one identified 5 key areas of the future development, and session two provided the opportunity to explore the potential outcomes of these in more detail with subject matter specialists. I am not sure how much more 'member led' we can make the workshops whilst adhering to the Terms of Reference and the agreed role of the PRG. It is therefore entirely appropriate and in keeping with the stated role of the PRG that the workshop summaries document the kinds of design elements, interface solutions between existing and housing and any future development, open space and amenity, traffic and access considerations etc that are important to PRG members should any residential development be approved. We believe that is what Metrix have done in these summaries of the sessions to date. Having said that, if you have feedback you would like to provide to the project team that does not neatly sit within the agreed Terms of Reference for the PRG, you are more than welcome to document it via email and send it through to me for capturing in our register of feedback. I hope this information is helpful in clarifying the scope of the PRG and its role. Kind regards, [Name] "	Consultation process			
10.11.20		Email	REF215		"Hi [Name] Just emailing you a little reminder to send in your list of questions you would like the project team to address at the next PRG – I need everyone's questions by COB tomorrow (Wednesday) so we can get input from the consultants as and where we need to. Thanks [Name], look forward to hearing from you. Kind regards, [Name]"	Consultation process			

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18.11.20		Email	REF216	"Hi [Name] We have been in liaison with [Name] Pleasant at City of Cockburn over the past week or so regarding your concerns in recent emails. We will provide some answers to [Name] specifically addressing those questions, so she can respond to you and the others included in your email. We do however feel there would be merit in meeting you on-site at Glen Iris, so we can discuss your specific concerns and perhaps drive around the land to show you the areas of the site that your questions relate to. If you are available tomorrow morning, we could meet at 8:30am. Please let me know. Regards, [Name] [Name] Principal"	"Thank you re your request to meet up with you [Name], however I must decline. As per my original email request to City of Cockburn, please keep all correspondence via them. Regards [Name]"	General opposition			
21.11.20	24.11.20	Email	REF217	"Hi [Name] Thanks for your email. Is there another Reference Group meeting still to be held? If not, will we get a chance to see the draft plans before they go to Council? Thanks. "	"Hi [Name] Yes, we'll be meeting again (probably in late Feb) to review a concept plan based on the various inputs from the community and the consultants. This will be prior to any lodgement of plans. Kind regards [Name]"	Consultation process			
21.11.20	24.11.20	Email	REF218	"Hi [Name].could you please confirm name and area of expertise for the Emerge presenter at the last Wednesday meeting. Thank you. TTFN "	"Hi [Name] Julia Morgan is a Senior Environmental Consultant within the environmental planning team at Emerge Environmental Associates. Julia provides environmental support and manages complex environmental approvals for all stages of planning and development design, specialising in the land development industry. She has worked on major residential, industrial and rural land developments throughout Western Australia, Victoria and New Zealand and holds a Masters of Environmental Policy and Planning (hons) and a Bachelor of Science. Kind regards [Name]"	Consultation process			
22.11.20	24.11.20	Email	REF219	"Hi [Name]. A question was asked regards the Stylet bush cricket and the response was" the grasshopper referred to is the Stylet bush cricket and was identified and reported on in the fauna assessment (Emerge Assoc 2020 etc). Could you please clarify " identified and reported" as this is very important being a P1 and any areas would be significant. Thank you. TTFN "	"Hi [Name] See below from Emerge: We identified the species in desktop review of conservation significant fauna. This means that the species or its habitat has been recorded in nearby area (within 10km). We have not recorded the species within the site. There is no information that indicates that the species does or might occur within the site. It is our professional opinion that the site does not provide important habitat for the species owing to the small size of the areas of remnant vegetation within the site and their generally degraded condition. Kind regards [Name]"	Flora & fauna			
22.11.20	24.11.20	Email	REF220	"Hi [Name]. The traffic fest advised that proposed infill entrances would be on the west from Glen Iris in the northern aspect. Could you please confirm the reported traffic flow on Glen Iris drive of 1500 traffic movements per day . Thank you. "	"Hi [Name] [Name] from GTA has provided the following advice: Highly dependent on final lot numbers and configurations but yes the daily two way vehicle trips on Glen Iris Drive would be in the order of 1,500 trips per day. Kind regards [Name]"	Information request			
24.11.29	24.11.20	Email	REF221	"Hi [Name]. At the last meeting a figure of $931000 per year was quoted for water costs to irrigate old golf course could you kindly confirm. Thank you. TTFN "	"Hi [Name] I'm not sure where that figure has come from, as it's not information anyone in our consultant or project team would have - we have never operated the golf course and are not privy to that information, so it's not anything we can confirm for you [Name]. Kind regards [Name]"	Information request			

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26.11.20	26.11.20	Email	REF222	"Hi [Name] Thank you for the response regards my recent questions; also the data from [Name] and Tanya. I realise my questions are unwanted and the GTA professionalism is appreciated. Question for GTA: Areas of interest is the northern part of the Estate, ie 608 homes, north of Berrigan Drive, inclusive of Glen Iris Drive to the west, continuing as Dean Road along the east. Glen Iris has many cars thus, conservatively, we allocate two cars per family although there is one house across the road from me with five cars and five drivers. Have you calculated existing am/pm movements already on the street, plus future development movements depending on present and future number based on daily two-way vehicle trips on Glen Iris Drive? We thus have current, say, 1,200 cars, plus potential infill cars of 400 north (200 homes) and 500 centre (250 homes). Therefore we will have 2,100 cars able to use the subject road. This does not include commercial, retail, service vehicles and trades associated with years of development. Kindly advise, or confirm, your figures based on the above, plus does it conform with Cockburn Council's 'guidelines for traffic density in suburban arteries'? At the moment the footpath is used by keen joggers, runners, walkers, plus a wide variety of children, prams, plus pet animals on their daily walk. They rule the verge so much so that the cyclists have to go on the road which will become a potential death trap with high traffic volumes. We had a house fire which was attended by six major engines loaded with water plus the big ladder truck. Those vehicles destroyed all of the pavement which had to be replaced. In addition, while the big ladder truck was in action, it caused cracks and depressions in the 6.6m wide road which was installed 25 years ago. Could the road be resurfaced and widened under your plans and potential traffic density for the future? Is there a crash data review with such a narrow road/volume ratio? Finally, will these figures comply with the reported trips per day of 10,000 traffic movements at the key intersection along Berrigan Drive for a typical week day? Thank you."	"Hi [Name] We are a quite a way off from having that level of detail– no formal modelling will be done until we have a plan to fully understand road access and movement, so GTA can't answer those questions at this stage. Kind regards [Name]"	Traffic			
27.11.20	27.11.20	Email	REF223	"To whom it may concern, I write regarding the pile of wood chips and old logs on the edge of the 17th Fairway on the Glen Iris Golf Course and [redacted]. I wrote to the City of Cockburn a couple of weeks ago as I regard it as a fire hazard. So far no action has been taken. Today I had cause to have termite treatment at my property. The technician pointed out this pile of wood is also an ideal breeding ground for termites. I would be grateful if you could see to the removal of this hazard ASAP. Thank you in anticipation "	"Thanks for getting in touch [Name] – I will let the project manager know and will find out what the plan is with that pile. Kind regards [Name] FURTHER REPONSE 1.12.20 Hi [Name] The project manager was on site yesterday morning and checked out the pile of logs you mentioned (see attached picture). He will arrange for our tree loppers to remove these when they are next on site, which at this stage is likely to be tomorrow (Wednesday). Kind regards [Name]"	Site maintenance			
30.11.20	30.11.20	Email	REF224	"Hi [Name], The smell from the lake is back after last night's rain, as expected. When will the lake bottom be scraped as you described? Over 2 weeks ago, you said it would be done in 2 weeks time. You also said you would copy me on any relevant correspondence. The remaining water is almost gone. Please advise [Name]"	"Hi [Name] Thanks for your note. I can understand that the rains last night would have again dampened the "mud" and today it would be smelling again as the sun has come through. I was on site around 1 week ago with a contractor looking at the excavation job. They have come back to me as of Friday last week, and provided feedback to me that a layer of 150mm to 200mm of clean sand fill over the top of the "mud" may be a suitable alternative to excavating the former lakes. I told them I wanted to seek some advice around this before committing one way or the other, as I want to make sure we have the right solution to stop the odour. We are committed to getting it sorted, and I'll have a position finalised this week for work to commence shortly. Regards [Name]"				
30.11.20	3.12.20	Email	REF225	"Dear Sir/Madam Attached please find a file dealing with the above-referenced matter. Thank you. "	"Thank you for your email to Eastcourt Property Group's Managing Director, [Name] Oosterhof, about the development of Glen Iris Estate in Jandakot. We acknowledge your views on the Precinct Reference Group and have noted them on our Community Engagement Register. Kind regards [Name]"	Consultation process	General opposition		

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1.12.20	1.12.20	Email	REF226	"Good morning [Name] Firstly I wanted to let you know I spoke with Len and told him that you mentioned to me the other day you would be interested in catching up with him for a coffee and a chat sometime. He told me by all means he would like that and to give you his mobile number and to feel free to give him a call to arrange a time to do so. His number is [redacted] if you don't already have it [Name]. On the subject of the gas mainline being installed through the golf course, the path that is marked by the posts with pink tape appears it will cut through the edge of the small pond that currently holds water for the several sets of small ducklings hatched over recent weeks. (Most recent being 11 new ducklings two weeks ago). It also appears several small trees at the ponds edge will need to be removed and obviously the earthworks and subsequent noise will frighten and send the ducks fleeing from the lake. I also wondered what this will do in affecting the current water levels? As you know they are too small to fly any distance at all or be strong enough to walk up to the one remaining lake containing enough water to support their survival over the next 2 months until they can fly away. Could you please let me know what is the plan for the laying of the pipeline close to the pond (closest to Hartwell parade) surrounding the ducks safety. I understand these works are not being carried out by yourselves but the ducks are on your land and surely there must have been discussions regarding them in preparation for works to commence. [Name], as you, myself and [Name] have discussed before this water source is the only one left for the ducklings unless they can move on and up to the northern one. I look forward to speaking with you soon. "	"Hi [Name] Thanks for the email. I'll get in contact with Len in the coming week for a coffee - appreciate you sending me his mobile number. The pegs with pink tape are the northern boundary of Lot 3 (which is the former Jandakot Rd reservation), now owned by Eastcourt. The actual ATCO pipeline will be on an alignment 4.2m inside (to the south) of that boundary. There will be 2 trees (both non-native) removed over near the lake towards Hartwell Parade, plus a long low branch from a close by White Gum tree will be lopped. The construction trench wont impact the lake or need the water to be drained, although I appreciate the construction noise and machinery will disturb the ducks and ducklings. We have made the contractor working for ATCO aware of the lake and ducks, as well as the local community concerns about their safety. We don't have much influence over this work, as ATCO operate under an State infrastructure arrangement. We have managed to make some small design changes to the overall pipeline installation to avoid as many native trees as possible, and have provided them with the advice around the ducks. Hope this helps with your query. Regards [Name]"	Flora & fauna			
2.12.20	3.12.20	Telephone	REF227	"Telecon with [Name] - voicemail from [Name] Weds 2 Dec; call returned Thurs 3 Dec: Wants to have a hard copy of the presentation from PRG #3 to discuss with his neighbours. Raised following issues: PRG and consultation process is too rushed. Consultants are unprofessional There is no trust in Eastcourt or Acumen Eastcourt is hiding behind Acumen He doesn't want any more traffic on Prinsep Road We will not listen to the community and will just develop a plan that suits Eastcourt [Name] to drop off hard copy of presentation to [Name]."					
2.12.20	2.12.20	Email	REF228	"Hi [Name]. I trust you are keeping well. Since there is still some water in at least one of the lakes at Glen Iris it seems very strange that there is a distinct absence of the abundant bird activity that used to frequent Glen Iris. Can you please confirm with Acumen or Emerge that a bird deterrent has not been installed to drive the birds away especially as bird numbers at nearby Jandakot airport have not changed. Thank you. "	"Hi [Name] No, we haven't installed a bird deterrent. Kind regards [Name]"	Flora & fauna			
3.12.20	3.12.20	Email	REF229	"Hi [Name] I live next to the pedestrian walk way on [Address]. It is identified as a 'Vehicle Conflict Area' can you please advise on why this is. Are we getting a road behind our house? All the other areas marked as 'Vehicle Conflict Area' are on existing roads. There is no current road near the back of my house. "	"Hi [Name] Thanks for getting in touch. I've raised this with the project manager, and he has advised: "The reason this is identified as Vehicle Conflict Area on the base context plan is because the site in this area is not wide enough for a public road, so we are just highlighting the fact a road won't be constructed in this area. Given it has an existing PAW ([Name]a I think this stands for Public Access Way!), it likely this area will be incorporated into a new and larger public open space area in the section of the future development, as other options are limited. The existing PAW will be retained, and the golf course bridge over the top will likely be demolished to open up the area as integrated open space." Hope that reassures you. Kind regards [Name]"	Traffic			

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4.12.20	4.12.20	Telephone	REF230	"Hi everyone I have just had a 20 minute phone call with [Name] [redacted] who was calling me as she felt we need to know about the behaviour of a break away faction within the PRG. This is the group that shared contact details with one another. ([Name] – note that [Name] is a member of this group). They are acting outside of the JRRA as far as [Name] is aware, although I imagine they are sharing information and tactics. Key organisers are [Name] [redacted], [Name] [redacted] and [Name] [redacted]. They are meeting every Tuesday night to progress their 'campaign' which so far includes writing to the Premier and Ministers, the Council, organising interviews on 6PR, walking the streets of Glen Iris and 'doorstopping' residents to tell them about the awful things that we are doing to their community, putting a petition together, making signs to put up on the internal roads ("Stop the carnage"), organising BBQs (tomorrow's Day on the Green event I would imagine),cornering people at the local shops/hairdressers, and apparently collecting duck poo from the bottom of one of the 'dried up lakes' to get it tested to see if it is a health hazard should particles of it become airborn (and that's before we even mention asbestos...). [Name] said she has about 30 emails in her inbox right now from them – they are highly active. She described hiding from [Name] [redacted] as he stalks residents on the local streets, and called [Name] [redacted] a bully. Her feeling is that the group is beginning to grow – from a handful of active residents to a broader community. One other thing that [Name] mentioned – she said that residents had tried to sue the original developer of the estate but that didn't work, so now they are coming after us – she was on a roll so I didn't get a chance to ask more about that. Other than that last point, nothing really that we didn't already know, but [Name] is outraged that we are being so open, professional and reasonable, while all the time these people are plotting 'behind our backs'. She worries we are wasting our time, and that none of us should be subjecting ourselves to the level of rudeness and bullying that these people are inflicting on us. She feels we need to be tougher on shutting people down when they are time wasting with silly or repetitive or irrelevant questions. For her part, she believes we are doing a great job – said she returns home from the PRG meetings all excited about the opportunities and possibilities for the new community. I told [Name] that while it is disappointing, we do regularly check in with each other to make sure everyone is doing okay, and that we are all still committed to acting in good faith and continuing to seek input from the community. We will never have constructive input from the likes of [Name] [redacted], but there are other voices and opinions that are out there and we need to give those people every opportunity to be heard. Upshot is – we keep doing what we are doing, acting with integrity, and accept that this group will keep doing its thing. Practical things we can do: Share workshop summaries as broadly as possible – demonstrates we are being v open and accessible with info Newsletter – this will reach the whole community and help to offset some of the misinformation being spread by opponents Keep adding content to HYS Ensure pollies and councillors continue to be briefed and receive our comms materials etc I think we can expect this group to ramp up over the holiday period. While we need to keep a watching brief, I think we stick to our strategy, stay on the moral high ground and trust the process. Maybe we can discuss on our catch up next week? Kind regards, [Name] "					
8.12.20	10.12.20	Email	REF231	"Hi [Name] My name is [Name] [redacted] I my address is [redacted]. I was wondering if you any indicative ideas for the planning of the driving range behind my property. Regards [Name]"	"Hi [Name] Thanks for getting in touch. We don't have a concept plan as yet -that is something we are working through with the Precinct Reference Group and the specialist urban design, planning, environmental and traffic consultants. Our next meeting of the PRG is planned for late February next year, when we should have more detailed information available. All of the information that is currently available can be found at https://www.haveyoursayglenirisestate.com.au/ Thanks [Name] [Name] "				
9.12.20	10.12.20	Email	REF232	"Hi [Name] Thank you for the info you are providing from the work of the Reference Group. We are new to the area [Address] and are keen to stay informed. Are we able to attend the next reference group meeting in late Feb 2021 or is it a closed meeting? "	"Hi [Name] Thanks for getting in touch and for your interest in the Glen Iris Estate project. The PRG workshops are for people who nominated to participate back in Aug/Sept; they have been working as a group to progress ideas and solutions across a range of topics they felt were important, and the February meeting will be the next step in that process. If you register at https://www.haveyoursayglenirisestate.com.au/ (if you haven't already) you will receive project updates as more information becomes available, as well as details of opportunities to provide feedback to the project team in the new year. In the meantime you are welcome to send through any specific questions to me and I will get the information back to you. Thanks [Name]. Kind regards [Name]"	Consultation process			

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11.12.20		Email	REF233	"Dear Sir, We are writing to you to express our strong opposition to the proposed rezoning of the land what was Glen Iris Golf Course. About [Number] years ago my wife and I bought a block in the Glen Iris Estate. At the time we paid a premium price for the block because it included t.e following amenities; (a) the block was adjoining a golf course with many trees and lakes fall of wildlife. (b) a public restaurant at the golf course, a public bar and cefe. (c) the Cockburn City Council did wonderful work planting what is now a mature tree-lined drive, with footpaths providing a lot of shade when walking in the pleasant quiet surrounds. (d) we designed our home (Beaumont Homes 1998) so that we could maximise the vista the golf course provided, including open views of mature trees and wild life. (e) the only road into Glen Iris was narrow and quiet because there were no schools or shopping centres in the estate. As we all well know, we arrived in this world with nothing and we will all leave with nothing - what happens with our lives in between depends on how we treat other people. It has even been said 'Watch, and be on your guard against avarice of any kind for a man's life is not made secure by what he owns, even when he has more than he needs' With. Christmas again on us and some time to reflect on the year we have all had, my wife and I are asking you to reconsider the proposed rezoning of Glen Iris, before it goes any farther. No doubt you are aware of all the anxiety it is causing the residents of Glen Iris and neighbouring communities.You would be welcome to come to our place for a cup cf coffee in order to get a feel for Glen Iris and its character. If we don't hear from you., we wish you and the people close to you a great Christmas and please spare a thought for Glen Iris in the New Year. "		General opposition			
14.12.20	14.12.20	Email	REF234	"Hi [Name], Pleased to hear below that you have had discussions with a contractor, however the weekend rain has produced more odour problems. Your initial forecast of a week or two to fix the problem has now turned into a month. Very keen to see this fixed now. Please advise the confirmed solution and when this work will be done. Thanks, [Name]"	"Hi [Name] The contractor is waiting for the result of laboratory tests on the dried mud layer to determine the appropriate re-use or disposal for that material. Those samples were taken to the lab about 10 days ago, and based on estimated timing, they should have the analysis back before the end of this week. We can then start the removal process of the "smelly" material. He contractor is local and can work over the holiday period, outside of public holidays, etc. Regards [Name]"				
14.12.20		Email	REF235	"Just read the community newsletter and it is a pack of lies , how can you put out such dribble. I hope people reading this don't actually believe this rubbish, is this from your survey which was worded so badly you couldn't really put down what you thought of the destruction of the golf course. Even in that the statement for you said it was offered to the council but they refused it and the council then came out and said it was a lie but never saw you letter apologising for putting out false information? Also the lakes were drainingj while young were still in them"		General opposition			
14.12.20		Email	REF236	"Dear Mr [Name] Oosterhof, Since my email of the 11 November 2020, to which I have not received a response, with the release of todays Community Disinformation Newsletter Edition 2, I thought I would take the time to write to you as we approach the festive season. The Community were hoping by now that you could no longer tolerate the ongoing tarnish to your organisations name and reputation from the frolics of your project team; so whilst you fumble your presents on Christmas Day, we hope you finally take time to consider your retreat from the Glen Iris Golf Course. Hopefully, you will finalise that decision whilst tucking into your bird.... To ensure the festivities and celebrations kick off in earnest, I will be taking the time to review the inaccuracies and assertions made by your project team in Edition 2, and will share these with Council and State Government. No doubt others will do the same..... "		General opposition	Consultation process		
18.12.20	21.12.20	Email	REF237	Merry xmas - unless you are a DUCK or the people with destroyed dreams!! [Name]	"Dear [Name], It is always distressing to see wildlife that have been injured or killed on local roads. I am assuming this photo was taken somewhere in Glen Iris, perhaps near Dean Road. Unfortunately, it seems there has always been danger in the area for the ducks, which is why the City of Cockburn has annually put out signs warning drivers to take care along Dean Road for many years now. I can assure you that our environmental consultants continue to regularly visit the Glen Iris Estate project site and are monitoring all wildlife. As always, if you or any other residents have information about wildlife at the site that you believe we should be aware of, please make contact. Regards [Name] [Name] Principal"	Flora & fauna			

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18.12.20	18.12.20	Email	REF238	" Hi [Name] , Could you please advise name plus official title for Metrix presenter at third gathering. Thank you. TTFN "	"Hi [Name] Do you mean [Name]? Stephen Gilmour, the main facilitator from Metrix? His title is Client Services Director at Metrix Consulting. Kind regards [Name]"				
21.12.20	21.12.20		REF239	"Further my letter of 16th December, could I please be favoured with a response? Regards [Name]. Thank you for your December Community Newsletter ... I have always had an interest in statistics ... and have been fortunate to share my interest with others as a [redacted - job title]. I was therefore intrigued to learn from your newsletter that 80% of the respondents were in favour of your development ... and 90% had no interest in the loss of amenity resulting from the proposed development ... and similarly 90% had no interest in declining property values resulting from the proposed development. I say declining property values (as opposed to increasing values) through first hand valuation of properties before the announcement of the development – and current valuations post development announcement. Here's a photo showing the concern some residents have regarding the negatives of the proposed development:- ... and a further 5 residents queuing up so sell as soon as these are sold – all citing the inverse of what your newsletter claims ... 80% in opposition to the development ... 90% are seeing declining property values ... 99% have concerns about Homeswest ... 98% are concerned about increased traffic and road safety ... and 90% are concerned about the loss of amenity. You would, of course, respond by saying the above statistics are anecdotal ... although the above homeowners have enough "skin in the game" not to believe the statistics you have produced ... and are voting with their feet. I – on the other hand – am prepared to keep an open mind, as the truth is always in the data. So, as a fellow statistician, I am sure you would have no objection (indeed, would be pleased) in sharing the datasets with me ... so that I can satisfy myself as to the veracity of your conclusions. Afterall ... to quote [Name] Twain ... ""There's lies, damned lies ... and statistics"". Should your conclusions stand up to the rigour of Fact Checking, I would be more than willing to be cited as a reference to the authenticity of your claims. Data should be sent by email to [redacted] "	"Hi [Name] Thank you for your feedback. Just to clarify, the newsletter does not state that '80% of respondents are in favour of the development'. Those statistics relate to the topics/areas of concern that community members have raised with the project team since April this year. So 20% have expressed a general opposition to the project; but others have been more specific, for example, identifying issues around flora and fauna, or traffic as their key areas of interest. The statistics merely reflect the topics that are top of mind for people who have contacted us to provide feedback. I hope that clarifies the information for you. Kind regards [Name]"	Consultation process			
21.12.20	21.12.20	Email	REF240	"Thank you for your response ... I am still having a little difficulty in understanding the figures. Am I to understand that the figures are percentages of ""areas of concern"" of the respondents? [Name]."	"In simple terms, if we had 100 telephone calls then: 20 of them were expressing general opposition to the development 18 of the callers wanted to talk to us about tree and site maintenance 17 of them were focused on the consultation process itself 10 of them were concerned about impacts on property values Etc etc Does that help? [Name]"				

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22.12.21		Email	REF241	"EMAIL TO STEVEN FOLEY AT JDSI Dear Mr. Foley At the 3rd Glen Iris Precinct Reference Group (PRG) meeting (December 2020), the matter of dilapidation reports was raised in relation to the proposed infill development. As part of the PRG, Mr. [Name]n Foley, Director, JDSi consulting group, replied to questions on dilapidation reports and the subject was not satisfactorily addressed. The writer referred to homeowners obtaining their own dilapidation report which was answered "they would not be accepted". Mr. Foles advised that dilapidation reports would be carried out "where necessary" and he advised they would be undertaken by "contractors". Further enquiries regards overall responsibility for matters arising from such reports was not addressed. The brief discussion was concluded by the facilitator with a stock reply to serious questions "Eastcourt implemented an industry standard approach etc" (PRG Q&A November 2020). Should the development proceed there are two major issues of concern, namely the Council's Plane Trees with their invasive root systems and the integrity of the aged boundary wall of most properties. The homeowners' wall is constructed of "quarry limestone" which is over 20 years' old, secured with ageing mortar joints which will be compromised by shock waves from heavy construction work (Ref: Bibra Lake damage from road works and ceiling damage, Tapping). London Plane trees are banned by many councils due to associated problems, however, Acumen et al propose further problem trees in the suggestion to transplant Plane trees (PRG December 2020). City of Cockburn acknowledges the problems of these trees as recently as 17 December 2020 in the Community Newspaper - "Cost the city considerably to deal with the London Plane issues, including excessive leaf litter and root damage to footpaths, driveways and homes." In addition, there are serious health issues, specifically respiratory concerns, associated with the fruiting balls. "The roots are so tough and aggressive they they (tree roots) can lift sidewalks and curbs, invade sewer pipes and crack building foundations" (www.urbanforestsurvey.com). It is the invasive roots affecting homes that will be exacerbated by construction shock waves - (forums.whirlpool.net.au) (Excavation Reinstatement Standards City of Cockburn - www.cockburn.wa.gov.au) (The Construction Vibration Damage Guide CVDG (vibrationdamage.com) "Family blame ceiling collapse on road work" (West Australian, 6 July 2015) blamed on Perth Road Infrastructure Project. "Ceiling collapse, Tapping home"", blamed on nearby Joondalup roadworks. Thus, heavy construction associated with any proposed infill development can affect homes who cannot be adequately insured. Should homeowners undertake their own dilapidation report you state it will not be accepted. An aggrieved homeowner with damage from construction shockwaves has recourse to whom? (a) Homeowner's insurance company? -no help as "known occurrence"; (b) Eastcourt ? - Industry Standard reply; (c) Construction company? - which one(s)? (d) Cockburn Council? - caused by compaction? (e) Cockburn Council? - caused by Council's approved Plane tree roots? (f) Where is pre-work dilapidation report, etc etc? Since any development will result in high profit for the Eastcourt and increased rates for the City of Cockburn, we have a right to protect our properties which are liable to be damaged in the process. With that in mind, and with regard to the comment that independent dilapidation reports undertaken by the homeowner not being accepted, please advise on what legal basis this can be asserted? "	"Hi [Name] [Name]n Foley from JDSI has passed on your email to [Name] as the Project Director, which was 100% the appropriate thing for him to do. The consultants who attend the PRG are not engaged by Eastcourt or Acumen to be 'on call' at all times to residents – community liaison remains the responsibility of myself and [Name] as Project Director, and I hope you will respect those professional boundaries. Should you require information relating to the project, which you believe requires input from the specialist consultants, please direct your enquiry through me and I will source the information for you as appropriate. This will be a more efficient process. I have attached the written responses we have previously provided to the Precinct Reference Group, which includes information about the property condition survey process and retaining walls, and which therefore addresses the points you have raised in your email. Kind regards [Name]"				

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22.12.21		Email	REF242	"Dear [Name] Throughout my business career I have been used to dealing with professionals, whatever the circumstances. Up until now I have always respected your politeness and professionalism; however, the tone in your latest email has surprised me and suggests that offence has been taken. It was never my intention to offend Mr. Foley. Mr. Foley gave me his business card (see attached) which would normally suggest he did not object to further contact. You say this is all incorrect under whatever current rules dictate. You state that the consultants are not engaged by Eastcourt or Acumen to be on call. I do not believe that any of the PRG participants have taken this approach but, as previously mentioned, Mr. Foley gave me his card which, to my mind, indicated that I could contact him direct for clarification of a statement he made. Accordingly, I do not believe I have disrespected professional boundaries as you have suggested. Your email dated 30 October 2020 (7.51pm) states "during workshop 3 we will be asking you to work with the consultants to develop a high level concept plan for the proposed development." "The consultants will be on board to advise on the site constraints and opportunities to be considered and to provide insights as you can work with them to delve deeper into the topics you discussed etc. Thanks everyone, [Name]." (emphasis mine) Questions were asked 13 October 2020 regards dilapidation; answers Q&A November 2020 and replies were, as normal - vague and inconclusive. At the third PRG session, Mr. [Name] was put forward to answer the many questions on dilapidation responsibility and after a short time questions were terminated 'to return to the planned agenda'. Your attached written responses have not addressed the question I raised in this current email ie what is the legal basis that an independent dilapidation report will not be accepted? There are three parties in this proposed development: Eastcourt, Cockburn Council and the residents of Glen Iris. The former two will receive great financial reward, but the latter will suffer mental, health, and financial hardships, which should receive serious consideration. Glen Iris is not virgin land, like Wellard. If the PRG and greater Glen Iris community were of the opinion that the PRG's were being conducted with truth and transparency and included both positive and negative discussion, there would be no need for correspondence to include the City of Cockburn delegated and elected members, nor the management of Eastcourt. Having held senior positions during my working career, if I were Eastcourt, I would want to know what is going on. Please pass on appropriate apologies to Mr. Foley, but I would still like to receive an answer to my question, ie what is the legal basis that an independent dilapidation report will not be accepted? Thank you. "					

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30.12.20	Meetings over Christmas holiday period.	Email	REF243	"Good morning [Name] I suspect you are presently on holiday at the moment and this is why I have included [Name] and [Name]a in this email so someone will open and read this information. The pond where the ducklings were located (behind clubhouse near corner of Hartwell Parade) is now sadly almost completely drained (see attached pics taken yesterday) leaving 16-18 still unable to fly, yet with no clean water to swim, cool themselves or obtain their now only food source from. As you know the grass is now completely dead so they are unable to eat the grasses or forage for bugs either. The small amount of water that remains as of yesterday is putrid and full of decaying matter which in itself poses the further threat of botulism, a slow and cruel death if they have been infected. They are unable to make their way up to the one remaining lake at the northern end of the estate mainly because they cannot yet fly but also because the weather is way too hot during the day to move such a distance and at night they are open to predation. This situation completely and utterly devastates myself and many other residents who have loved these birds living here for the past 15-25 years. You have advised me in our many previous conversations and emails that the draining of the lakes are being managed by the watchful and continual monitoring of the wildlife and under advice given to you from your "environmental experts", therefore may I ask when was the last time they visited the estate and taken note of the number of ducklings present as well as the water levels and condition of the remaining water, ie presence of algal bloom and the added possibility of the ducks contracting botulism. Despite the advice you have been given from your environmental team and stated on the "Glen Iris Have your Say" website that ducks can fly at 5-6 weeks, this is actually incorrect. My veterinarian, local vet Dr Toni of Perth Pet Vet, an experienced avian specialist confirmed for me they cannot fly at all until 7-8 weeks and not able to fly PROFICIENTLY until 10-12 weeks of age. Therefore they CANNOT RE-LOCATE from the estate for at least another 4-6 weeks. I am asking from you as the Project Director for Eastcourt for the factual information as to when the last remaining lake at the northern end of the estate behind homes on glen iris drive will be drained. I am also pleasing with you on behalf of the ducks and all residents to PLEASE allow this lake to drain naturally over the coming months to enable the ducklings enough to time to develop their flying capability and be strong enough to make the journey to another wetland where they can once again live in a beautiful, safe and healthy environment. I look forward to your response with answers to my questions so that I can share with our many concerned residents. "	"Hi [Name] As per our phone chat just now, if Native Arc wish to come into the property and assess the potential to relocate the ducklings from Hartwell Parade lake, that is ok. Depending on their timing, I can meet them on site to open gates, etc. I'm available Sunday morning, or must of Monday if that works for Dean at Native Arc. Regards [Name] Hi Team Further to the email from [Name] over the Xmas / New Year break, I had several conversations with her and a couple of on-site meetings. [Name] had been inContact with Dean from Native Arc, and asked for permission for Native Arc to come down and assess the situation around the Central lake which is now all but dried out. On the first visit at 10am on 3 Jan, we didn't see any ducklings at this lake or it's surrounds, however I took the opportunity to take [Name], Len (husband), Dean and Sue (Native Arc vet) for a tour up to the northern lake. Dean commented that there was still good levels of water around for the small ducklings seen in the northern lake, but would be concerned if there were small ducklings around the evaporating Central lake. [Name] said she had seen them mostly in the evenings, so we re-visited that same evening around 6pm – only one fairly mature duckling was seen at the Central lake. Dean said he'd come back the next evening (Monday 4th) with some volunteers to catch any ducklings in the area and re-locate them (possible down to Bibra Lake). On that next evening they caught 4 ducklings and Native Arc relocated them. I'm waiting on a email from Dean just confirming the capture and relocation, so we have a record of this work. As we know, [Name] is highly sensitive to the ducks, and although quite emotive in her emails, she is rational and generally accepting of the situation. I believe the outcomes over the past week with interactions between the Project team, [Name] & Len and Dean at Native Arc has been a good outcome, and one that we could document as being a good collaborative and sensitive approach to the welfare of the ducks. Dean from Native Arc has suggested that as soon as the ducklings in the northern most lake are old enough to fly independently (12-16 weeks after birth), then we should move quickly to drain that lake and remove the liner to avoid another season of water in the lake and therefore duckling breeding, if it is our intention to not retain the irrigation lakes. He has estimated this should be around late March, based on some of the very small ducklings we saw on Monday morning. Regards [Name] [Name] Principal"	Flora & fauna			
31.12.20		Telephone	REF244	His home backs onto golf course, grass is getting quite high, concerned about snakes.	Left a voicemail but didn't provide a telephone number to call back on.	Site maintenance			

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1.1.21	4.1.21	Email	REF245	"Dear Mayor and Councillors, Happy New Year. Further to my email of the 16 December 2020 (below), as a very concerned ratepayer and resident of Glen Iris Golf Course Estate, Jandakot (along with so many other residents), further research has shown that the assertions made by Eastcourt Property Group and Acumen's email update of the 16 December 2020 are not based on fact, and that the true environmental impact of 800 news houses on the water table is being hidden by Eastcourt Property Group and Acumen. Assertion 1- The groundwater licence allowing 325 million litres of groundwater to be extracted annually" – This was a maximum upper limit, and is unlikely what the golf course actually used (see assertion no2 below) It is important to remember that the previous owners had a number of statutory responsibilities as permit holders including: "using water efficiently and responsibly, minimising impacts on the water resource" (Responsibilities of licence and permit holders) Eastcourt Property Group have not provided any confirmation of water usage over the last 5 years even though this has been requested of them (see email below 16.12.20). The lack of data means that the figure of 325ML is distorted, has been used out of context, and is baseless. Assertion 2- "saving the equivalent of 130 Olympic swimming pools of water every year". As no records of the water usage of the Glen Iris Golf Course have been provided, to establish the approximate usage, a review of other golf courses across the country and their water usage has been carried out. The table below identifies that the Mean water consumption of an average 18 hole golf course is in the region of 200ML per annum, or 80 Olympic Pools. However, as identified in my previous email, the water consumption used by 800 new houses, would equate to approximate 261ML, or 105 Olympic Swimming pools, a difference from the Mean of 61ML of additional water used, or 25 additional Olympic Swimming pools. With any retail and open spaces, these variances will be greater. This is the true environmental impact which is not being disclosed by Eastcourt Property Group and Acumen. As stated on the Water Corp website, " Climate change is a global issue with a very real local impact. The biggest challenge we continue to face is declining streamflow into our dams and irregular rainfall throughout WA" Building more than 800 homes on a long-established green space, with no residential controls or limits over water usage, will have a major impact on this already scare resource. Whereas, an 18 hole Golf Course, that will implement water efficiency measures and will be a participant of the Department of Water's Waterwise Golf Course Program will have a far less impact. As already demonstrated, it is estimated that the original Glen Iris Golf Course used 30% less water than 800 Houses. Therefore, I implore you to reject any statements from Eastcourt Property Group/ Acumen that the Glen iris Golf Course was not environmentally sustainable; when in actual fact 800 houses will cause a far worse environmental impact – ie increase water consumption, loss of established eco system, loss of fauna, etc. I also implore you to request from Eastcourt Property Group to demonstrate how the 800 homes will be designed to reduce the environmental impact during construction and when lived in. I look forward to your urgent response, action and confirmation via email. "	"RESPONSE FROM RACHEL PLEASANT AT CITY OF COCKBURN. Good afternoon [Name] Thank you for your email. The City is responding to your email below on behalf of the Mayor and Elected members. Elected Members are not able to provide commitments as to support or otherwise on any matter until Council's formal deliberations as part of a Council meeting. In the meanwhile, the City can advise the planning process has not commenced as a proposal has not been received. I can confirm a future proposal, like all rezonings, will be required to be supported by relevant studies and documentation including environmental impacts. This include flora and fauna studies, drainage and how public spaces can be managed including provision of ground water. Certain matters are addressed at various stages of the planning process however I can confirm they will be required. At the relevant future point in time we will be able to consider the below once further context of what is proposed is before us. Kind regards [Name]"	Disputes facts provided	General opposition.		
6.1.21	6.1.21	Email	REF246	"Hi [Name] Happy New Year! My son has expressed a potential interest in buying one of the new blocks, preferably a small one, in the development. I appreciate that it is very early days, but do you have any indication, subject to approvals etc, of when the first blocks may be available? Another leading question - do you have any idea of the likely size of the smallest blocks and potential price range? I appreciate there are no clear answers to the above questions yet, but any indications you can provide would be appreciated. Thanks. Regards [Name] Holtby IN REPLY TO JARROD Hi [Name] Thanks for your quick response. Please be assured I will treat the information as totally confidential - it is just to help my son consider his options. Regards [Name]"	"Good morning [Name] Happy New Year to you too. Based on the timeframes we expect for rezoning and planning applications, the most likely timing for release of first lots is probably around 2 years from now (so early 2023). That will of course be subject to the approvals being granted (as none of this is a foregone conclusion). In terms of lot sizes, as you are aware, the Project team are committed to the delivery of predominantly larger lots (by contemporary standards) in the Glen Iris Estate, but having said that it is likely there will still be some R40 density within the overall development (as per the current zoning of the former Driving Range area). This would mean lot sizes around 250sqm, but they could be part of built form townhouse / terrace developments. Outside of that option, and at a complete guess at this stage, the smaller freehold lots may be around 350 sqm – 375sqm. Coming from a few others in the community, I'd be very wary of providing these sorts of answers to the questions for fear of them being twisted and manipulated in various forums, but I feel comfortable in your discretion and respect for the eventual outcomes and process. Regards [Name] [Name] Principal"	Land sales			

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6.1.21	6.1.21	Email	REF247	When will your company start building houses on the old Lakes golf course.	"Hi [Name] Thank you for your enquiry about the timing of the proposed future Glen Iris Estate, which was received by Eastcourt on 1st January. I am the community engagement manager for the project, and handle all enquiries from the community. At the moment the project is in the very early stages of site investigations, consultation and planning. In order for any future residential development to occur the land requires a rezoning to be approved by the City of Cockburn. The very earliest we would expect any land to be released for sale would be 2023, and that is 100% subject to the relevant planning approvals being granted, which is by no means a foregone conclusion. The best way to keep up to date with project progress is to register at https://www.haveyoursayglenirisestate.com.au/ Thanks for your interest [Name]. Kind regards [Name]"	Land sales			
6.1.21	6.1.21	Email	REF248	"Hi [Name], Just a short note to let you know the current status of the ducklings removed on Monday evening with Dean [redacted] from Native Arc. This morning [Name] went to Bibra lake with Native Arc to release the ducklings as all visits to the area revealed there were no other ducklings on that lake, all went well they were released in a group with other orphaned ducklings from Native arc. We made a personal donation to Native Arc and would appreciate it if you could do the same on behalf of your company. As you are probably aware this is their only source of revenue. As discussed on Sunday the perception is that the North lake is being drained any efforts to ensure it is maintained until after April. This may help alleviate some of the residents that back onto the lake's concerns about the ducklings on the lake."	"Hi All Update to the duck relocation and Native Arc assistance below from Len [redacted] with a couple of pictures. It has all ended well with the 4 captured ducklings successfully relocated to Bibra Lake with some others that Native Arc had recently saved from another situation. [Name] and Len are happy (or happier) now. With their permission, it might be good to have them mentioned in a future posting or article on this topic. We should use this to post an update to our HYS website, and in that reinforce that we will not be doing any work to drain the northern lake until after we get the OK from Native Arc in terms of the capability of the ducklings to independently fly (to cover off Len's point below re the local community perception on us draining that lake). Water levels are dropping slowly, but that is all just natural evaporation in the warm weather, but there is a lot of water still remaining. [Name], we should chat about a donation to Native Arc from the project to thank them for their assistance and willingness to now provide regular on-site advice on ducks (and probably quenda in time when we need it). Regards [Name]"	Flora & fauna			
13.1.21	13.1.21	Email	REF249	"Hi [Name] I noticed today the appearance of numeric markings on each lane at each end of the road bridge at Twin Waters Pass. Can you please advise whether you know anything about their purpose. Cockburn council say they know nothing about them. My concern is that the markings basically define the extent of the bridge and I am concerned as to what they may mean. Thanks. "	"Hi [Name] Happy New Year to you. I'm not immediately aware of what the marking are either, however we have been having surround survey work done over the past month or so to get a full picture of current road levels and drainage infrastructure in Glen Iris. Please be assured we have no intention of doing anything to impact the current "bridge" on Twin Waters Pass, and if fact given it is a public road, we don't have any rights to be altering that infrastructure. I'll check with my surveyors, but I'm guessing it's just general surround survey markings. Regards [Name]"	Development information request			
14.1.21	14.1.21	Email	REF250	"Hi [Name] Thanks for your quick response. For your information, I have since had a follow-up call from Cockburn Council who visited the site and said the markings were made by Acumen, with regards to drainage. I'm not sure why a drainage survey would require markings in the middle of each lane at each end of the bridge. Regards SIMON'S REPLY TO JARROD Thanks [Name]!"	"Hi [Name] It is all about building a picture of all the existing surrounding infrastructure – location, direction, levels and capacity – so our engineers can build a full picture of all the drainage services, as many of these already connect into drainage sumps and retention basins on our land. In time, they will also need to "pothole" and survey all the other services in road verges adjacent to the land, to ensure we have a complete picture of all the surrounding services. This is critical as the Dial Before You Dig information is not accurate enough for the engineering design requirements. We don't need to go to this level of work yet, but it will be needed in time as applications for rezoning and development progress. Regards [Name] "	Development information request			
14.1.21	25.1.21	Email	REF251	"[Name] Yet again Eastcourt/Acumen has failed with their commitment to keep the community updated on plans and activities on and around the golf course! This week there have been numerous trucks and excavators on the course that nobody was made aware of not to mention the extreme fire risks this is posing to the residents having numerous vehicles working over the very dry grass. Not only is work being carried out on the course but also on the various roads where surveying is being carried out, again all very presumptuous when a scheme amendment has not been approved. The movements this week have caused great stress to a number of residents, Eastcourt/Acumen are failing in their commitment to keep the residents informed. Can you please explain to us why Eastcourt/Acumen has not advised the community of these activities? And you no doubt wonder why the community does not trust Eastcourt/Acumen or any of the misleading literature that is puts out. Can you please advise the community what the current plans are over the next few weeks as you have previously promised. "	"Hi [Name] I think the work you may be1253ubscribers to haveyoursayglenirisestate to keep them up to date with what might be happening on site. Unfortunately the removal of the mud got caught between Christmas and New Year, and we had to get the contractors in as quickly as they were available once we had the results from the material testing which gave us no time to let the community know. On balance it seemed more important to remove the source of the odour in a timely manner rather than delay it in order to provide advance notice of what was really quite minor works on site. In relation to surveys, I am not sure what you are specifically referring to but as you will be aware from your attendance at the Precinct Reference Groups and discussions with the specialist consultants, there are a range of studies, surveys and investigations (including traffic surveys) that need to be undertaken in order for the project team to develop a plan. Kind regards [Name]"	Development information request			

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18.1.21	18.1.21	Email	REF252	"Dear [Name] Further to the exchange of emails below, I do not appear to have received a response from you or the Project Team regarding my question - ie ""what is the legal basis that an independent dilapidation report will not be accepted?" I look forward to receiving your response. Thank you. Regards [Name] "	"Dear [Name] Homeowners are fully entitled to obtain their own dilapidation reports if they wish to do so, to have a record of the condition of their property. However, in the future, the appointed civil contractor working on Glen Iris Estate will want to complete their own dilapidation surveys as part of their responsibility prior to construction commencing. This would usually be a condition of the contractor's insurance arrangements. Kind regards [Name]"	Development information request			
18.1.21	25.1.21	Email	REF253	"Dear [Name] Thank you for your reply; however, this is confusing information. Mr. Foley clearly told the last PRG group of 22 participants that the contractor(s) would make the decision as to which homes would require a dilapidation report (ie within a certain radius of construction) to which I asked the question about homeowners undertaking their own dilapidation report, to which Mr. Foley replied that they would not be accepted. You have stated that homeowners are fully entitled to obtain their own dilapidation reports should they wish to do so etc... however, whilst you have answered the question in part, it has still not addressed Mr. Foley's comment that an independent dilapidation report would not be accepted. It is for this statement that I am now seeking clarification. "	"Hi [Name] We believe we have answered your question in our last response but perhaps it wasn't clear, so we'll try and elaborate a little further. Any landowner can arrange to have their own dilapidation survey completed on their property so they may understand the condition of their home, outbuildings and structures on their property. This report will be for the information of the homeowner. In terms of any civil contractor undertaking works on the former golf course land in the future, the Contract covering those works (which will be under the supervision of JDSi as project engineer) will require dilapidation surveys to be done by the Contractor on any property that the Engineer and/or Contractor deems to be within an area of influence of those works. The contractor will employ a specialist contractor to complete those surveys, so they have a full record of the condition of any home within that nominated area prior to any works commencing. For clarification on your question, it is highly unlikely that the civil contractor will accept a report prepared by someone other than their nominated contractor acting under their instructions, primarily for insurance requirements. This was the point made by [Name] in the PRG Q&A session. Kind regards [Name]"	Development information request			
19.1.21	19.1.21	Email	REF254	"Hi [Name], I'd like to please request more information regarding the potential re-development of the Glen Iris Golf Course. As an incoming buyer of a home bordering the golf course, I'm slightly concerned about the increased number of residences in the forseeable future. Specifically, may I ask: 1. What type of structures are planned for this redevelopment - houses? Apartment complexes? 2. What is the timeline for this process to occur? Has council approval been sought? What stage is this redevelopment in? 3. The house in question is along Woodlands way. Will there be a public space (e.g a park) between woodlands way and the supposed new residences? Thanks very much for your time. I hope to hear from you soon. Best regards, [Name]"	"Hi [Name] Thanks for your enquiry. I've attached copies of the community newsletter for the project, which will provide you with some useful background. You can also see more project information at https://www.haveyoursayglenirisestate.com.au/ You will see that the vision for the project is for a high quality residential community that reflects the standard and quality of the existing homes and streetscapes within Glen Iris. We are in the very early stages of this project. The land requires rezoning to enable residential development in that location, and that is a rigorous process that can take around 18 months to 2 years. At the moment we are undertaking a range of technical studies and investigations (eg geotech, environmental, hydrology/drainage etc) and engaging with the community to help the project team understand the priorities for the community for any future residential development. Once that work is complete – probably some time in Autumn this year, the project team will share a high level concept plan with the community before submitting its application for the rezoning to the City of Cockburn. Unfortunately we are not in a position yet to provide you with any specifics about the plan for the section of land near Woodlands Way, other than to say we are looking at ways to soften any interface between existing properties and any new housing. I've attached the summaries from three resident workshops we have held, which will give you an idea of the kinds of issues we are exploring in this regard. The best way to keep up to date with the project is to register on the website above. Thanks [Name]. [Name] "	Development information request			
28.1.21	29.1.21	Email	REF255	"Hello EastCourt, I have been following keenly on the redevelopment plans for the Glen Iris golf course at Jandakot. As a current resident in [reducted] and prospective land buyer, I will kindly like to know when you will be commencing development plans and more importantly when land blocks will be ready for sale to the general public. Thanks, [Name] "	"Hi [Name] Thanks for your enquiry, which Eastcourt has passed on to me as the Community Engagement Manager for the project. Information about the proposed development within Glen Iris is available at https://www.haveyoursayglenirisestate.com.au/, and this is the best way to keep up to date with project progress. I've also attached copies of the community newsletter for the project, which will provide you with some useful background. You will see that the vision for the project is for a high quality residential community that reflects the standard and quality of the existing homes and streetscapes within Glen Iris. We are in the very early stages of this project. The land requires rezoning to enable residential development in that location, and that is a rigorous process that can take around 18 months to 2 years, so we are a long way off releasing land for sale. Kind regards [Name]"	Land sales			
28.1.21	5.2.21	Phone	REF256	[Name] left voicemail 28 Jan re closure of golf course – 0400 406 355 – LR returned call 5 Feb – left voicemail		General enquiry			

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28.1.21	28.1.21	Email	REF257	"Hi Team, I have driven through Glen Iris and done a bit of research to discover you have bought the Golf course and are planning an estate. Is there any indication of a plan or when you will be selling land there/indication of pricing as I am interested in selling my land in Piara Waters to purchase here instead. Kind regards [Name]"	"Hi [Name] Thanks for your enquiry, which Eastcourt has passed on to me as the Community Engagement Manager for the project. Information about the proposed development within Glen Iris is available at https://www.haveyoursayglenirisestate.com.au/, and this is the best way to keep up to date with project progress. I've also attached copies of the community newsletter for the project, which will provide you with some useful background. You will see that the vision for the project is for a high quality residential community that reflects the standard and quality of the existing homes and streetscapes within Glen Iris. We are in the very early stages of this project. The land requires rezoning to enable residential development in that location, and that is a rigorous process that can take around 18 months to 2 years, so we are a long way off releasing land for sale. Kind regards [Name] "	Land sales			
28.1.21		Email	REF258	"Hi [Name] I am just touching base with you as we did end up recently buying in Jandakot :-) I just want to confirm we are still on the mailing list to receive any updates about the glen iris development? Also are there any updates recently you can let me know off? Thank you so much! [Name] "	"Hi [Name] Congratulations! Hopefully lockdown is giving you a chance to get settled in – there has to be some upside to this crazy situation. Hope you are staying safe and well. The best way to keep up to date is via https://www.haveyoursayglenirisestate.com.au/ - you can also register on the site to receive updates. Let me know if you have any issues registering and I will see if I can add you from my end. Kind regards [Name]"	Development information request			
2.2.21	2.2.21	Email	REF259	"Re: Jandakot Golf Course Development. I would like to register my interest for land at the above mentioned development. Ideally I would like 1200m2 on as high an elevation as possible, im not particularly worried about the land shape though. Please let me know if you have anything available yet. Thank you,"	"Hi [Name] Thanks for your enquiry, which Eastcourt has passed on to me as the Community Engagement Manager for the project. Information about the proposed development within Glen Iris is available at https://www.haveyoursayglenirisestate.com.au/, and this is the best way to keep up to date with project progress. I've also attached copies of the community newsletter for the project, which will provide you with some useful background. You will see that the vision for the project is for a high quality residential community that reflects the standard and quality of the existing homes and streetscapes within Glen Iris. We are in the very early stages of this project. The land requires rezoning to enable residential development in that location, and that is a rigorous process that can take around 18 months to 2 years, so we are a long way off releasing land for sale. Kind regards [Name] [Name]"	Land sales			
2.2.21	2.2.21	Email	REF260	"Good Afternoon, I read a few days ago that Eastcourt bought the Glen Iris golf course. May I ask how I can get updates on the development as I will be very interested in investing in property in that area if the future is to develop in residential properties. Thanks, "	"Hi [Name] Thanks for your enquiry, which Eastcourt has passed on to me as the Community Engagement Manager for the project. Information about the proposed development within Glen Iris is available at https://www.haveyoursayglenirisestate.com.au/, and this is the best way to keep up to date with project progress. I've also attached copies of the community newsletter for the project, which will provide you with some useful background. You will see that the vision for the project is for a high quality residential community that reflects the standard and quality of the existing homes and streetscapes within Glen Iris. We are in the very early stages of this project. The land requires rezoning to enable residential development in that location, and that is a rigorous process that can take around 18 months to 2 years, so we are a long way off releasing land for sale. Kind regards [Name] "	General enquiry			

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2.2.21		Phone	REF261	"Hi [Name] Just had a call from [Name] [reducted] – the trees behind his property are dropping branches – watched one drop last Saturday when having a bbq in his backyard. He says it looks a mess and is concerned that it is unsafe. He mentioned lack of water for trees – didn't want to listen to an explanation of why that probably isn't the cause – said his lawn is dead now because the trees are sucking water from his lawn because they have no other source. He wants someone to check out the trees from a safety POV and tidy up the fallen branches. Also – he has rats 'shitting and pissing' all over his deck. He has put baits down for the past 5 weeks but still has a rat problem. Believes this is linked to us draining the lakes and the site drying out. I told him we have had no other reports of rat issues but he said City of Cockburn has had complaints from residents on Glen Iris Drive but Council 'has refused to do anything'. Can we: Take a look at the trees he is referring to and make an assessment as to safety? If the trees don't pose a hazard, could we remove the branches that have already fallen and tidy it up a bit? This might appease him. Rats – is this likely to be linked to the drying out of the site? Do we have a pest management plan – do we bait etc? Could/should we? I have told [Name] I will call him back next week with an update. Kind regards [Name]"		Site maintenance			
5.2.21	9.2.21	Phone	REF262	"To [Name] Just had a chat with [Name] (the caller). He is local and runs a [redacted] business. Most of his work is up north but he is looking for somewhere mostly to store machinery connected to his business. I said it was unlikely we would be able to help but I'd run it past you. He was v reasonable and it's a genuine enquiry. If you wanted to call him his number is [redacted]. Let me know is it's a blanket no and you want me to ring him back to spare you the conversation. Kind regards [Name]"	"Hi [Name], Might be a little difficult, we are already leasing a portion to a local survey company and one tenant is enough. Iam happy to call and relay the message or more than happy for you to – please confirm. Cheers All good, I've just called and let him know. Kind regards [Name]"	General enquiry			

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6.2.21		Email	REF263	"Dear all As a very concerned ratepayer and resident of Glen Iris Golf Course Estate, Jandakot (along with so many other residents), again I feel compelled to write to you about further misleading and inaccurate information spread by the Acumen team in their appalling management of the Glen Iris Golf Course Estate. For a number of months a large number of residents have written to both City of Cockburn as well as the Health Department raising concerns with excessive dust being generated from the unmaintained golf course. This dust is invading their properties and homes, not to mention the health problems a number of residents are encountering including blocked noses, coughing, and respiratory problems, which have never been encountered previously. A recent response from Acumen to Council Health officers has been along the lines of "prove that this is our dust". This statement is a totally arrogant, disrespectful and heartless comment from Eastcourt/ Acumen which, it is supposed, is no surprise given their long on-going behaviour and lack of community care factor to date. Further to this, below is a quote from the "haveyoursaygleniriseestate" website. "Have your say Glen Iris Estate 02/02/21 Acumen has advised ATCO that residents have raised concerns about dust potentially generated by on-site works, and as a result ATCO is increasing its dust management activities, as well as actively monitoring fire risks. " As you can see, this statement is an attempt by Eastcourt/Acumen to steer the blame away from Acumen and shift this onto ATCO. Not one resident would have any ill feeling towards ATCO as they carry out their works as part of the much-welcomed Metronet project. Additionally, ATCO's work has only been in progress for a limited amount of time whereas our dustbowl has been in existence since around October last year. ATCO's work alongside Hartwell Parade is not even on the actual golf course; the work on the golf course is minimal. Therefore, Eastcourt/Acumen needs to be made responsible for managing dust control on the golf course, not ATCO! To ensure they are aware, I have copied into this email to the Project Manager of ATCO who works on the project, whom I also spoke to yesterday, as it is only fair that they are made aware that Acumen are attempting to unfairly shift blame from themselves and onto ATCO for the dust generation, when we are all aware it is in fact Acumen's deficient management that is the root cause. I'd like to also mention that a number of residents have also mentioned the excessive speeds and frequency that the 'security guard' travels around the course throughout the day and night; this is also stirring up dust clouds, which then gets blown onto people's properties and into their homes. I have attached to this email a picture taken by a resident of her ceiling fan blade; this blade was cleaned only a week prior to the photos being taken. Her concern has been not only about the dust entering her home but is equally concerned about the dust she and her young family are breathing in. If the golf course is infilled with 800+ houses, is this something that the residents of Glen Iris can look forward to? – years and years of construction dust, dirt and health problems; years and years of not being able to keep our windows open, years and years of not being able to sit outside by our pools, in our gardens, without being subjected to what we are being subjected to now? I understand from a resident that air quality samples have been taken on the golf course but did not show significant readings. However, you quite rightly acknowledged that the readings could have been taken at a different time and place. In view of this please advise where those seriously affected residents can obtain a meter to measure the air quality/dust on their properties? From what residents have experienced to date - that the team involved with the apparent '(mis)management' of the golf course - appear to be completely incompetent and could they have breached a number of obligations to the local residents as well as the fauna? This no doubt will be highlighted to all again in the future. I again wanted to highlight the true facts of what is happening to the community residents and not be misled by any propaganda that is provided to you. I am hoping that the Council can compel Eastcourt Property Group/Acumen to put in place an adequate dust management program until the winter rains arrive and take care of their problem. I have copied in the elected members and the Minster for Planning knowing that they are not currently in a position to comment on this until the Scheme Amendment Application has been submitted by Eastcourt; however, I felt it was important that they be kept fully informed of Eastcourt's ongoing deception and attempts to try and demonstrate that it has been a good neighbour and has transparently consulted with the community - in order to tick a box! "	"Hi [Name] Eastcourt has passed your email on to me so I can clarify the sequence of events for you in relation to resident concerns about dust, as you may not be aware of the discussions Acumen has been having with Council on this issue. Acumen received feedback from Council on 20 January that residents have contacted them expressing concern about dust emanating from the site. On 21 January, Acumen contacted the Council and asked for details about the specific locations where dust was an issue for residents, so that we could develop targeted control measures. Council officers responded on 27 January with five locations (identified by street names). Acumen also had discussions with Council relating to the potential causes of the dust, and on 29 January we outlined a range of proposed measures to address the issue. We have since updated Council on 2 Feb and again on 5 February in relation to our dust management response, which is outlined below. When and where possible, we will: Require any vehicles that need to be on the site (e.g. fence maintenance, bush fire inspections, wildlife monitoring) to be driven at a maximum speed of 15km/h – speed signs will be installed on site later this week. Apply hydromulching to dust-generating areas of the site where practical. Install dust screen fencing in appropriate areas where hydromulching would not effectively minimise dust. Security officers have been instructed to conduct patrols at the site from external roads where logistically possible. Those elements of the patrols which need to be undertaken inside the fence to be done at the new maximum speed limit of 15km/h. Given that we are aware that dust has been a concern for residents, it was completely appropriate for the project team to advise ATCO, so that they could ensure that they had effective management strategies in place when they were working, particularly given that their vehicle 'lay down' area is within the project site. Any resident that has concerns about dust or any other issue relating to site maintenance can contact me via email at [Name]@glenirisestate.com.au or on 6115 6365, and I will immediately advise the project team. Kind regards [Name]"	Site maintenance			
8.2.21		Email	REF264	"Hi [Name] Would you please be able to forward the attached to [Name] [redacted]? He has attended the meetings as your proxy but as he didn't complete the EOI form I don't seem to have an email address for him. Thanks [Name] [Name]"		Information for residents			

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9.2.21	9.2.21	Email	REF265	"Hi [Name], Sorry to have to report that the lake opposite my house is giving off a bad smell again, after the recent rain. The SW wind blows towards us which makes it worse. I think the lake liner was only punctured in so many places- is it possible that the remaining liner is still hindering drainage? Or whether it will take a few deluges before residual bacteria are flushed out? The lake on the other side of the bridge still has the mud on the bottom- it will produce odour, and it's possible that I can smell that. Is this lake going to be scraped soon? This is starting to seem like an ongoing problem, I really hope not. [Name]"	"Hi [Name] Thank you for sending me the note, and sorry you are again experiencing this. I have been made aware earlier today that the rains have caused some more odour around Twin Waters Pass. I'll be on-site tomorrow to investigate what further works we may need to do. I'll keep you informed. Regards [Name] "				
09.2.21		Email	REF266	"Dear [Name], Thank you very much for the letter and allowing me a chance to provide my feedback. Firstly I would like to say that my signing of the form in no way shows my support for the small group of residents who oppose the development. I understand that the golf course has gone and that the land has been sold for redevelopment. I personally don't play golf and I am actually more saddened by the closing of the clubhouse and restaurant. I actually believe that development of the land was a forgone conclusion and I am not deluded enough to think the council would in anyway buy it back (even if it was for sale) My frustration was more to do with the lack of Q and A time given to the reference group and that the people within the group that get what little time there is always seem to be the same people, as they are the most vocal. It would have been nice to be able to have a purely Q and A session where we could have all had a chance to ask questions and listen to the answers from the consultants. I understand that this isn't likely to happen now as time is ticking away. My first question was more specific to people that don't back on to the land. Obviously once earthworks start in the area there is going to be some disruption to everyone. I am also aware that building reports will be done on houses specifically within the boundary of works being done. To check for cracks, movement etc. My concern is that as Perth is all sand, any compacting may or may not impact my house. I would like to get a report done on my house as well. To protect both myself and the contractor. Is this going to be offered to everyone on the estate or if we get one done without the contractors involved are we wasting our money? I am also assuming that the land will be developed in stages and was wondering what the plan was for this. The land as it currently stands is an eye sore and a fire risk. If its going to be a couple of years until you build in certain areas will more be done to reduce the fire risk and residents anxiety during bush fire season? Some sort of time line would have been nice to see. I also felt that the congestion side of the project didn't really seem to have an answer. Berrigan drive to the freeway is already a nightmare during the morning peak and there didn't seem to be an answer as to what can be done about this once more cars are added in to the equation. It won't be long until Berrigan drive is as congested as Armadale road/beeliar drive. Is there really no way of adding a road connecting to Lakes road or Karel Ave for people wanting to connect to Roe highway in the north? and connection to princep road in the south? Looking forward to seeing plans/ a timeline fo planned development in the near future and thank you for your time. "		Development information request			

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14.2.21		Email	REF267	"I still await the favour of a response to my email of 27th January. Could you please extend the consideration of a rejoinder? [Name]. RESPONSE DATED 15.2.21 Thank you for your belated email. ""I am not sure what further response you require."" you ask. Plainly you have not read the emails I have sent you. I have asked that you supply the residents of Glen Iris with an erratum to your misleading statistics issued in your December circular. You have failed to respond to this request. I have further asked for an explanation to what you claim to be a ""high level concept"" ... and what is meant by glib phrases such as ""The long and the short of it ..."""? Alas no explanation. It would appear that in your haste to shut down any attempt at a constructive conversation you have overlooked my genuine desire to help you communicate more effectively and factually with the Community. To circulate a newsletter that has statistics with glaring errors - such that the percentages add up to much more than 100 - does nothing for the credibility of the claims ... and when the error is greater than the value of 8 of the 15 topics of interest (indeed, your error is greater than the values of over half of the topics identified), then I would suggest that an erratum to the Community is in order. I requested a copy of your data set to assist you in compiling your statistics accurately - I have no interest in the data per se - just the meta data to help you produce reliable statistics for the Community. Alas, after several emails of offers of assistance the offer is met with a terse ""...we have probably exhausted this conversation now."" I understand that ""Eastcourt is undertaking this process voluntarily – they are not required to engage with the community at this early stage, but have chosen to do so"" ... but as the old adage goes, if you are going to do something, do it correctly and accurately ... or don't bother. [Name]."	"Hi [Name] I am not sure what further response you require. We will not be supplying you with 'the data set'. As clearly outlined in my earlier email, our aim with this process is to understand the community's key priorities and areas of interest should the proposed redevelopment proceed. Our register of more than 200 interactions via phone and email, which we have categorised according to primary and secondary/other topics, has provided us with some of those insights. These are supplemented by the detailed discussions held at the Precinct Reference Groups, and from the original community survey that provided us with an initial baseline understanding of community sentiment. Eastcourt is undertaking this process voluntarily – they are not required to engage with the community at this early stage, but have chosen to do so. The community will have further opportunities to submit their feedback through the formal process, which includes a period of public advertising by the City of Cockburn. I have nothing further to add in response to your email [Name], and I now consider our correspondence on this specific topic to be closed. Kind regards [Name]"				
15.2.21	16.2.21	Email	REF268	"Hi [Name], I was wondering if the Glen Iris Golf Club is potentially for sale. I have read that the property was bought by a development company but I was interested in the property to renovate it and bring the golf course back to life for the community. If you have any information it would be great if you could pass it onto me. Thank you, [Name] marsh"	"Hi [Name] Thanks for getting in touch. The land was purchased by Eastcourt Property Group last April, with a view to developing a new residential community. This will require the land to be rezoned and that process is currently being worked through. More information is available at https://www.haveyoursayglenirisestate.com.au/ Kind regards [Name]"	Development information request			

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16.2.21	16.2.21	Email	REF269	"You should be ashamed. What you are doing to the Glen Iris Course is morally and ethically wrong. How do you sleep at night. You need to read your own words on your website. Professional.....no. Creating vibrant and connected Communities. You are destroying the Glen Iris Community. You have let a property go to ruin. Animals dying. You should be ashamed. You mention 'Family' many times. Hmmmmm Good people and good families do not do what you are doing to our Community. This is all about money.....nothing else. You, the Government, the Council and those fence sitting politicians should be all ashamed. For the love of money is the root of all evil. Think about that..... If I am wrong, if you can provide fair and valid reasons why you are doing this, I will listen. If you can show how the Community will be genuinely be better off, I will listen. Otherwise, the truth will stand."	"Hi [Name] Thank you for providing this feedback to Eastcourt, which they have passed on to me as the Community Engagement Manager for the project. The project team and specialist consultants are currently working on a high level concept plan for the proposed new residential community, which they expect to be able to share with the community in early Autumn. The concept plan will be based on inputs from the reference group workshops that have been held with community representatives, other community members through Have Your Say Glen Iris Estate(https://www.haveyoursayglenirisestate.com.au/) plus the outcomes of technical investigations from the project consultants, and discussions with other stakeholders such as the City of Cockburn technical officers, Department of Education, Water Corporation, the Department of Planning, Lands and Heritage, and Main Roads WA to name a few. The overall approach of the project team is to plan the parks, open space and recreational facilities first, and then design the residential lots around the green spaces. Quality, rather than quantity, will be one of the new estate's defining features. They are not planning a dense, small-lot housing estate with as many houses as possible – it is anticipated there will be between 600-800 homesites in total. The aim is for the majority of lots at the new Glen Iris Estate to be in keeping with the surrounding homes, and that means a variety of housing options and bigger blocks than you might expect to find in many new estates today. The concept will also include spaces that everyone can access and enjoy, from retained trees and playgrounds, to parks, paths and cycleways. The potential for creating a neighbourhood hub with a small upmarket grocery outlet, and a café or restaurant is also being explored. In relation to the fauna on site, in June 2020, environmental consultants completed an assessment which provided the project team with a detailed understanding of the wildlife found across the project site, including the seven artificial lakes built as part of the former golf course. As a result of the initial assessment, two snake neck turtles living in one of the lakes were relocated by a specialist under licence from the Department of Biodiversity, Conservation and Attractions. Around 45 koi fish in another lake were safely relocated to Woodvale Fish and Lily Farm to be rehomed by the Koi Society of WA. With the site no longer operating as a golf course, the irrigation system was stopped and the ageing equipment dismantled, and work began to slowly drain the artificial lakes. Conscious that ducks may have been breeding around these lakes in 2020, the project team decided not to completely drain all of the lakes until the ducklings could fly. Early this year, they also began working with non-profit wildlife rescue organisation Native Arc to continue the comprehensive monitoring and management of the ducks at Glen Iris. In addition to relocating several ducks to Bibra Lake, Native Arc advised the project team to drain the remaining lakes at the project site before the next breeding season. This process has begun. The team has also sought advice about any potential impact the draining of the lakes may have on quenda at the site, which is a concern that has been raised by some residents. The advice they have received, both from environmental consultants and a leading university researcher is that quenda do not need extra water (e.g., via watering stations) as their water intake is generally through ingesting plant material containing water, rather than drinking from water sources. [Name], I hope this information addresses some of your concerns in relation to the project. I'd encourage you to visit https://www.haveyoursayglenirisestate.com.au/ and consider registering for project updates so you receive all the latest information as it becomes available. Kind regards [Name]"	General opposition			

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16.2.21		Email	REF270	"Dear Mr. [Name], I refer to your letter of the above date regarding PRG for the Glen Iris Estate. Firstly, I don't recall being asked to or completing a feedback report about the workshops. I have asked another participant, but they also are not aware of this 'FeedBack' request. From my point of view, the meetings are very rushed with insufficient time being allocated for residents to ask questions of the consultants or for the consultants to reply. Attendees are frequently 'Shut Down' if the line of questioning is not going in the direction those running the evening want it to go. As a concerned resident who will certainly be affected by the development I find this very intimidating. We have been told we are being listened to, but I haven't seen this in action as yet. To date, I have no confidence that any of my concerns have been considered or included in the plan Eastcourt will finally take. Although our property backs onto the Golf Course, we certainly did not purchase it for the golf (although it was sold as a 'Golf Course Estate'). I have played the course may-be a dozen times in the years we have lived here. The golf club restaurant and bar did provide a great gathering space for locals and we do miss this as it was conveniently located. We initially rented within the Glen Iris estate after arriving in WA. We loved the area because of the wonderful vista, the bird life and the greenery offered by the Gold Course. Hence when we came to purchase our home we chose to stay within the estate. You have no idea how wonderful it is to arrive home and sit on our back deck as the sun sets with the filtered light coming through the trees that are on the Golf Course just adjacent to our rear boundary. Also the magnificent amount of bird life that frequents these trees and the local area. This is so stimulating and the reason we purchased here and I fear you are going to take this away. Although I have been told you intend to save as many trees as possible, I can only believe the trees you will save are those that aren't in your way of shoving in a few more housing blocks. None of our questions on this have been answered in a way that I can be confident of what the outcome will be. The trees may not be native to this particular area, but they are trees of considerable girth and height and have many years of growth. It will take years to replace this piece of nature if they are removed and the subsequent bird life lost. Another area of concern I have raised, which certainly hasn't been addressed in any way, is how the huge volumes of additional traffic this development will generate, will be managed. I am fearful that vehicles will be channelled into the residential streets within the existing estate making life a misery for those who live here. Further, Berrig-an Drive will no doubt have to handle considerable additional volumes of traffic from your proposed estate, but to date there has been zero feedback on how this will be undertaken, although the question has been raised at all the PRG meetings. Of a personal nature, as I am close to retirement the value of our property, as you would expect, had been factored into my retirement plans. Any talk of compensation for the loss of amenities, the many years of civil and construction works that we will have to endure going on over our back fence or for the loss of property value on our home, has been shut down. I believe this would be of a concern for all who back directly onto the course. Eastcourt to date hasn't shown how this development is, or will be of any benefit to the many existing residents that will be greatly affected by your proposed development. Regards, [Name]"		General opposition			

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18.2.21	5.3.21	Email	REF271	"Hi [Name] I would be grateful if you could forward my concerns about the proposed development of the Glen Iris Golf Course to [Name] [Name]. They are as follows: 1 : VIEWS - our property is an ex-display home which was built to maximise the views over the golf course for which we paid a premium. Now we will be looking at roof tops and satellite dishes. 2 : LOSS OF COMMUNITY - The golf course and The Iris Bar and Bistro was a social hub which played a major role in contributing to the mental health and wellbeing of all age groups. 3 : INCREASED NOISE POLLUTION - EXTRA TRAFFIC - At present we have severe noise pollution from the Kwinana Freeway, the Mandurah Train Line Plus the new Thornlie Link, the existing freight line to the North of the estate and Jandakot Airport which is the busiest airport in Australia for take offs and landings. 4 : ENVIROMENTAL - Contamination of the Jandakot Mound the existing estate barely passed the DOE for approval, how can a 600 - 800 home development improve the environmental impact? Loss of Flaura and Fauna which has been a joy to watch develop over the last 20 years. 5 : DEVALUATION OF PROPERTY - The estate had a unique identity which added to the value of the properties with the loss of the golf course it will just become another housing suburb. 6 : DILAPIDATION - If earthworks begin who will be responsible for any damage caused to the adjoining properties by heavy vehicles. 7 : WHAT IS YOUR PLAN B? Regards [Name]"	"Thanks [Name] – all community feedback is automatically shared with the whole project team, including [Name]. I have provided some further information below in response to the points you have raised: Views – the project team are very aware of the need to ensure there is a soft interface between existing homes that currently back on to the site and any future development. This has been discussed at length at the Precinct Reference Group (see attached summaries from Workshops #2 and #3), and the designers are currently working on a concept plan that aims to address this issue as far as possible. Loss of community – again, any new development would include significant public open space – both active and passive – with walk trails, BBQs and picnic areas, playgrounds etc for the whole community to enjoy. It would also incorporate a small high quality commercial centre, to accommodate a local independent supermarket, café etc – again providing a focal point for community. Traffic – this is an issue that has also been discussed at length at the PRG workshops (as you will see from the attached summaries). We are currently preparing a fact sheet to assist the community in understanding how the traffic would be managed, and where exit and entry points are likely to be created. Devaluation of property – a new development with increased amenity, quality parks and streetscapes, and housing design that reflect the current standard of homes in the existing suburb will ensure that Glen Iris continues to be a premium residential community. Dilapidation Surveys - I have attached a Project Information Sheet that outlines the process in relation to any impacts on adjoining properties from earthworks should the proposed development go ahead. Jandakot Mound - Parts of the site are within the Jandakot Groundwater Mound, within the Priority 3 zone. That in itself doesn't prevent future development. Much of the existing suburb also sits within the JGM boundary. According to Dept of Water Public Drinking Water Supply Area land use compatibility tables, Residential uses are Acceptable in a Priority 3 zone. Flora and Fauna – please find attached a fact sheet about flora and fauna at the site. Thanks [Name] – I hope this additional information is helpful. Kind regards [Name]"				
21.2.21	23.2.21	Email	REF272	"Hi [Name] We live in the Glen Iris Estate, I haven't completed any surveys yet. However would love to know when the site development is likely to be completed? Also it would be fantastic if there was an area which included water, even using the existing 'man made' lakes that all residents could access / dogs could run in (perhaps with a small 'beach' area) ... that would be a unique attraction and make the estate stand out from the others... Also park areas suitable for older kids as all the current parks in the estate only cater for small children. Things like soccer goals, tall money bars, pump tracks, etc... Thanks, [Name] "	"Hi [Name] Thanks for getting in touch. The site has to go through a rezoning process prior to any work commencing. The new owners of the site are hoping to submit the application to council later this year. Should the rezoning be approved, we anticipate it will be at least 18 months to 2 years before any construction work starts on site. I will share your feedback about parks and playgrounds etc with the project team. In the meantime, more information is available online at https://www.haveyoursayglenirisestate.com.au/ - if you register on the site you will also receive regular email updates (we promise not to bombard you! – probably a monthly email at this stage). Kind regards [Name]"	General enquiry			
26.2.21		Email	REF273	One thing I would do to the golf course club house is reopen the bar and restaurant get someone in there that will work hard for money its just sitting there. The person who owns the golf course isn't interested in doing anything nowto it.					
28.2.21		Email	REF274	"If you had of left the lakes as they were, this problem would not have occurred. I imagine with the long week-end, some of you played golf, while this week you set out to destroy the golf course we once loved. 'Money is the root of all evil' Shame on you all."					

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28.2.21	1.3.21	Email	REF275	Will the lime blow about as its quite dangerous ?	"Hi [Name] Thanks for your email. The lime is agricultural lime – not hydrated lime, that can sometimes cause irritation and be dispersed by wind. Agriclutural lime is not a fine powdered lime, and we won't be using a spreader like in some application techniques. Instead we will use a tipper truck to unload the Ag Lime, then use a bobcat to spread it across the base of the lake. This is the same process that City of Cockburn uses on its lakes and drainage basins, and we are taking this approach to odour control based on their advice. We will have a water cart on site just in case we need to damp down, but we will also only undertake the works when the weather conditions are favourable – ie not windy or raining. We have postponed the work to later this week – most likely Thursday and Friday – when it has stopped raining. Kind regards [Name]"				
1.3.21		Email	REF276	"Dear [Name], In response to [Name]'s Community Notice, which has only given the community two days notice of works occurring (email received 28.2.21, and works to commence 2.3.21), yet again this demonstrates Eastcourt Property Groups lack of urgency around community engagement. The whole debacle of draining lakes, puncturing the membrane, scraping out the residue, and now applying agricultural lime is hugely farcical!, If you had left the lakes as you found them, ie full with operational infrastructure, ie pumps; you would have saved yourself dollars, reputational embarrassment, and a slight reduction in the communities anger towards Eastcourt Property Group. Agricultural lime is a hazardous substance, that causes irritation to eyes and to the respiratory system. In particular, If the fine particles of limesand are inhaled, respiratory tract irritation/inflammation may occur causing coughing and sneezing. Large amounts may cause chemical pneumonitis. Obviously you will have already approved your contractors JSEA (Job Safety and Environmental Analysis), and will have approved their Safety Management Plan. Hopefully this is robust, as it possible there will be another incident similar to the works that generated the dust storms. These documents should be made available to the JRRA prior to the works commencing, and in advance of the complaints that will follow. Finally, I will shortly respond to [Name]'s impolite email of the 14 January 2021. Regards [Name]"						

DATE RECEIVED	DATE RETURNED	VIA	SUBMITTER REFERENCE NUMBER	NATURE OF ENQUIRY	REPONSE	PRIMARY CONCERN	SECONDARY CONCERN	REGISTER ON EHQ?	ACTION REQUIRED
1.3.21		Email	REF277	"Dear [Name] and [Name] Many years ago, I founded (and later sold) the Aquarius wastewater system (see website) and initiated the use of ozone (O3) to replace chlorine as a disinfectant. I was also a consultant to the WA Health Department regards wastewater management and treatment. The "lakes" at Glen Iris are similar to secondary tanks in a septic system. Lack of moisture and poor Ph has created an anaerobic system rather than a sweet smelling aerobic digesting system. Septic tanks are also known as OXIDATION PONDS, also called lagoons or stabilization ponds which are large shallow ponds (Glen Iris?) designed to treat wastewater through the interaction of sunlights, bacteria and algae. In Glen Iris' case, no moisture (water) resulting in anaerobic conditions. Algae grows using energy form the sun and carbon dioxide and inorganic compounds released by bacteria in water. Oxygen (aerobic) is essential in the water to initiate aerobic conditions with no odours. Adding lime will initiate a favourable trend towards a Ph for aerobic conditions, made impossible by the lack of water. There are three solutions: 1. Bury the sludge under a thick layer of sand, which would violate the current land zoning. 2. Sludge deposits in the pond must all be removed by dredging on windless days. 3. Reinstate the ponds, stabilizing the Ph, creating aerobic conditions as previous. Another area of concern is parasites which are present in fish, duck faeces and most animals. The parasites are specific to a host and should not infect humans but parasite vectors are created in huge numbers being easily transported in wind from dust and excavations. Ducks carry parasites and lice which should not affect humans but can affect pets; also the intermediate parasite stages are contained in faeces which accumulate in water where ducks spend much of their time. The current rains (March) will reduce the anaerobic environment due to introducing water and initiating a more favourable chemical mix and Ph, the odour will not be noticed. However, after the rains with dry weather, the odour will return and the lime will be ineffectual as a sole dry treatment. Regards [Name] Glen Iris resident"					
2.3.21	2.3.21	Email	REF278	"Hi [Name], The rain has accumulated again in 2 low areas in the lake bed opposite my place (east of the bridge), and more offensive odour is present. I believe the plastic liner is stopping the lake bed from draining, and a quick solution may be to remove the liner, even just for a 10m diameter at the 2 low areas, to allow water to drain away quickly. What do you think? I note that you will be spreading lime over the lake bed west of the bridge today- this may help, but still why not remove the liner at any low points also? [Name]"	"Hi [Name] Thanks for your email. We were all set to be spreading ag lime today, however the recent weather and pooling water in the lakes has meant this will need to be delayed a few days. I was on-site at 6:30am this morning with our contractor looking at the situation. After we removed the mud layer, we thought the odour would be mitigated, but it seems the organic matter is within the sand too hence the recurring odour issues when the sand is wet. As there is more rain forecast for tomorrow and into Thursday, we have arranged to have pumps on site from Thursday morning and Friday to have the water pumped out of the lakes and then the ag lime dosing can occur. I'm hopeful the ag lime dosing can happen on Friday for the lake closest to you. During our last work on the lakes when we removed the dried mud layer, our contractor dug into the base of the lake expecting to find a plastic liner on this lake, however no liner was found in this lake. The pooling of water seems to be at natural ground water level, hence we want to fill these lakes as soon as practicable to cap the organic material leached into the soil and avoid the pooling of water at the low ground levels. We are preparing a development application to lodge with City of Cockburn for these fill works with imported sands, along with traffic management and dust management procedures. I'm sorry this means a few more days of the odour, but we are trying to get this done to avoid on-going future problems. Thank you for your patience in this matter, and for regularly being in contact with us. Regards [Name] [Name] Principal "				

DATE RECEIVED	DATE RETURNED	VIA	SUBMITTER REFERENCE NUMBER	NATURE OF ENQUIRY	REPONSE	PRIMARY CONCERN	SECONDARY CONCERN	REGISTER ON EHQ?	ACTION REQUIRED
8.3.21	10.3.21	Email	REF279	"Hi [Name], Just following up, regarding the Wake. I have organised the charter bus and have made them aware of locking the gates. Hope to hear from any updates from your end. Let me know if there is anything I can assist with. Thank you, [Name] Account Executive"	"Hi [Name] Sorry – just sorting it today for you, hope to be able to provide the info you need by the end of the day. [Name] "				
8.3.21	11.3.21	Email	REF280	"Hi [Name] Are you able to share draft plans for the Glen Iris Estate? I would like to know if the proposed plan has the potential to obstruct the views of properties backing onto the golf course. Thanks [Name]"	"Hi [Name] Thanks for your enquiry. We will have a high level concept plan to share with the community in late March. The easiest way to keep up to date is to visit https://www.haveyoursayglenirisestate.com.au/ and register for project updates. Kind regards [Name]"				
18.3.21	18.3.21	Email	REF281	"Hi [Name], My partner and I are interested in the development of the glen iris estate however it's not immediately clear what stage the development is up to, nor what the future timeline looks like. Can you advise how long the project is expecting to take to get to a point at which blocks are available? Or is this an open ended question due to the nature of project approvals, etc? Many thanks [Name]"	[Name] [Name] called [Name] back and told him it would take an estimated 2 years if all approvals went forward before any land would be released for sale.				
29.3.21	29.3.21	Phone	REF282	His soccer club currently plays out of Mosman Park (seniors) and Coobellup (juniors) as well as having a base at the Croation Club in North Freo. They are looking for land to purchase to create a permanent home for the club – playing field plus club rooms. They anticipate selling the Croatian site for $8-10m. Would we interested in selling them part of the 54 hectares for this purpose? Or do we have any plans for playing fields at the development?	[Name] [Name] said no to both questions but offered to pass on his details and be in touch if the situation were to change.				
30.3.21	1.4.21	Email	REF283	"Hi [Name] Two questions stemming from you email: 1) At the end of PRG-Workshop #2 I asked whether the Workshop Attendees would be able to sight/review the Concept-Plans prior to submission to Council. [Name] [Name] of Aumen (in front of c. 30 witnesses) stated that this would be the case. Am I to understand that Acumen are no longer going to honour this commitment? 2) Re. your phraseology below ""..protocol requires.."".....can you please clarify? Have Council mandated that you must show them the concept plans before they are shown to the PRG attendees? Best Regards [Name]"	"Hi [Name] Thanks for the email. Absolutely Acumen are honouring their commitment for PRG members to sight the plans before submission to Council. The application for amendment to the Town Planning Scheme and Local Structure Plan, of which the concept plan forms a part, will be submitted sometime in May, after the PRG meeting, In terms of sharing the plan with Elected Members prior to the PRG, it is always appropriate for Elected Members to be briefed on a planning matter of this scale prior to the public, and you will find that is standard practice. I look forward to seeing you at the next PRG, and in the meantime enjoy the Easter break. Thanks [Name] [Name]"				
29.3.21	13.4.21	Email	REF284	"Hi [Name] There is a over grown tree from Eastcourt property in Glen Iris hanging over our Fence and is now starting to cause damage to our fence please see attached photos . The previous owners of Glen Iris used to maintain this tree . We have never had issues in the past of the tree hanging over our fence . I Can you please arrange this tree to be cut back ASAP as it is a fire hazard and has a bee hive in the tree and we are unable to go out our backyard and use our pool . We are on the first hole House is[redacted] Can you please advise me when you have arranged the tree to be cut back or removed Regards [Name]"	"Hi [Name] Just letting you know that the tree loppers will be on-site this Thursday to complete a tidy-up of fallen branches and trimming back the large Japanese Pepper tree at the back of your property. Kind regards [Name] "				

DATE RECEIVED	DATE RETURNED	VIA	SUBMITTER REFERENCE NUMBER	NATURE OF ENQUIRY	REPONSE	PRIMARY CONCERN	SECONDARY CONCERN	REGISTER ON EHQ?	ACTION REQUIRED
12.4.21	12.4.21	Email	REF285	"Hi [Name] Looking forward to the next planned meeting and hope those in opposition are not too disruptive to stifle meaningful discussions There is a seperate issue I seek your assistance on relating to the undermining of our and our neighbours limestone based fencing by several large shrubs and trees predominantly bougainvillea. We had hoped this could wait till site fencing was resolved however it now appears some limestone pillars are in danger of collapse . Would it be possible for you to put us in contact with the person we need to work with to resolve this Kind regards [Name]"	"Hi [Name] Thanks for getting in touch – I'll follow up with [Name] and see what can be done. Will be back in touch later this week hopefully! [Name]"				
15.4.21	13.4.21	Email	REF286	"[Name], I am unable to attend. Can I nominate a fellow resident to attend in my place? Thanks [Name]"	"Hi [Name] That's disappointing, but thanks for letting me know. We are more than happy for you to nominate a proxy. If you can let me know who you are nominating (or ask them to email me), I will send them the Terms of Reference for reading and signing before the meeting.I've attached them to this email as well, in case you wanted to share them with your proxy. Kind regards [Name]"				
16.4.21	16.4.21	Email	REF287	" Hi [Name] A number of residents including myself have spotted a small white van frequenting the course. Can you confirm if Acument are trapping any of the wildlife on the course including Quendas and this van is taking any form of trapped animal away from the course? I'd appreciate your confirmation. Regards [Name]"	"Hi [Name] I have checked and apparently the security guard is currently using a white van for his site patrols, as his usual silver car is in for repairs. Kind regards [Name]"				
18.4.21	17.4.21	Email	REF288	"ok thanks [Name] So you can confirm that no animals are currently being trapped or removed from the course? [Name]"	Yes I can confirm that no animals are currently being trapped or removed from the course.				
23.4.21	23.4.21	Email	REF289	" Hi [Name], I am a resident of the estate and am wondering what the fate of the boards inside the club house with all the awards is and if they have been homed? If not I'd like to save them if possible and take them as a piece of memorabilia? Thank you in advance, [Name]"	"Hi [Name] Thanks for getting in touch. The honour boards are no longer in the clubhouse - they are with [redacted]. Kind regards [Name]"				
2.5.21		Email	REF290	"Hi I live on the Glen Iris Estate. Eastcourt the owners drained the lakes Incase of drowning ? but have left this mess behind. I know it is private property but kids climb the fence and often play there. Kids will be kids there is no padlocks on the bores. Accident waiting to happen. Regards [Name]. Attached several photos of the areas left behind. "		Danger due to draining of the lakes			

DATE RECEIVED	DATE RETURNED	VIA	SUBMITTER REFERENCE NUMBER	NATURE OF ENQUIRY	REPONSE	PRIMARY CONCERN	SECONDARY CONCERN	REGISTER ON EHQ?	ACTION REQUIRED
6.5.21	6.5.21	Email	REF291	"Hi [Name] Thank you for the meeting reminder. I got the proposal and have looked over it. I think that the brief the PRG has provided was pretty much met. While I do not live directly backing on to the golf course I think that the green belt that has been put in effectively gives these people a nice outlook. There is a lot of green space and the block sizes lends to quality homes. I love the walking paths and best of all we get to keep our bridge. I guess now the council has the last say. The only thing that disappointed me was there didn't seem to be any water ways but we can't get everything. So on saying that I won't be attending this meeting as I believe it is going to have a lot of negativity that I feel for myself will be painful to listen to. Well done to you and the team and thank you for allowing me to have some input."	"Thank you so much for such a positive and encouraging email. We are very aware of how challenging this proposal has been for some community members. Despite that, we have had significant input from residents – via the PRG, direct conversations and emails, the survey etc - that has resulted in the concept plan that we have shared. It's great to hear you see that you can see how the planners have responded to the community's input. I hope Tuesday's meeting is constructive – you are not the only person to have hesitated about attending for the reason you have given, but I am sure Metrix will do their best to keep the conversation respectful and constructive. It would be lovely to see you there but completely understand if you don't come. We'll share the meeting summary with everyone afterwards as usual. One last request - can I encourage you to make a submission to council when the proposal is released by City of Cockburn for public advertising? The plan includes elements that we need community support for, as they are not standard – the public open space being one. Developers have to provide a minimum of 10% open space – we are proposing 25%, as that delivers on community expectations, but is significantly more than Council would usually expect. If that level of green space is important to you, it's important to let council know. Thanks again for the feedback, and for taking the time to come along to the sessions."				
7.5.21		Email	REF292	"[Name], - Can you please advise if there is a draft of the proposed development's land covenants. - The smaller lots on the concept plan I believe are going to be developed by East court, can you please advise if there are any concept plans of the types of residences being proposed."					

GLEN IRIS ESTATE

APPENDIX 3
CERTIFICATES OF TITLE

WESTERN AUSTRALIA

REGISTER NUMBER	
6/D91027	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
1	12/4/2011

VOLUME 2765 FOLIO 992

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.

REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 6 ON DIAGRAM 91027

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

ECP ACQUISITIONS 9 PTY LTD OF 756 CANNING HIGHWAY APPLECROSS WA 6153
(T O383082) REGISTERED 6/4/2020

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. G289136 EASEMENT TO CITY OF COCKBURN. SEE SKETCH ON VOL 2078 FOL 282. REGISTERED 25/9/1996.
2. *O383083 MORTGAGE TO COMMONWEALTH BANK OF AUSTRALIA REGISTERED 6/4/2020.

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: D91027
PREVIOUS TITLE: 2078-282
PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY: CITY OF COCKBURN

NOTE 1: DUPLICATE CERTIFICATE OF TITLE NOT ISSUED AS REQUESTED BY DEALING O383083

WESTERN AUSTRALIA

REGISTER NUMBER	
7/P21402	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
2	10/2/2014

VOLUME 2195 FOLIO 189

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

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REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 7 ON PLAN 21402

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

ECP ACQUISITIONS 7 PTY LTD OF 756 CANNING HIGHWAY APPLECROSS WA 6153
(T O383047) REGISTERED 6/4/2020

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. THE LAND THE SUBJECT OF THIS CERTIFICATE OF TITLE EXCLUDES ALL PORTIONS OF THE LOT DESCRIBED ABOVE EXCEPT THAT PORTION SHOWN IN THE SKETCH OF THE SUPERSEDED PAPER VERSION OF THIS TITLE. VOL 2195 FOL 189.
2. G004044 EASEMENT TO CITY OF COCKBURN. SEE SKETCH ON VOL 2195 FOL 189. REGISTERED 12/10/1995.
3. G289135 EASEMENT TO CITY OF COCKBURN. SEE SKETCH ON VOL 2195 FOL 189. REGISTERED 25/9/1996.
4. G394840 EASEMENT TO CITY OF COCKBURN. SEE SKETCH ON VOL 2195 FOL 189. REGISTERED 11/2/1997.
5. G523659 EASEMENT TO CITY OF COCKBURN. SEE SKETCH ON VOL 2195 FOL 189. REGISTERED 7/7/1997.
6. G523660 EASEMENT TO CITY OF COCKBURN. SEE SKETCH ON VOL 2195 FOL 189. REGISTERED 7/7/1997.
7. EASEMENT BURDEN CREATED UNDER SECTION 167 P. & D. ACT FOR WATER, SEWERAGE OR DRAINAGE PURPOSES TO WATER AUTHORITY OF WA SEE PLAN 21402.
8. EASEMENT BURDEN CREATED UNDER SECTION 167 P. & D. ACT FOR GAS PURPOSES TO GAS CORPORATION SEE PLAN 21402.
9. EASEMENT BURDEN - SEE PLAN 21402.
10. *O383048 MORTGAGE TO COMMONWEALTH BANK OF AUSTRALIA REGISTERED 6/4/2020.

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----------

END OF PAGE 1 - CONTINUED OVER

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: 2195-189 (7/P21402)
PREVIOUS TITLE: 2183-870
PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY: CITY OF COCKBURN

NOTE 1: DUPLICATE CERTIFICATE OF TITLE NOT ISSUED AS REQUESTED BY DEALING O383048.

WESTERN AUSTRALIA

REGISTER NUMBER	
512/D94292	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
2	10/2/2014

RECORD OF CERTIFICATE OF TITLE

VOLUME 2183 FOLIO 872

UNDER THE TRANSFER OF LAND ACT 1893

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BGRoberts
REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 512 ON DIAGRAM 94292

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

ECP ACQUISITIONS 7 PTY LTD OF 756 CANNING HIGHWAY APPLECROSS WA 6153
(T O383047) REGISTERED 6/4/2020

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. EASEMENT BURDEN - SEE DIAGRAM 94292.
2. *O383048 MORTGAGE TO COMMONWEALTH BANK OF AUSTRALIA REGISTERED 6/4/2020.

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: 2183-872 (512/D94292)
PREVIOUS TITLE: 2015-165, 2139-82
PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY: CITY OF COCKBURN

NOTE 1: DUPLICATE CERTIFICATE OF TITLE NOT ISSUED AS REQUESTED BY DEALING O383048.

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Landgate
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WESTERN AUSTRALIA

REGISTER NUMBER	
139/P18946	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
3	10/2/2014

VOLUME 1947 FOLIO 547

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

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REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 139 ON PLAN 18946

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

ECP ACQUISITIONS 8 PTY LTD OF 756 CANNING HIGHWAY APPLECROSS WA 6153
(T O383074) REGISTERED 6/4/2020

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. B368209 EASEMENT TO THE STATE ENERGY COMMISSION OF WESTERN AUSTRALIA. SEE SKETCH ON VOL 1947 FOL 547. REGISTERED 11/7/1977.
2. G004043 EASEMENT TO CITY OF COCKBURN. SEE SKETCH ON VOL 1947 FOL 547. REGISTERED 12/10/1995.
3. I296686 EASEMENT TO CITY OF COCKBURN. SEE SKETCH ON DEPOSITED PLAN 29509. REGISTERED 15/11/2002.
4. *O383075 MORTGAGE TO COMMONWEALTH BANK OF AUSTRALIA REGISTERED 6/4/2020.

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: 1947-547 (139/P18946)
PREVIOUS TITLE: 1869-309
PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY: CITY OF COCKBURN

NOTE 1: DUPLICATE CERTIFICATE OF TITLE NOT ISSUED AS REQUESTED BY DEALING O383075.

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WESTERN AUSTRALIA

REGISTER NUMBER	
509/D91028	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
2	10/2/2014

VOLUME 2183 FOLIO 871

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

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REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 509 ON DIAGRAM 91028

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

ECP ACQUISITIONS 7 PTY LTD OF 756 CANNING HIGHWAY APPLECROSS WA 6153
(T O383047) REGISTERED 6/4/2020

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. EASEMENT BENEFIT - SEE DIAGRAM 94292.
2. EASEMENT BURDEN CREATED UNDER SECTION 27A OF T. P. & D. ACT - SEE DIAGRAM 91028.
3. *O383048 MORTGAGE TO COMMONWEALTH BANK OF AUSTRALIA REGISTERED 6/4/2020.

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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----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

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SKETCH OF LAND: 2183-871 (509/D91028)
PREVIOUS TITLE: 2015-165, 2139-82
PROPERTY STREET ADDRESS: 76 DEAN RD, JANDAKOT.
LOCAL GOVERNMENT AUTHORITY: CITY OF COCKBURN

NOTE 1: DUPLICATE CERTIFICATE OF TITLE NOT ISSUED AS REQUESTED BY DEALING O383048.

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Landgate
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WESTERN AUSTRALIA

REGISTER NUMBER	
3/D30047	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
2	10/2/2014

RECORD OF CERTIFICATE OF TITLE

VOLUME 2190 FOLIO 500

UNDER THE TRANSFER OF LAND ACT 1893

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REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 3 ON DIAGRAM 30047

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

ECP ACQUISITIONS 7 PTY LTD OF 756 CANNING HIGHWAY APPLECROSS WA 6153
(T O383047) REGISTERED 6/4/2020

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. THE LAND THE SUBJECT OF THIS CERTIFICATE OF TITLE EXCLUDES ALL PORTIONS OF THE LOT DESCRIBED ABOVE EXCEPT THAT PORTION SHOWN IN THE SKETCH OF THE SUPERSEDED PAPER VERSION OF THIS TITLE. VOL 2190 FOL 500.
2. G500077 EASEMENT TO GAS CORPORATION. SEE SKETCH ON VOL 2190 FOL 500. REGISTERED 12/6/1997.
   *H510366 NOTIFICATION. THE GRANTEES OF EASEMENT G500077 ARE NOW THE GRANTEES ARE NOW ALINTAGAS NETWORKS PTY LTD. REGISTERED 25/7/2000.
3. *O383048 MORTGAGE TO COMMONWEALTH BANK OF AUSTRALIA REGISTERED 6/4/2020.

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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----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

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SKETCH OF LAND: 2190-500 (3/D30047)
PREVIOUS TITLE: 2183-873
PROPERTY STREET ADDRESS: LOT 3 DEAN RD, JANDAKOT.
LOCAL GOVERNMENT AUTHORITY: CITY OF COCKBURN

NOTE 1: A000001A PENDING SURVEY - DIAGRAM 86320.
NOTE 2: DUPLICATE CERTIFICATE OF TITLE NOT ISSUED AS REQUESTED BY DEALING O383048.

LANDGATE COPY OF ORIGINAL NOT TO SCALE 17/05/2021 12:07 PM Request number: 62021456

Landgate
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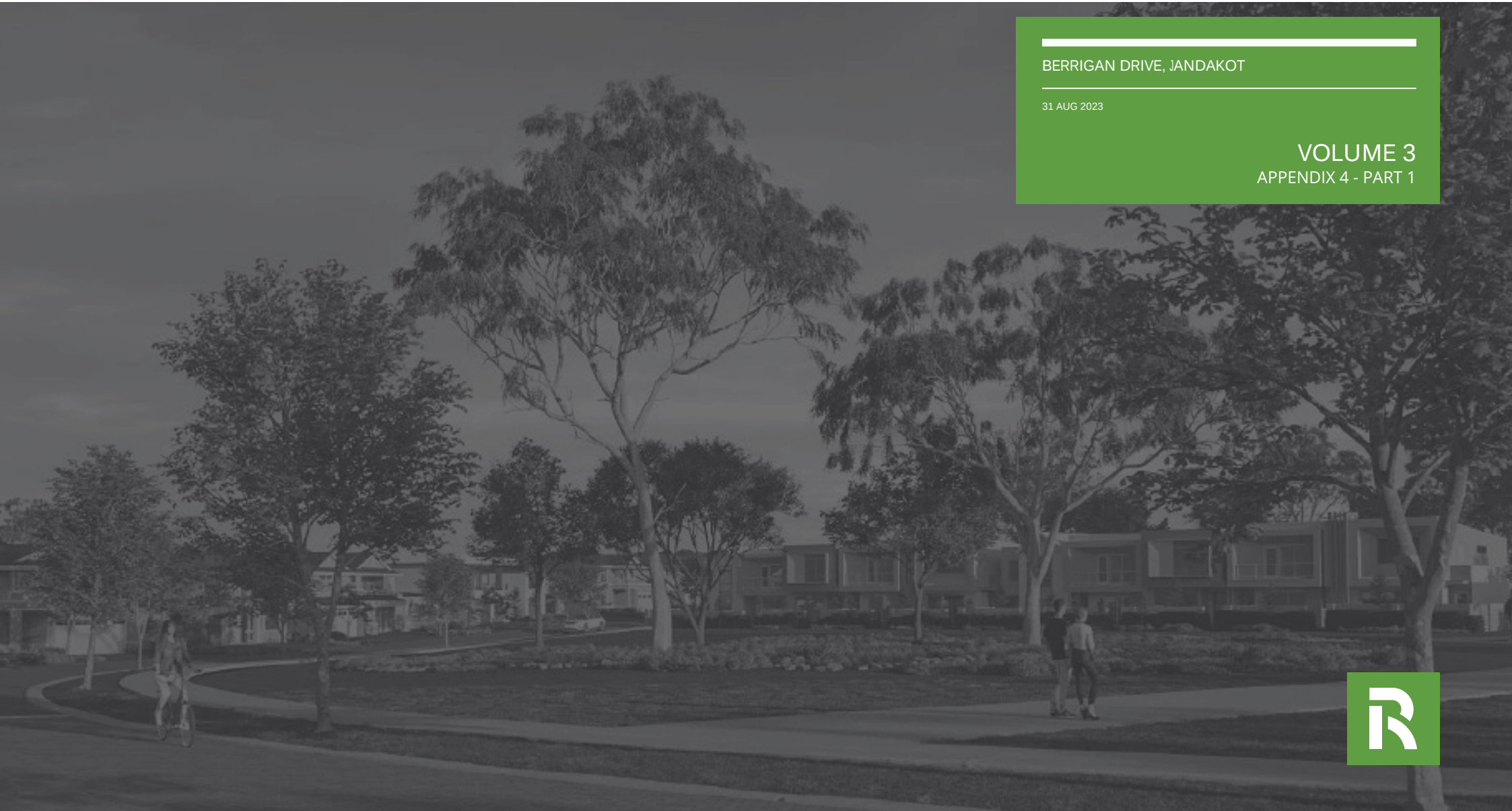
GLEN IRIS ESTATE

STRUCTURE PLAN



BERRIGAN DRIVE, JANDAKOT

31 AUG 2023

VOLUME 3
APPENDIX 4 - PART 1

GLEN IRIS ESTATE

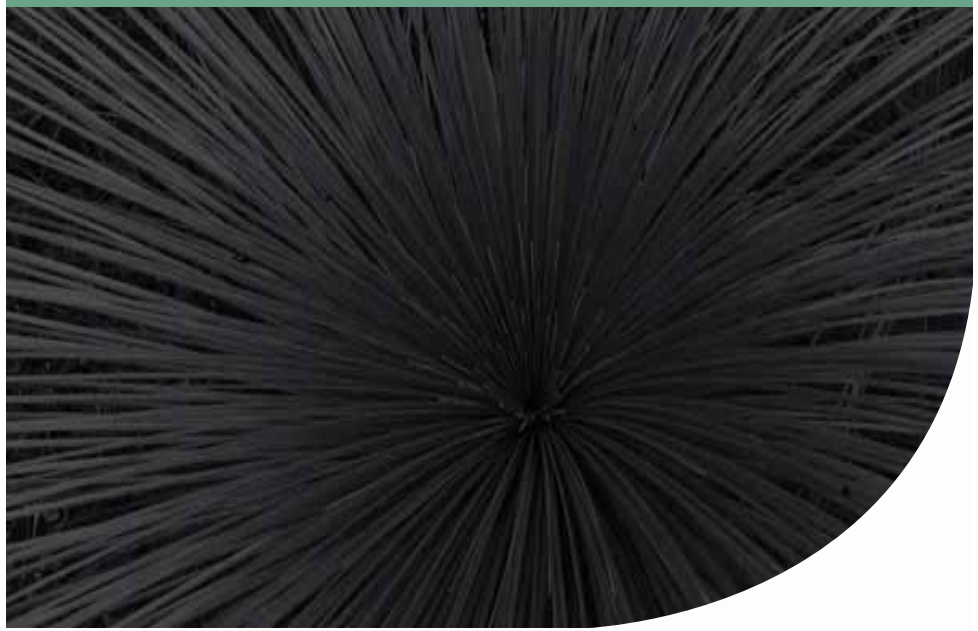
APPENDIX 4
ENVIRONMENTAL ASSESSMENT REPORT

Environmental Assessment and Management Strategy: Local Structure Plan

Former Glen Iris Golf Course

Project No: EP20-009(09)

Prepared for Acumen Development Solutions on behalf of Eastcourt Property Group
August 2023



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Executive Summary

This *Environmental Assessment and Management Strategy* (EAMS) has been prepared on behalf of ECP Acquisitions 6 Pty Ltd (the proponent), an entity related to Eastcourt Property Group, to support a Local Structure Plan (LSP) for the residential development of the former Glen Iris Golf Course. Located within the City of Cockburn (CoC), the proposed LSP includes Lots 6 and 7 Glen Iris Drive, Lots 3, 509 and 512 Dean Road and Lot 139 Imlah Court in Jandakot (an area herein referred to as 'the site'), encompassing an area of approximately 53.7 hectares (ha). The site is surrounded by residential and rural residential properties and the Yangebup freight rail line to the north, residential development and Kwinana Freeway to the west, Jandakot Airport to the north-east, commercial and industrial units to the south-east, and residential and mixed business zoned land to the south.

The site is currently zoned 'Development' under the CoC Town Planning Scheme (TPS) No.3 and 'Urban' under the Metropolitan Region Scheme (MRS). The site was operated as a golf course until it was permanently closed in March 2020 and then sold to Eastcourt Property Group who intends to redevelop the site as a residential estate.

Environmental context

Desktop research and site-specific investigations did not identify any restricted landforms or unique geological features within the site. Mapping released by the Department of Water and Environmental Regulation (DWER) identifies the site has a 'moderate to low' risk of Acid Sulfate Soils (ASS) occurring within 3 m of the natural soil surface, but a 'high to moderate' risk of ASS occurring beyond 3 m of the natural soil surface.

Based on a detailed flora and vegetation assessment undertaken by Emerge Associates across 2020 and 2021, four plant communities were identified scattered in patches across the site. The dominant plant communities were identified as planted trees and shrubs and turf and bare ground covering the majority of the site (98.5%) and classified as being in mainly 'Degraded to Completely Degraded' condition. Vegetation mapped as in 'Very Good' or 'Good' condition comprises 1.3% of the site's extent. None of the vegetation communities were considered representative of any State or Commonwealth listed threatened ecological community or state priority ecological community. No conservation significant flora species were identified during the site-specific investigations, including during the surveys in Winter and Spring 2021.

A total of 15 native, three introduced, and two conservation significant fauna species were recorded during site-specific surveys. The conservation significant species recorded were Carnaby's black cockatoo, listed as a protected matter under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and quenda, listed as Priority 4 species at the state level.

The overall quality of the black cockatoo habitat on the site was scored as five (5) out of ten (10) for Forest red-tailed black cockatoos (FRTBC) and three (3) out of ten (10) for Carnaby's black cockatoo (CBC). This score was determined considering factors such as the presence of 11 potential black cockatoo habitat trees (none with suitable nesting hollows) within the site, the absence of known or suspected roosting activity, and the limited extent and low feeding resource value of the foraging habitat.

The presence of quendas was confirmed within the site, with three suitable habitats identified; however, the majority of the site was identified as unsuitable for this species, with more suitable habitat identified in the surrounding areas where more intact remnant vegetation occurs.

Noise mitigation in the form of quiet house design would be required in proximity to Kwinana Freeway and Berrigan Drive. The rail noise levels would comply within site without any mitigation being required. The central and southern portions of the site are subject to aircraft noise from Jandakot Airport and fall within Australian Noise Exposure Forecast (ANEF) 20 to 25 contours. Residential development is acceptable within these contours, subject to internal noise level meeting the criteria contained in AS2021 and application of the CoC's *Local Planning Policy 1.12: Noise Attenuation* over the entire Jandakot Frame Area that includes the site.

There is 'Industrial' zoned land and industrial development/operations to the south of the site, with the uses within 500 m of the site largely comprising smaller depots, work yards and storage yards, with the exception being Fremantle Steel Group's steel fabrication facilities being located approximately 200 m from the nearest portion of the site. A search of the DWER Licences and Works Approvals database for the CoC does not indicate that there are any existing prescribed premises within 500 m of the site. Given the nature of the uses (currently and likely into the future) it is expected that noise would be the primary consideration in relation to the site, and there is no reason to expect that there would be significant dust or odour emissions, or higher levels of risk that would be of concern or require larger separations that would preclude residential development within the site. Any new industrial uses in the future within the industrial zoned land to the south would need to give appropriate consideration to the existing residential dwellings situated on Imlah Court, which are situated closer to the industrial area than the site. These existing residential dwellings immediately to the south of Imlah Court would provide a noise compliance threshold on industrial uses to the south and are located closer to these existing industrial uses than the site. Built form noise mitigation requirements associated with Jandakot Airport (to address AS2021 and the City of Cockburn's *Local Planning Policy 1.12: Noise Attenuation*) and the ability to provide interface treatments (i.e., solid fencing) along Imlah Court and Princep Road would ensure that any noise impacts were minimised and acceptable for any new sensitive uses within the site.

Local Structure Plan response

Based on the environmental values or attributes identified, this EAMS sets out how the LSP has responded and where required provides an environmental management framework to guide the development of the site through future subdivision and development. The principal responses are:

- Flora and Vegetation: Some areas of vegetation in 'Very Good' and 'Good' condition will be retained within the 10.15 ha of public open space (POS) and 2.6 ha of landscape interfaces that will be spread across the site. While some vegetation clearing will be required to implement the LSP this is primarily limited to isolated and disturbed patches generally comprised of non-native vegetation in 'Degraded' and 'Completely Degraded condition. POS areas can be planted with native vegetation and would then be likely to have higher ecological value than the majority of the site in its current state.
- Native fauna: Impacts on native fauna will be minimal given the site's limited habitat values and condition. The proposed LSP would allow for the retention of some of the site's black

cockatoo foraging habitat and up to ten (10) of the identified black cockatoo habitat trees will be retained subject to detailed engineering and earthworks design and approval from the City of Cockburn.

- Hydrology – stormwater and groundwater: The current hydrological functions of the site will be managed through the application of the *Better Urban Water Management Framework* (implemented through the standard planning process), as detailed in the Local Water Management Strategy (LWMS) prepared to support the LSP. It is anticipated that the site's future irrigation will use 60-70% less groundwater than required to maintain the golf course. The redevelopment will also remove the risk to groundwater quality posed by the golf course's use of fertilisers and other chemicals.
- Bushfire management: Bushfire hazards can be suitably managed through the provision of appropriate setbacks to achieve a bushfire attack level (BAL) of BAL-29 or less and constructing dwellings in accordance with *Australian Standard 3959-2019 Construction of buildings in bushfire prone areas*. Appropriate mitigation measures for bushfire can be resolved in further detail at the time of subdivision and would not compromise any proposed vegetation retention or enhancement opportunities.

The EAMS concludes that the proposed urban development can be suitably managed through the standard planning process to remove the likelihood of it giving rise to significant adverse environmental impacts. As such, there are no significant environmental issues or constraints within the site to the extent that it would preclude the site from redeveloped for urban land uses.

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List of Abbreviations

Table A1: Abbreviations – General terms

General terms	
AHD	Australian Height Datum
ANEF	Australian Noise Exposure Forecast
ASS	Acid Sulfate Soil
EAMS	Environmental Assessment and Management Strategy
ESA	Environmentally Sensitive Area
ha	Hectares
km	Kilometres
LWMS	Local Water Management Strategy
MNES	Matters of National Environmental Significance
PEC	Priority Ecological Community
PDWSA	Public Drinking Water Source Area
TEC	Threatened Ecological Community
UWMP	Urban Water Management Plan
WoNS	Weeds of National Significance

Table A2: Abbreviations – Legislation and policies

Legislation and policies	
BC Act	Biodiversity Conservation Act 2016
EP Act	Environmental Protection Act 1986
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
TPS No. 3	Town Planning Scheme No. 3

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Table A3: Abbreviations – Organisations

Organisations	
CoC	City of Cockburn
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity Conservation and Attractions
DoEE	Department of Environment and Energy (now known as the Department of Agriculture, Water and the Environment)
DoW	Department of Water (now known as Department of Water and Environmental Regulation)
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
WAPC	Western Australian Planning Commission

Table A4: Abbreviations – Planning and building terms

Planning and building terms	
LSP	Local Structure Plan
MRS	Metropolitan Region Scheme
TPS	Town Planning Scheme

1 Introduction

1.1 Background

ECP Acquisitions 6 Pty Ltd (a company related to Eastcourt Property Group) proposes to develop the former Glen Iris Golf Course into a residential estate and is progressing the preparation of a local structure plan (LSP), provided in Appendix A. The former golf course comprises Lots 6 and 7 Glen Iris Drive, Lots 3, 509 and 512 Dean Road and Lot 139 Imlah Court in Jandakot (herein referred to as 'the site') within the City of Cockburn (CoC). The site is located approximately 16 kilometres (km) South of the Perth Central Business District. The site is zoned 'Urban' under the Metropolitan Region Scheme (MRS) and 'Development' forming part of Development Area 45 under the CoC *Town Planning Scheme No. 3* (TPS No.3). The existing TPS No. 3 zones within and the surroundings of the site are illustrated below in Plate 1.

The site is approximately 53.7 hectares (ha) in size, as shown in Figure 1, and is surrounded by residential and rural residential properties and the Yangebup freight rail line to the north, the Kwinana Freeway and residential development to the west, Jandakot Airport and areas zoned 'Resource' (currently rural-residential development) to the east, industrial development to the south-east, and residential and mixed business to the south as shown below in Plate 1.

Plate 1: City of Cockburn TPS No. 3 zones and reserves within and surrounding the site (DPLH 2023)

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1.2 Purpose of this report

Emerge Associates (Emerge) was engaged by ECP Acquisitions 6 Pty Ltd to prepare an Environmental Assessment and Management Strategy (EAMS) to support the preparation of the LSP (see Appendix A) to guide the future urban development of former Glen Iris Golf Course. This EAMS provides an assessment of the potential environmental impacts that could arise from future residential development and outlines a strategy for environmental management within the site to be implemented during the future planning and development processes.

The EAMS is the principal supporting environmental document for the LSP preparation process, providing a synthesis of information regarding the environmental values and attributes of the site. It is consistent with the Western Australian Planning Commission's (WAPC) *Structure Plan Framework* (WAPC 2015b) and:

- Identifies and assesses the existing environmental values and attributes of the site (Section 2)
- Discusses the land use planning context and the proposed LSP (Section 3)
- Discusses how the LSP design responds to the existing environment and outlines the proposed future environmental management strategy (Section 4)
- Describes how the environmental management strategy will be implemented (Section 4)
- Summarises the LSP's response to the site's existing environmental values and attributes (Section 5).

1.3 Assessment scope

Emerge was engaged to undertake a range of environmental investigations and assessments across the site to support the EAMS, and additional investigations were conducted by others including an Acoustic Assessment, Geotechnical Investigations, Bushfire Management Plan and a Local Water Management Strategy, as outlined in Table 1 below. This EAMS has incorporated the outcomes of these investigations and assessments to provide an overarching environmental assessment. It further documents the existing environmental attributes and values and ensures that significant attributes and values can be accommodated within the LSP and future development stages.

Table 1: Environmental investigations, assessments and strategies undertaken/prepared to support the LSP

Component	Purpose	Relevant EAMS section/s
Detailed Flora and Vegetation Assessment (Emerge)	To assess and document the existing flora and vegetation values within the site	Section 2.2.1 Appendix C
Basic 1 Fauna and Targeted Black Cockatoo Assessment (Emerge)	To assess and document the existing terrestrial vertebrate and avian fauna habitat values and known species occurrences within the site.	Section 2.2.6 Appendix E
Arboricultural Assessment (Emerge)	To provide information on attributes of all large trees (DBH > 300mm) within the site to inform tree retention.	Section 4.3.2 Appendix F
Geotechnical Investigation Report (CMW Geosciences)	To provide recommendations with respect to geotechnical aspects of the proposed development including site prepration and earthworks, site classification, suitable foundation parameters, drainage, and indentification of geohazards and risks to the proposed development.	Section 2.1.2 and 2.6.2 Accompanies the LSP
Local Water Management Strategy (Hyd2o)	To address stormwater management of the site including areas outside the LSP area and provide an overall assessment of the existing water management system of the area and how it will be modified and integrated with the new development to improve water sensitive urban design outcomes as a result of the proposed land use change.	Section 2.3 and 4.5 Accompanies the LSP
Acoustic Assessment (Herring Storer Acoustics)	To investigate and provide any recommendations regarding noise impacts to the proposed development from surrounding land uses.	Section 2.6.3 and 4.7 Appendix G
Bushfire Management Plan	To investigate and provide any recommendations regarding bushfire risk and associated mitigation requirements	Accompanies the LSP

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2 Existing Environment

The outcomes of previously completed investigations, in addition to further site-specific targeted investigations undertaken by Emerge and others, have informed the identification and assessment of the existing environmental attributes and values within the site and are discussed in further detail below.

2.1 Landform and soils

2.1.1 Topography

The site's elevation ranges from 25 m Australian Height Datum (m AHD) in the southern portion to 40 m AHD in the northern portion of the site (DoW 2008), as shown in Figure 2.

2.1.2 Landform, soils and geology

Landform and soils influence vegetation types at regional and local scales. The site occurs on the Swan Coastal Plain, the geomorphic unit that characterises much of the Perth metropolitan area.

Examinations of broad-scale soil mapping place the site within the Bassendean soil association (BSA) (Churchward and McArthur 1980). The BSA comprises sand plains with low dunes and occasional swamps, iron or humus podzols, and complex steep dunes. It was confirmed during Emerge's field surveys that the site is located on Bassendean sands which typically are very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz and moderately well sorted of eolian origin (Purdie *et al.* 2004).

Desktop research and the Emerge field surveys did not identify any restricted landforms or unique geological features at the site.

In November and December 2020, a geotechnical investigation was carried out under the direction of CMW Geosciences Pty Ltd to provide further information on the ground conditions and provide recommendations with respect to geotechnical aspects of the proposed future residential development of the site (CMW Geosciences 2021). 55 test pits were excavated to depths of up to 2.2 m to investigate the underlying soil conditions, facilitate sampling for laboratory testing, and to assess excavatability and inform earthworks recommendations. These investigations generally confirmed the regional soil and landform mapping.

2.1.3 Acid Sulfate Soils

Acid Sulfate Soils (ASS) is the name commonly given to naturally occurring soils and sediment containing iron sulphide (iron pyrite) materials. In their natural state, ASS are generally present in waterlogged and/or anoxic conditions and do not present any risk to the environment. However, when oxidised, ASS can pose issues through sulphuric acid production, which can present a range of risks for the surrounding environment, infrastructure, and human health.

The Department of Water and Environmental Regulation (DWER) provides broad-scale mapping indicating areas of potential ASS risk (DWER 2021). A review of the DWER mapping suggests that the entire site is classified as having a 'moderate to low' risk of ASS occurring within 3 m of the natural soil surface, but a 'high to moderate' risk of ASS beyond 3 m of the natural soil surface.

2.2 Biodiversity and natural area assets

2.2.1 Flora and vegetation

2.2.1.1 Historical context

Historical aerial images available from 1953 and onwards show that the northern and southern portions of the site, separated by Berrigan Drive, were subject to vegetation clearing at different timeframes, as shown in Plate 2 to Plate 5. The northern area of the site consisted of native vegetation until construction of the central part of the golf course commenced, which is visible in aerial imagery from 1965 shown in Plate 3. By 1995 the remainder of the vegetation on the northern area was cleared for further golf course construction, shown in Plate 4 and Plate 5. Scattered remnant native trees appear to have been retained between the course fairways, however most of the vegetation has been cleared for golf course construction. The southern portion of the site, except for two patches near the southern boundary, was completely cleared of native vegetation for the golf course in the early 1990s. The vegetation on the site is therefore highly disturbed and sits within an artificial landscape setting.

Plate 2: 1953 Glen Iris Golf Course historical aerial imagery.

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Plate 3: 1965 Glen Iris Golf Course historical aerial imagery.

Plate 4: 1985 Glen Iris Golf Course historical aerial imagery.

Plate 5: 1995 Glen Iris Golf Course historical aerial imagery.

2.2.1.2 Regional context

Variations in native vegetation within the site can be classified based on regional vegetation associations. Heddle et al. (Heddle *et al.* 1980) mapping shows the site as comprising the 'Bassendean central and south' complex, described as vegetation ranging from woodland *Eucalyptus marginata – Allocasuarina fraseriana*-Banksia spp. to low woodland of *Melaleuca* spp. and sedgelands on the moister sites. This complex was determined to have 26.87% remaining as of 2019 (Government of Western Australia 2019).

2.2.1.3 Site-specific investigations

Ecologists from Emerge visited the site on 11 March 2020, and then again on 19 August, 9 September and 7 and 28 October 2021 to conduct the flora and vegetation assessment, as documented in Appendix C. As part of the survey, an assessment was made of the type, condition, values of vegetation across the site, and weed mapping was undertaking. The details of the survey for flora and vegetation are summarised in the sections below. To support this assessment and inform the consideration of tree retention within the LSP's layout, an Arboriculture Assessment was also completed in early 2021, as contained in Appendix G.

2.2.1.4 Plant communities

Based on the findings from the survey, four plant communities were recorded in the site, as described below in Table 2 and shown in Figure 3.

Plant community TdSt exists as multiple small patches on the edges of artificial lakes and is considered to be likely planted or a combination of planted and naturally generated vegetation. Plant

community EmB exists as scattered patches in the northern, central, and southwestern parts of the site. Plant communities planted trees and shrubs and turf and bare ground exist across the site and were likely previously installed for the site's historical use as a golf course.

The reminder of the site supports multiple artificial lakes, buildings and hardstand comprising an area of approximately 2.3 ha in size.

Table 2: Plant communities present within the site

Plant community	Description	Area (ha)
EmB	Woodland to open woodland *Eucalyptus marginata* subsp. *marginata*, *Banksia attenuata* and *Banksia menziesii* over mixed shrubland *Xanthorrhoea preissii*, *Allocasuarina humilis* and *Hibbertia hypericoides* over open sedgeland *Mesomelaena pseudostygia* over non-native grassland **Ehrharta calycina.*	1.9
TdSt	Closed sedgeland *Typha domingensis*, *Schoenoplectus tabernaemontani*, **Cortaderia selloana* and *Baumea* sp..	0.2
Planted trees and shrubs	Predominantly scattered non-native planted trees and shrubs such as **Corymbia* spp., **Eucalyptus* spp., *Melaleuca* spp. and *Grevillea* spp. with occasional native plants.	13.6
Turf and bare ground	Closed non-native grassland (turf) and bare ground.	35.7
	Total	51.4[1]

Note 1: Excludes areas of infrastructure and open water (2.3 ha).

2.2.1.5 Vegetation condition

The condition of the vegetation across the site was determined to range from 'Completely Degraded' to 'Very Good'. The majority (95.8%) of the site was mapped as being in 'Completely Degraded' condition predominantly due to the former use of the site, mainly consisting of Turf and bare ground. Approximately 1.30% of vegetation was mapped as 'Very Good'' condition with the remaining plant communities (2.86%) considered 'Good-Degraded' and 'Good' (Table 3). The mapped extent of the vegetation condition classes across the site is shown in Figure 4.

Table 3: Extend of vegetation condition categories within the site

Condition category (Keighery 1994)	Size (ha)
Pristine	0
Excellent	0
Very good	0.43
Very good – good	0
Good	0.69
Good – degraded	0.22
Degraded	0.8
Completely degraded	49.25

2.2.1.6 Threatened and Priority Ecological Communities

Threatened Ecological Communities (TECs) are recognised as rare or under threat and therefore warrant special protection. Selected TECs are afforded statutory protection at a Commonwealth level under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). TECs listed under the EPBC Act are categorised as either 'critically endangered', 'endangered' or 'vulnerable'.

At the state level, the *Biodiversity Conservation Act 2016* (BC Act) provides for direct statutory acknowledgement and protection for TECs. DBCA have recently advised that 65 TECs previously nominated for the listing of TECs under the BC Act have now been officially listed by order of the Minister for Environment under section 27 of the BC Act as either 'critically endangered', 'endangered' or 'vulnerable' (Government 2023). 'Modification' in relation to an occurrence of a TEC under Section 44 of the BC Act are required to be referred to DBCA and granted authorisation under Section 45 of the BC Act by the Minister.

Known locations of TECs and PECs within 10 km of the site were searched for using the publicly available *Protected Matters Search Tool* (DAWE 2021), and NatureMap (DBCA 2020b). These search results identified 10 TECs and two PECs as occurring or potentially occurring within a 5-10 km radius of the site.

The structure and composition of plant community EmB indicates that it had the potential to represent the EPBC Act listed TEC 'Banksia Woodland of the Swan Coastal Plain' (BWTEC) and the previously state listed PEC 'Banksia dominated woodlands of the Swan Coastal Plain IBRA region'. However, the EmB vegetation community does not satisfy the criteria to be considered a patch of BWTEC due to the small size of the patches. Since the EmB vegetation community does not represent the BWTEC it also does not represent a PEC.

The remainder of the site was not identified as being representative of any other State or Commonwealth listed TECs or PECs.

2.2.1.7 Threatened and priority flora

Certain flora species that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth level, flora species may be listed as 'threatened' pursuant to the EPBC Act. At a State level, plant species may also be classed as 'threatened' under the BC Act. Species that are potentially rare or threatened, meet the criteria for near threatened, or have recently been removed from the threatened species list are classed as 'priority' flora species. However, priority flora species are not afforded statutory protection.

During the detailed flora and vegetation assessment, which has involved survey across multiple dates including in Winter and Spring 2021, there were no threatened or priority flora species identified within the site, and none are likely to occur in the site.

2.2.1.8 Locally and regionally significant flora

No locally or regionally significant flora species have been identified within the site.

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2.2.1.9 Weeds

The term 'weed' can refer to any plant that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. A particularly invasive or detrimental weed species may be listed as a 'declared pest' pursuant to the state *Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread. At a National level, the Australian government has compiled a list of 32 Weeds of National Significance (WoNS) (DoEE 2019c).

As part of the flora and vegetation assessment, mapping of weed species was undertaken within the site. The weed cover within the site was widespread, with moderate-high coverage across the site, particularly in the areas subject to historical disturbance. The areas within the site classified as turf and bare ground are also consistent with widespread weed cover.

No species listed as a declared pest pursuant to BAM Act or weed of national significance were recorded within the site during the site assessments.

2.2.2 Dieback

Opportunistic observations of signs of Phytophthora dieback were noted (if present) and the location(s) recorded with a hand-held GPS unit. Signs of dieback assessed include where sensitive species were noticeably dead, dying, or absent, particularly where other less sensitive species were not. Sensitive species were identified from literature and sources such as Dieback Working Group (2021).

No signs of Phytophthora dieback were observed within the site.

2.2.3 Bush Forever

The Government of Western Australia's *Bush Forever Policy* (Government of WA 2000) is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of Bush Forever is to protect comprehensive representations of all original vegetation complexes by targeting a minimum of 10% of each for protection. Bush Forever sites represent regional ecosystems and habitat and have a vital role in conserving Perth's biodiversity.

No Bush Forever site occurs within the site. A number of Bush Forever sites occur to the east and west of the site.

2.2.4 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat.

Based on mapping undertaken as part of the Perth Biodiversity Project (PBP), there are no mapped regional ecological linkages within the site. One biodiversity ecological linkage (No.48) is located approximately 0.8 km to the north of the site and extends to the west and east. The extent to which the site could contribute to any local ecological linkage is limited due to the lack of remnant vegetation, whereas areas to the east and south of the site that do still support native remnant vegetation would provide a local ecological linkage function.

2.2.5 Environmentally Sensitive Areas

'Environmentally sensitive areas' (ESAs) are prescribed under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and have been identified to protect native vegetation values of areas surrounding values such as significant wetlands, threatened flora, threatened communities and *Bush Forever* sites.

No ESAs are present within or near the site. Multiple ESAs occur to the east and west of the site.

2.2.6 Terrestrial fauna

2.2.6.1 Site-specific surveys and investigations

An ecologist from Emerge visited the site on 11 March, between 10:30 am to 4:30 pm, and 28 May 2020, between 2:00 pm to 6:00 pm, to determine the fauna values associated with the site. A fauna list was compiled, and fauna habitat values were described, with particular reference to 'threatened' and 'priority' fauna species with potential to occur within the site, see Appendix D. In addition, following concerns raised by local residents regarding quenda, camera traps were installed during April 2021 to monitor for their presence.

2.2.6.2 Species of conservation significance

Certain fauna species that are considered to be rare or under threat warrant special protection under state and/or federal legislation. At a federal level, fauna species may be listed as 'threatened' pursuant to the EPBC Act. At a state level, fauna species may also be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act). In addition to this, the Department of Biodiversity Conservation and Attractions (DBCA) maintains a list of priority fauna species which, while not considered threatened under the BC Act and therefore not protected directly, elicit some concern over their long-term survival.

A total of 15 native, three introduced and two conservation significant fauna species were recorded within the site during site-specific surveys.

The conservation significant species recorded were:

- Carnaby's black cockatoo listed as 'endangered' under the EPBC Act

- Quenda, listed as Priority 4 at state level.

Based on the results of the fauna survey and the camera trap monitoring, these two fauna species of conservation significance were positively identified as utilising the site for some purpose, as described below:

Calyptorhynchus latirostris (Carnaby's black cockatoo [CBC]), see Appendix E

- Approximately 20 CBC were recorded perching in trees during the site assessment on 11 March 2020 within the central portion of the site.
- No signs of foraging or night roosting were recorded or observed, however the native woodland and planted trees and shrubs plant communities support plants known to be suitable foraging habitat for CBC.
- The site contains trees suitable for breeding or roosting habitat by black cockatoos, however currently there are no suitable hollows and no evidence that the site is used for roosting.
- The site is located outside the CBC's breeding range.
- There were no signs of roosting during the field visits (which included a dusk visit) and there are no records in the BirdLife Australia datasets indicating that black cockatoos use this site. The Birdlife Australia roost dataset is acknowledged as being a key reference for known roosting locations for black cockatoos on the Swan Coastal Plain portion of the Perth metropolitan area.

Isoodon fusciventer (quenda)

- Diggings of quenda were found and recorded in the southern portion of the site within dense understorey vegetation within the planted trees and shrubs, and riparian habitats.
- The site contains three habitats suitable to support quenda: Native Woodland, Riparian (not inundated), planted trees and shrubs (where understory vegetation is present and dense).
- The camera trapping undertaken in April 2021 confirmed the presence of quenda on the site.

In addition, 45 further species of conservation significance have the potential to occur on the site, however the majority of these are birds that may only use the site intermittently if at all, including forest red-tailed black cockatoo (FRTBC) which are 'likely' to occur due to potential habitat present at the site. No direct or indirect record of FRTBC was made during the site survey.

2.2.6.3 Fauna Habitat

According to the most dominant flora species, fauna habitats were identified from observations made during the site survey. The identified fauna habitats were then mapped on aerial images with boundaries interpreted from aerial photography, plant communities and notes taken in the field.

Five fauna habitats were recorded in the site. Native woodland is present as scattered patches and has the highest fauna habitat values due to the presence of native trees, shrubs and ground cover and contains microhabitats such as logs, rocks, and leaf litter. The riparian and water habitats provide value for aquatic fauna species and those associated with riparian areas. The planted trees and shrubs habitat mainly provides habitat for avian species as the majority is devoid of any understorey vegetation. The turf and bare ground habitat extends over a large portion of the site

and has minimal habitat values for native fauna species. A description of the habitat and the corresponding area is provided in Table 4.

Table 4: Fauna habitats identified within the site

Fauna habitat classification	Description	Area (ha)
Native woodland	Woodland to open woodland Eucalyptus marginata subsp. marginata, Banksia attenuata and Banksia menziesii over mixed shrubland Xanthorrhoea preissii, Allocasuarina humilis and Hibbertia hypericoides over open sedgeland Mesomelaena pseudostygia over non-native grassland *Ehrharta calycina.	1.9
Riparian	Closed sedgeland *Typha domingensis*, *Schoenoplectus tabernaemontani*, **Cortaderia selloana* and *Baumea* sp. (likely planted or a combination of planted and naturally regenerated).	0.2
Water	Water in artificial lakes of varying depth.	1.4
Planted trees and shrubs	Predominantly scattered non-native planted trees and shubs such as **Corymbia* spp., **Eucalyptus* spp., *Melaleuca* spp. and *Grevillea* spp. with occasional native plants.	13.6
Turf and bare ground	Closed non-native grassland (turf) and bare ground.	35.7
Total		52.8

2.2.6.4 Black cockatoo habitat

During the 'Targeted Black Cockatoo Assessment' a total of 11 black cockatoo habitat trees were recorded within the site. All the habitat trees were *Eucalyptus marginata* (jarrah), with each determined not to be suitable for black cockatoo breeding due to the absence of hollows.

Foraging habitat was also identified during the site assessment predominantly comprised of Banksia *attenuata* (candlestick banksia), Banksia *menziesii* (firewood banksia), *Eucalyptus patens* (Swan River blackbutt), jarrah, marri, *Melia azedarach* (Cape lilac) and *Tipuana tipu* (tipuana). A total of 4.76 ha of foraging habitat was mapped within the site for Carnaby's black cockatoo (CBC), as shown in Figure 5, and 4.88 ha for forest red-tailed black cockatoo (FRTBC), shown in Figure 6. The foraging habitat for both species of black cockatoo is comprised of vegetation providing a high, moderate or low value feeding resource, see Appendix E, with the vast majority of the vegetation being in the low resource category, as shown in Figure 5 and Figure 6.

The overall black cockatoo habitat quality score for the site, which evaluates the site's foraging, roosting, and breeding habitat, was determined to be five (5) out of ten (10) for the FRTBC representing a 'moderate' score and three out of ten for the CBC representing a 'low' score.

2.3 Hydrology

2.3.1 Groundwater

Information on the regional groundwater resources obtained from the Department of Water (DoW) Water Register (DoW 2015) indicates that the site is underlain by a multi-layered aquifer system comprised of the following resources:

- Perth - Superficial Swan (unconfined).
- Perth - Leederville (confined).
- Perth - Yarragadee North (confined).

The Department of Water and Environmental Regulation (DWER) Water Information Reporting Tool (DoW 2015) includes groundwater and surface water monitoring information from bores and wells across the state. The current water table at the northern portion of the site is 18 m from ground level with the base of the aquifer 59 m below surface level. The southern part of the site has a water table of 4 m from ground level with the base of the aquifer 47 m below surface level.

2.3.2 Surface water

There are no surface water bodies present within the site.

The site does not connect to any arterial drainage scheme, and all stormwater generated on site is infiltrated. The site currently provides stormwater storage and infiltration areas for adjacent developed areas that drain into the site, including 18 bubble up pit outlets.

2.3.3 Wetlands

Wetlands include "areas of seasonally, intermittently or permanently waterlogged soils or inundated land, whether natural or otherwise, fresh and saline, e.g. waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries" (Wetlands Advisory Committee 1977). Wetlands can further be recognised by the presence of vegetation associated with waterlogging or the presence of hydric soils such as peat, peaty sand or carbonate mud (Hill *et al.* 1996).

Wetlands of national or international significance may be afforded special protection under Commonwealth or international agreements. The following lists of important wetlands were checked as part of this assessment:

- Ramsar List of Wetlands of International Importance (DBCA 2017b).
- A Directory of Important Wetlands in Australia (DBCA 2018).

No Ramsar or listed 'important wetlands' are located within the site.

DBCA maintains the Geomorphic Wetlands of the Swan Coastal Plain dataset (DBCA 2020a), which categorises geomorphic wetland features into specific management categories to guide land use and conservation.

A review of the dataset indicated that no wetlands with conservation values (i.e. Conservation or Resource Enhancement management category) occur within or near the site, as shown in Figure 2. There are a number of Multiple Use management category wetlands in close proximity to the site, but these support limited values, and have been partially developed in the past.

2.3.4 Public drinking water source areas

DWER proclaims public Drinking Water Source Areas (PDWSAs) to protect identified drinking water sources, including surface water and groundwater sources (DoW 2009). They are proclaimed under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* or *the Country Areas Water Supply Act 1947* as Water Reserves, Catchment Areas or Underground Water Pollution Control Areas. PDWSAs provide drinking water to local populations and can be vulnerable to contamination from a range of land uses. Once an area is identified as a PDWSA, consideration needs to be given to the intended land use and associated activities to ensure that they are appropriate in meeting the PDWA's water protection quality objectives.

Parts of the site are located within a Priority 3 (P3) PDWSA, the '*Jandakot Underground Water Pollution Control Area'* (UWPCA). A review of *the Land use compatibility tables for public drinking water source areas* (DoW 2016) indicates that land zoned for urban purposes is an acceptable use within a P3 PDWSA.

The site's past use as a golf course posed potential risks to groundwater quality through the transmission of nutrients, pesticides, and chemicals (Water Corporation 2006). The historical use of fertilizers on the site posed a significant risk, as the site is located within the wellhead protection zone of a number of public drinking water supply bores. Human activity and litter were other potential hazards identified by the Water Corporation (2006).

2.4 Heritage

2.4.1 Aboriginal cultural heritage

DPLH maintain the Aboriginal Cultural Heritage Inquiry System (ACHIS), which is a directory containing locations and information about Aboriginal Cultural Heritage (ACH) in Western Australia.

A search of any occurring ACH within the site and immediate proximity was undertaken with no ACH Directory or Historic Places identified within the site on the ACHIS.

2.4.2 Non-Indigenous heritage

A desktop search of the Australian Heritage Database (Department of the Environment 2019), the State Heritage Office database (Heritage Council 2019) and the City of Cockburn Local Government Inventory and Heritage List (City of Cockburn 2021), indicated there are no registered heritage sites located within, or in proximity to the site.

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2.5 Bushfire

Portions of the site are identified within a 'bushfire prone area' on the state-wide Map of Bush Fire Prone Areas as prepared by the Office of Bushfire Risk Management (OBRM 2019), see Plate 6. Strategic planning proposals, including Local Structure Plans, require a bushfire hazard level assessment under the Guidelines for Planning in Bushfire Prone Areas Version 1.4 (the Guidelines) (WAPC and DFES 2017; DPLH & WAPC 2021).

A Bushfire Management Plan (BMP) (eco logical Australia 2021) has been prepared to support the LSP. The BMP includes an assessment of vegetation within and surrounding the site to determine applicable bushfire hazards, in accordance with *Australian Standard 3959:2018 Construction of buildings in bushfire-prone areas* (AS 3959), and an assessment of the bushfire protection criteria outlined in the Guidelines.

Plate 6: Bushfire prone areas.

2.6 Other land use considerations

2.6.1 Historical and existing land uses

A review of historical images available from 1953 (WALIA 2020) onwards shows that the northern and southern portions of the site, separated by Berrigan Drive, have been subject to vegetation clearing at different times, see Plate 2 to Plate 5 in Section 2.2.1.1.

The northern portion of the site supported native vegetation until construction of the central part of the Glen Iris Golf Course commenced, which is first visible in imagery from 1965. The remainder of

the northern portion of the site was cleared of native vegetation by 1995 for further golf course construction. Scattered remnant native trees appear to have been retained between the golf course fairway, but most vegetation was cleared during the construction of the golf course.

The southern portion of the site supported native vegetation until construction of the golf course commenced, which is first visible in imagery from 1995. The entire southern portion of the site, except two areas near the south boundary, was completely cleared of native vegetation for the golf course.

2.6.2 Potential site contamination

A review of the DWER Contaminated Sites Database indicates that the site is not registered as a contaminated site pursuant to the Contaminated Sites Act 2003. A 'Remediated for restricted use' site is located adjacent on the south-east portion of the site.

Residual construction and demolition debris may be present across the site at the locations of former buildings. During site investigations by CMW Geosciences, segments of suspected asbestos containing materials (ACM) in the form of fractured cement pipe were found in the upper 0.5 m of soil in three locations in an area along the western boundary of the central precinct adjacent to Hartwell Parade (CMW Geosciences 2021). Such occurrences are not uncommon, being a legacy of the ACM pipework previously used by the Water Corporation, some of which is still actively used for water supply. The proponent will remove this ACM before any further development commences.

2.6.3 Surrounding land uses

The central and southern portions of the site are within the predicted Australian Noise Exposure Forecast (ANEF) 20 to 25 contour for Jandakot Airport, as shown in Figure 2. The ANEF system is a tool used to illustrate the impact of aircraft noise in an area using visual contours and provides guidance on the acceptability of new development sites within each of the ANEF zones.

An acoustic assessment has been undertaken by Herring Storer Acoustics (Herring Storer Acoustics 2021) to support the LSP process and the proposed redevelopment of the site. The acoustic assessment report, provided in Appendix G, provides high level acoustic advice and informs on the potential noise impacts on future residential development caused by road traffic (Kwinana Freeway and Berrigan Drive), rail traffic (Yangebup freight rail line and future Thornlie-Cockburn passenger rail line), aircraft associated with Jandakot Airport, and industrial activities to the south of the site on Prinsep Road.

The acoustic assessment indicates that road noise emissions would result in several future lots in three separate areas within the site to require quiet house design in proximity to Kwinana Freeway and Berrigan Drive Rail noise from both the Yangebup Freight Line and the Thornlie rail line would be compliant without requiring any mitigation.

Based on the guidance within *SPP 5.3 Land Use Planning in the Vicinity of Jandakot Airport*, the majority of the northern portion of the site is not adversely impacted by aircraft noise. An area of the central and southern portion of the site is within the ANEF 20 to 25 contour. As a consequence, development approvals for future residential development on lots within this area will be

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conditioned such that the internal noise levels from aircraft noise events are to meet the criteria in AS2021 (*Australian Standard 2021 Acoustics-Aircraft noise intrusion-building siting and construction*). These lots will also require notifications on titles for aircraft noise. The City of Cockburn's *Local Planning Policy 1.12: Noise Attenuation* will also apply for the Jandakot Frame Area, that includes the site.

Industrial land uses to the south of the site would raise some noise impact considerations, however the location of existing residential premises located on Imlah Court are located at closer proximity to the industrial premises than any proposed development would be within the site. Therefore, expectations are that compliance with regulatory criterial contained in the *Environmental Protection (Noise) Regulations 1997* would be achieved for the existing situations at these locations. Notwithstanding this, considerations of any potential for noise impact from this area has been undertaken for the proposed future residential development of the site. Noise amelioration in forms of noise walls (on Prinsep Road), upgraded building designs (as per SPP 5.3) and building setbacks (50 m) of lots have been considered for future residential development. The implementation of the noise amelioration, noise levels can be managed regardless of compliance with the regulatory criteria.

3 The Proposal

3.1 Historical planning context

A request to initiate a Town planning scheme (TPS) amendment was lodged with the City of Cockburn in October 2021.

Subsequent the scheme amendment request having been received and initiated by the responsible authority; it was formally referred to the EPA under Section 48A of the *Environmental Protection Act 1986* (EP Act) in December 2021. On 20 April 2022, the EPA considered that the proposed scheme amendment should not be formally assessed under Part IV Division 3 of the EP Act, therefore for the purposes of Part IV of the EP Act, the scheme is defined as an assessed scheme. Notwithstanding this, the EPA provided advice and recommendations pursuant to Section 48A(1)(a) on the environmental issues raised by the scheme amendment. The formal decision by the EPA is attached in Appendix H and a summary of the advice and recommendations provided below:

Flora and Vegetation and Terrestrial Fauna:

'In addition to structure planning provisions, it is recommended the scheme provisions are modified to include reference to future development being required to prioritise black cockatoo habitat for retention.'

'Consistent with DBCA advice, it is recommended that through future stages of planning, vegetation containing black cockatoo habitat is set aside in public open space and enhanced through the planting of black cockatoo habitat species to mitigate the impacts from the development. Planting should be designed to reduce the risk to fauna of vehicle strike.'

Social Surrounds:

'There is 'Industrial' zoned land and industrial development/operations to the south of the site.

Future residential development associated with the amendment may be subject to dust, noise and odour impacts from industrial land use.

EPA's Guidance Statement No. 3 Separation Distances between Industrial and Sensitive Land Uses should be considered in managing potential impacts to surrounding land uses prior to progressing urban development.'

Inland Waters:

'Parts of the amendment area are located within the 'Jandakot Underground Water Pollution Control Area', a Priority 3 (P3) Priority Drinking Water Source Area (PDWSA), and within Wellhead Protection Zones (WPZ).

Future stages of planning should consider Water Quality Protection Note (WQPN) 25 Land use compatibility tables for public drinking water source areas (DWER 2021) and State Planning Policy (SPP) 2.3 Jandakot Groundwater Protection (WAPC 2017).

Future development should demonstrate best practice water management, consistent with Better Urban Water Management (WAPC 2008). Future water management plans should be prepared in consultation with Department of Water and Environmental Regulation to support local structure planning and subdivision, and should ensure that pre development hydrology is maintained post development, and that post development water quality.'

The TPS was formally amended in June 2023 and the site is now zoned 'Development' under the current CoC *Town Planning Scheme No. 3* (TPS No.3).

3.2 Local planning framework

As part of the formal TPS No.3 amendment, a number of provision insertions were made within the scheme text, some of which specify future environmental requirements as part of the LSP implementation. The TPS No.3 provisions are:

- An approved Structure Plan together with all approved amendments shall be give due regard in the assessment of applications for subdivision and development in accordance with clause 27(1) of the Deemed Provisions.
- The Structure Plan is to provide an appropriate mix of residential and compatible land uses.
- Public open space and the use of wider, landscaped road reservations shall be arranged to:
  - Promote the retention of significant mature trees and provide an amount of public open space beyond minimum standards in recognition of the character of the area and the former use as a private recreational space;
  - Retain where practicable an appropriate, amount of black cockatoo habitat, in consultation with the Department of Biodiversity, Conservation and Attractions;
  - Provide for future active recreational needs of the community; and
  - Provide an appropriate interface to surrounding landholdings.
- Future subdivision and development of the DA 45 area is limited to a maximum of 250 dwellings (by no later than 2026), until such time as a new traffic-light controlled intersection on Berrigan Drive is approved by Main Roads Western Australia and constructed at the subdivider/developer's expense.

3.3 Local Structure Plan

The Local Structure Plan (LSP) will provide a framework for the provision of future land use, subdivisions and development within the site. An indicative subdivision concept to support the LSP is provided in Appendix A. The Subdivision concept identifies the following land uses within the proposed LSP:

- Development of low to medium density residential lots.

- Public open space areas divided between the northern, central and southern portion of the site and covering 10.15 ha) of the site, which will retain native vegetation.
- Landscaped interfaces to act as buffers to existing residential areas surrounding the site, covering approximately 2.6 ha of the site.
- Conservation areas
- An integrated local road network.
- A local centre.

Specific LSP spatial considerations in response to identified environmental values include:

- Retention of native vegetation and potential black cockatoo habitat trees within POS and conservation areas.
- Landscape interfaces between existing residential areas and new development by retaining existing vegetation and mature trees.

A landscape strategy has also been prepared to demonstrate the intended open space and landscape treatment outcomes, which is included as Appendix B.

3.4 Future planning approvals process

3.4.1 Subdivision and development

Subject to the approval and endorsement of the LSP by the CoC and the WAPC, urban development of the site will be progressed through subdivision and/or development approvals during future planning stages.

In is anticipated that future subdivision approvals for the staged urban development of the site will include a range of conditions, some of which may relate to environmental matters. These conditions will need to be implemented before titles for subdivision lots are issued. Other components of redevelopment may be progressed through development approval, for example, forward bulk earthworks or other non-subdivisional works; in which case a Native Vegetation Clearing Permits may be required in accordance with Part V of the EP Act.

All environmental impacts associated with the implementation of urban subdivision and development works across the site have been considered by the EPA under Section 48A of the EP Act during their assessment of the TPS 3 scheme amendment.

Section 38 of the EP Act enables any person to refer a proposal likely to have a significant impact on the environment to the EPA, who then decide whether or not to assess the proposal. Notwithstanding this, Section 48I outlines that any proposal likely to have a significant impact on the environment, but which is within an area and for a land use that is subject to an assessed scheme (i.e., a scheme for which a determination has been made by the EPA under Section 48A), is not required to be referred to the EPA under Section 38 of the EP Act. Given the environmental impacts associated with implementation of urban subdivision and development works across the site were considered by the EPA under Section 48A of the EP Act (at the TPS No.3 scheme amendment stage),

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it is not required that the implementation of urban development works within the site would be referred under Section 38 of the EP Act.

4 Environmental Assessment and Management Strategies

This section outlines the spatial response of the LSP to the environmental attributes and values associated with the site and the environmental management considerations that will be required as part of future subdivision and development. Only those environmental values and attributes that require specific consideration based on their presence within the site, and/or applicable legislation and policy requirements have been assessed.

An assessment of the TPS amendment (and subsequent development of the site) against the EPA's environmental factors has been provided within the *Environmental Assessment Report* (Emerge Associates 2021), which supported the scheme amendment. The LSP raises no additional environmental considerations of relevance to the EPA; hence, this assessment has not been repeated in this EAMS.

4.1 Scope of Assessment

Environmental issues that are required to be included within this EAMS are listed below:

- Acid Sulfate Soils
- Flora and Vegetation
- Fauna
- Hydrology
- Bushfire Management
- Noise.

The EAMS identifies the policy framework for each impact, including the site context, management objectives, the considerations of the impact within the LSP and potential future management strategies.

4.2 Acid Sulfate Soils

4.2.1 Policy framework, site context and management objectives

DWER, through the WAPC, ensures ASS are adequately managed during the land use planning and development process. The objective of the DWER's ASS policy framework is to manage ASS appropriately to prevent the release of metals, nutrients and acidity into the soil and groundwater system that may adversely affect the natural and built environment and human health.

The principal management objective for acid sulfate soils within the site is to ensure that any future development that may disturb acid sulfate soils is appropriately managed to avoid environmental impacts.

Where relevant, the WAPC includes a standard condition relating to ASS management on subdivision applications (model subdivision condition EN8, (WAPC and DPLH 2019)) which states:

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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 Water and Environmental Regulation (DWER) 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 Water and Environmental Regulation).

4.2.2 Structure plan layout considerations for acid sulfate soils

During Geotechnical investigations (CMW Geosciences 2021), ground conditions for site preparations and earthworks were identified. It is not anticipated that bulk earth works below a depth of 1 m will be required throughout development, hence it is highly unlikely that any earthworks will cause disturbance of ASS. Therefore, ASS management does not require any spatial consideration within the LSP.

4.2.3 Future acid sulfate soils management requirements

As earthworks will not likely occur below 3 m, there is limited likelihood of encountering ASS; hence no specific management measures are required. Should earthworks extend beyond 3 m below natural ground into areas with a 'high to moderate' risk of ASS, an ASS self-assessment will be undertaken, and this will indicate what further investigation and management might be required.

4.3 Flora and vegetation

4.3.1 Policy framework, site context and management objectives

In the context of environmental impact assessments, the EPA's objective for flora and vegetation is '*to protect flora and vegetation so that biological diversity and ecological integrity are maintained*'. Where a proposal may potentially impact upon flora and vegetation values, the following mitigation hierarchy should be applied to minimise potential impacts:

1. Avoid impacts
2. Minimise impacts
3. Offset impacts

The majority of the site (95.8%) is mapped as being in 'completely degraded' condition due to the site's former use as a golf course consisting of predominantly 69.4% 'closed non-native grassland (turf) and bare ground'. The areas of vegetation in 'very good –good' and 'good' condition are quite scarce, comprising an area of approximately 1.12 ha.

4.3.2 Structure plan considerations for flora and vegetation

The majority of flora and vegetation within the site does not hold any conservation significance; however, the retention of the native environmental values within the site was an important design consideration throughout the LSP design process. The implementation of the LSP will require the clearing of isolated and disturbed patches of native vegetation, generally in a 'completely degraded' condition. Patches of the Banksia dominated vegetation community (EmB) and a significant number of the existing trees will be retained in areas of public open space, conservation areas and landscape interfaces. The findings of the Arboricultural Assessment influenced decisions about tree retention and the LSP layout. The extent of proposed vegetation and tree retention is illustrated in Figure 7 and Figure 8.

Native Woodland Community EmB comprises the highest vegetation value and condition within the site. 1.04 ha (53%) of native woodland is to be retained within the POS areas and approximately 0.9 ha cleared due to engineering constraints/requirements. In particular 95% of the patch of EmB vegetation in 'Very Good' condition has been included within POS.

The planted trees and shrubs community covers approximately 26.4% of the site and is not of any conservation significance due to its 'Completely Degraded' condition and non-native planted vegetation. Notwithstanding, 5.86 ha of this community will be retained within the landscaped interfaces between existing housing and future residential development. The earthworks and engineering necessary to implement the LSP will result in the removal of approximately 700 of the identified trees and the retention of 539 trees.

4.3.3 Future management requirements

The POS and conservation areas within LSP have been located to enable the retention and future management of parts of the site's native woodland vegetation. Furthermore, the LSP incorporates landscaped interfaces to existing residential areas, allowing for further retention of existing vegetation. A landscaping plan will be prepared for the POS and conservation areas and will address fencing, weed control, revegetation works, fauna management and landscape treatments.

The condition of the native vegetation within the POS areas is likely to improve due to appropriate management, which may involve planting additional native species, increasing the total vegetation diversity. The number of trees within the site will ultimately increase, with two street trees proposed for each new home, and additional trees planted within the POS areas, at least a minimum of 1000 new trees the species of which will be endemic and native to the site.

A landscaping plan will be prepared for the POS and buffer areas and will address fencing, weed control, revegetation works and landscape treatments, generally in accordance with the landscape strategy provided in Appendix B.

Where native vegetation is required to be cleared within the site, this will likely be undertaken in accordance with a subdivision approval and associated authorised subdivision works, and in accordance with a Construction Environmental Management Plan.

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4.4 Fauna

4.4.1 Policy framework, site context and management objectives

In the context of environmental impact assessment, the EPA's objective for terrestrial fauna is *'to protect fauna so that biological diversity and ecological integrity are maintained'*. The application of the mitigation hierarchy should be applied to avoid or minimise impacts to terrestrial fauna where possible.

The EPBC Act also provides protection for listed 'threatened' species, including black cockatoos. Any proposed action which is considered likely to result in a 'significant' impact upon these species, identified by DAWE as Matters of National Environmental Significance (MNES), should be referred to the Department (now the Department of Climate Change, Energy, the Environment and Water).

Five fauna habitats were recorded in the site as outlined in Section 2.2.6.3. Native Woodland is present as scattered patches and was found to have the highest fauna habitat value due to the presence of native trees, shrubs and groundcover. The dense understorey and ground cover within the Native Woodland vegetation community make it suitable quenda habitat. Riparian vegetation community furthermore provides suitable quenda habitat due to the thick ground cover. However, most of the planted trees and shrubs community do not provide any suitable habitat for quenda lacking the dense understorey vegetation and cover for the species.

The site provides 4.76 ha of foraging habitat for Carnaby's black cockatoos (CBC) and 4.88 ha for forest red-tailed black cockatoo (FRTBC), of which the majority provides a low foraging resource, see Appendix E. Surveys identified 11 habitat trees for black cockatoos, though none contain suitable breeding hollows. Areas surrounding the site to the north, east, south-east, especially Bibra Lake Reserve less than 2 km north-west of the site, are identified as a suitable feeding habitat for black cockatoos (DBCA 2017a).

4.4.2 Structure plan considerations for fauna

The LSP has principally focussed on retaining the Native Woodland habitat, that provides foraging habitat for CBC and FRTBC, and quenda habitat. Up to 10 of the black cockatoo habitat trees will be retained (subject to agreement with the City of Cockburn), see Figure 8, subject to detailed engineering and earthworks design. The potential clearing of habitat trees is unlikely to cause any adverse impacts on black cockatoos given the more suitable habitat surrounding the site.

Revegetation of the POS areas within the site, using local native plant species, will provide additional fauna habitat within these areas.

4.4.3 Future management requirements

A preliminary self-assessment against the *Matters of National Environmental Significance Significant Impact Guidelines* (DotE 2013) was undertaken to determine the likelihood of whether future subdivision or development approval applications will require referral pursuant to the EPBC Act. It was concluded that due the limited extent of quality foraging habitat for black cockatoo species, and the absence of any trees with suitable breeding hollows on the site, future development is highly unlikely to significantly impact any species of black cockatoo. Hence a referral pursuant to the EPBC Act is presently deemed unnecessary.

Once detailed designs have been progressed to the stage that they can support a subdivision or development application, sufficient certainty will be available to confirm the extent of any impact to black cockatoo species. Using this information, the self-assessment in accordance with the *Matters of National Environmental Significance Significant Impact Guidelines* will be reviewed to determine if the confirmed impact extent raises any issues that will alter the current view that any impact to black cockatoo species will not be significant.

A landscaping plan will be prepared for the POS and buffer areas and will address fencing, weed control, revegetation works, fauna management and landscape treatments, generally in accordance with the landscape strategy provided in Appendix B. Additionally, a fauna relocation management plan will be prepared to accommodate for the site's quenda population, which is anticipated to be implemented as a condition of future subdivision approvals.

Where fauna habitat is required to be cleared within the site, this will likely be undertaken in accordance with a subdivision approval and associated authorised subdivision works, and in accordance with a Construction Environmental Management Plan.

4.5 Hydrology

4.5.1 Management objectives

In the context of environmental impact assessment, the EPA's objective for inland waters is *'to maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected'.*

In addition, the *State Water Strategy for Western Australia* (Government of WA 2003) and *Better Urban Water Management* (WAPC 2008) endorses the promotion of integrated water cycle management and application of water sensitive urban design (WSUD) principles to provide improvements in the management of stormwater and to increase the efficient use of other existing water supplies.

There are no surface water bodies or natural wetlands within the site, however, parts of the site are located within a Priority 3 Public Drinking Water Source Area (PDWSA), the *Jandakot Underground Water Pollution Control Area.* Land used for urban purposes, including residential development, is acceptable within a Priority 3 PDWSA.

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The principal management objective for hydrology within the site is to ensure that the post-development environmental flows and/or hydrological cycles are improved or maintained to pre-development conditions, especially regarding groundwater sources, the PDWSA and water pollution control area.

4.5.2 Structure plan layout considerations for hydrology

A Local Water Management Strategy (LWMS) has been prepared (Hyd2o Hydrology 2020) to support the LSP, in accordance with the requirements of state and local planning policies. The LSP provides an opportunity for the overall improvement of the local water environmental by reducing nutrient runoff and the use of irrigation bore water abstraction from the local superficial aquifer, by between 60-70%.

The LWMS addresses the site's stormwater management, including areas outside of the LSP area that currently discharge stormwater into the site. The LWMS provides a comprehensive assessment of the existing water management system of the site and how it will be modified and integrated with the new development to improve the WSUD outcomes. The LWMS provides a complete water cycle management approach to the proposed development and the stormwater management system has been designed in accordance with the objectives and principles of *Better Urban Water Management* (BUWM) (WAPC 2008), see summary below, and in consultation with stakeholders such as the City of Cockburn and DWER.

LWMS summary:

- The stormwater management system will consist of a series of in lot soakwells, road drainage pits, piped drainage, overland flows paths, swales and distributed bioretention and flood storage areas within the POS areas and road reserves for water quality treatment and major event management.
- Pipe networks, and associated maintenance, will be minimised through the implementation of many small-scale local catchments to treat and infiltrate stormwater runoff at the source.
- Underground storage will be required in some areas due to constraints provided via the level of existing pipes inverts entering the site from external catchments.
- Water quality will be managed within POS areas through the biofiltration treatment of runoff generated by the first 15mm of rainfall prior to infiltration.
- Development levels will have suitable clearance above groundwater and 1% AEP flood levels.
- Soakwells within lots sized to retain and infiltrate first 15mm rainfall.
- Water-wise landscaping will be implemented to retain stormwater and minimise runoff.
- Use of cut/fill across the site to minimise import fill and establish levels to meet the design criteria of clearance above groundwater and the 1% AEP level in POS infiltration areas.
- Groundwater quality is expected to improve relative to the current mean total nitrogen values, which ranging from 0.70 mg/L to 9.30 mg/L, exceeding the guideline limit of 1.2 mg/L. These elevated levels are likely due to fertiliser application on the former golf course.

4.5.3 Future management requirements

The LWMS provides for the environmental management framework for groundwater and stormwater within the site.

The predevelopment groundwater and stormwater monitoring program is set to be completed by the end of winter 2021, with the final results to develop water quality targets. All future planning stages are to be consistent with BUWM, including preparation of Urban Water Management Plans (UWMPs). Furthermore, the staging of stormwater is set to be detailed in the relevant UWMP's and implemented to ensure critical hydrological performance criteria are maintained during the staged redevelopment.

Generally, a UWMP will address the following considerations:

- The detailed drainage design including the size, location and design of POS areas, integrating major and minor flood management capability.
- Imported fill specifications and requirements, including management of groundwater levels and proposed cut/fill levels.
- Implementation of water conservation strategies, including the provision of POS irrigation water use distribution details.
- Non-structural water quality improvement measures.
- Management and maintenance requirements.
- Construction period management strategy.
- Monitoring and evaluation program.
- Status of groundwater abstraction license.

4.6 Bushfire management

4.6.1 Policy framework, site context and management objectives

State Planning Policy 3.7 Planning in Bushfire Prone Areas (WAPC 2015a) requires that a bushfire management plan accompany any local structure plan that occurs partly or wholly within a bushfire prone area. A Bushfire Management Plan (BMP) (eco logical Australia 2021) has been prepared to support the LSP.

4.6.2 Structure plan considerations for bushfire management

The majority of the on-site vegetation is proposed to be cleared to enable urban development, which will be set amongst landscaped buffers, managed Public Open Space (POS) and various easements. The BMP concludes that the current on-site vegetation will not be a bushfire hazard issue post-development, since these hazards can be managed through a staged clearing process, adequate separation of future built assets from bushfire classified vegetation, and ongoing fuel management that can be undertaken in and around individual development stages.

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4.6.3 Future bushfire management requirements

The BMP considers that the bushfire hazards within and adjacent to the site and the associated bushfire risk is readily manageable through standard management responses and compliance with acceptable solutions outlined in the Guidelines. These responses will be detailed in further BMPs prepared to support future subdivision or development applications. Bushfire management requirements are not expected to affect vegetation retention or enhancement opportunities that have been considered as part of formulating the current structure plan,

4.7 Acoustic Impacts

4.7.1 Policy framework, site context and management objectives

The site is located within a developed area with urban residential development to the west adjacent to Kwinana Freeway, Jandakot Airport located 1.6 km to the east, and industrial development to the south of the site past Berrigan Drive and Jandakot Road, and such is likely to be impacted by transport noise. *SPP 5.4 Road and Rail Noise* (DPLH 2019) recognises that excessive noise has the potential to affect the health and amenity of a community, as well as the wellbeing of individuals. SPP 5.4 aims to protect people from unreasonable levels of transport noise by establishing a standardised set of criteria to be used in the assessment of development proposals.

The site is located approximately 1.6 km west of Jandakot Airport and thus subject to the provisions of state planning policy in relation to aircraft noise, *SPP 5.3 Land Use Planning in the Vicinity of Jandakot Airport* (WAPC 2017). The central and southern portions of the site are within the predicted Australian Noise Exposure Forecast (ANEF) 20 to 25 contour for Jandakot Airport, see Figure 2. The ANEF system is a tool used to illustrate the impact of aircraft noise in an area using visual contours and provides guidance on the acceptability of new development sites within each of the ANEF zones.

4.7.2 Structure plan layout considerations for noise

Noise insulation is not mandatory for residential development within the 20 to 25 ANEF; however, some areas may experience maximum aircraft noise levels in excess of the Indoor Design Sound Levels specified in *Australian Standard 2021:2015 Acoustics: Aircraft Noise Intrusion – Building Siting and Construction* (AS 2021:2015) and noise insulation is recommended in such cases. Additionally where land is zoned for residential purposes or to permit residential development, the maximum dwelling density should generally be limited to R20 and a notice on title advertising of the potential for noise nuisance is required as a condition of any subdivision or planning approval within the noise exposure zone (WAPC 2017).

The road traffic noise assessment indicates that noise levels will exceed the target in three areas of the site based on the future traffic volumes on Kwinana Freeway and Berrigan Drive, and some future lots would require quiet house designs in the form of quiet house packages. The lots in these areas will also require notification on titles of the freeway noise impact. Rail noise from the Yangebup Freight line and the Thornlie rail line have been assessed as being below the night time noise target; hence no responses is required.

4.7.3 Future management requirements

The noise assessment of the site (Storer 2023) has not identified the need for any physical management measures e.g. noise barriers. However, future residential lots within the areas exceeding the road noise target and those in the central and southern portions of the site located within the ANEF 20 to 25 contours require notification on titles of the freeway noise impact, and potential aircraft noise, respectively. Furthermore, the design of dwellings on lots within the ANEF 20 to 25 contours must be designed to achieve internal noise levels (for aircraft noise events) that meet the criteria contained in AS2021. A "deemed to satisfy construction" has been provided in the noise assessment report including recommendations and requirements for glazing, walls, roof, and ceiling.

It is expected that the built form treatments to respond to aircraft noise and interface treatments (i.e., solid fencing) will adequately mitigate any noise emissions from industrial uses to the south given the presence of existing residential dwellings (i.e., noise sensitive premises) to the south of the site which are closer to the industrial uses.

The acoustic assessment report is provided in Appendix G.

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5 Implementation Framework

A summary of how the LSP responds to the environmental values and attributes within the site is provided in Table 5. The table also outlines the proposed and potential future management measures required for the subdivision and development process.

Table 5: Environmental management framework implementation table

Factor	Structure plan phase (completed)	Subdivision phase	Part of development works
Acid sulfate soils	• Consider ASS Risk mapping as prepared by DWER. No spatial response in LSP required.	• If required, completion of ASS self-assessment and preparation of an Acid Sulfate Soil and Dewatering Management Plan.	• Implementation of an Acid Sulfate Soil and Dewatering Management Plan, as required.
Native vegetation	• Assessment of flora and vegetation values and preliminary consideration of potential retention opportunities. • Retention of native vegetation in POS area.	• Preparation of landscaping plan for the POS areas. • Preparation of a Construction Environmental Mangagement Plan.	• Implementation of plans.
Native fauna	• Assessment of fauna habitat and preliminary consideration of potential retention opportunities. • Retention of potential black cockatoo habitat trees within POS areas.	• Preparation of landscaping plan for the POS areas. • Preparation of a Construction Environmental Mangagement Plan to provide measures to minimise impacts to fauna during construction works. • Preparation of a fauna relocation management plan to accommodate for the site's quenda population, which is anticipated to be implemented as a condition of future subdivision approvals.	• Implementation of plans.
Hydrology and stormwater management	• Preparation of a Local Water Management Strategy. • POS areas to provide adequate stormwater biofiltration via a system of swales.	• Preparation of Urban Water Management Plans.	• Implementation of the plans.
Heritage	• Preliminary desktop investigations into heritage sites.	• N/A	• N/A
Bushfire risk	• Preparation of a Bushfire Management Plan. • Provision of public open space and road reserves to accommodate appropriate setbacks. • Determining a spatial layout that reduces the bushfire hazard to future development.	• Complete detailed BAL assessment to support dwelling construction.	• Dwellings within 100 m of bushfire threat to demonstrate compliance with AS 3959. • Notifications placed on titles of lots subject to a bushfire risk.

Factor	Structure plan phase (completed)	Subdivision phase	Part of development works
Site contamination	• Removal of ACM (water pipes).	• N/A	• N/A
Noise	• Preparation of a Noise Impact Assessment • Determine noise implications from road and aircraft.	• Preparation of a Construction Environmental Mangagement Plan to provide measures to minimise noise impacts during construction works.	• Implementation of plans. • Notifications placed on titles of lots subjected to elevated levels of road or aircraft noise.

6 Conclusion

This *Environmental Assessment and Management Strategy* (EAMS) has been prepared to support a Local Structure Plan (LSP) for the former Glen Iris Golf Course redevelopment.

The EAMS provides a synthesis of information regarding the environmental values and attributes of the site, obtained from a range of sources such as local and regional reports, databases, mapping and site-specific investigations. The following documents provide support to this EAMS:

- *Detailed Flora and Vegetation Assessment, Former Glen Iris Golf Course* (Emerge Associates 2021), see Appendix C.
- *Basic 1 Fauna Assessment, Former Glen Iris Golf Course* (Emerge Associates 2021), see Appendix D.
- Targeted Black Cockatoo Assessment, Former Glen Iris Golf Course (Emerge Associates 2021), see Appendix E
- *Arboricultural Assessment, Former Glen Iris Golf Course* (Emerge Associates 2021), see Appendix F.
- *Local Water Management Strategy, Glen Iris, Jandakot (Hyd2o Hydrology 2021)*
- *Bushfire Management Plan* (eco logical Australia 2021)
- *Acoustic Assessment (Storer 2023)*, see Appendix G.

The environmental attributes and values identified within the site have been outlined in Section 2 of this document, and consideration of potential impacts on environmental values have been outlined within Section 4.

Listed below is a summary of the principal spatial responses.

- Native Vegetation: areas of the native woodland vegetation community will be retained within areas of Public Open Space and landscape buffers. Up to 10 of the 11 black cockatoo breeding habitat trees will also be retained.
- Hydrology: The current hydrological functions of the site will be maintained by applying the Better Urban Water Management Framework (implemented through the standard planning process), as detailed in the LSP's Local Water Management Strategy (LWMS). The LSP and the future use of the site are likely to improve the overall quality of local groundwater through the removal of potentially pollution activities associated with the golf course, e.g., the use of fertilizers.
- Bushfire risks: Appropriate setbacks and vegetation management measures will be employed to ensure that residential dwellings are subject to no more than BAL-29.

The EAMS has found that the implementation of the proposed LSP can be suitably managed through the standard planning processes to remove the likelihood of it giving rise to significant adverse environmental impacts.

7 References

7.1 Legislation

Biodiversity Conservation Act 2016

Contaminated Sites Act 2003

Environmental Protection Act 1986

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Figure 8: Structure Plan Habitat Retention

Figure 1: Site Location

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Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(09)--F26
Drawn: GAR
Date: 01/04/2021
Checked: PPS
Approved: ALB
Date: 04/06/2021

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GDA 1994 MGA Zone 50

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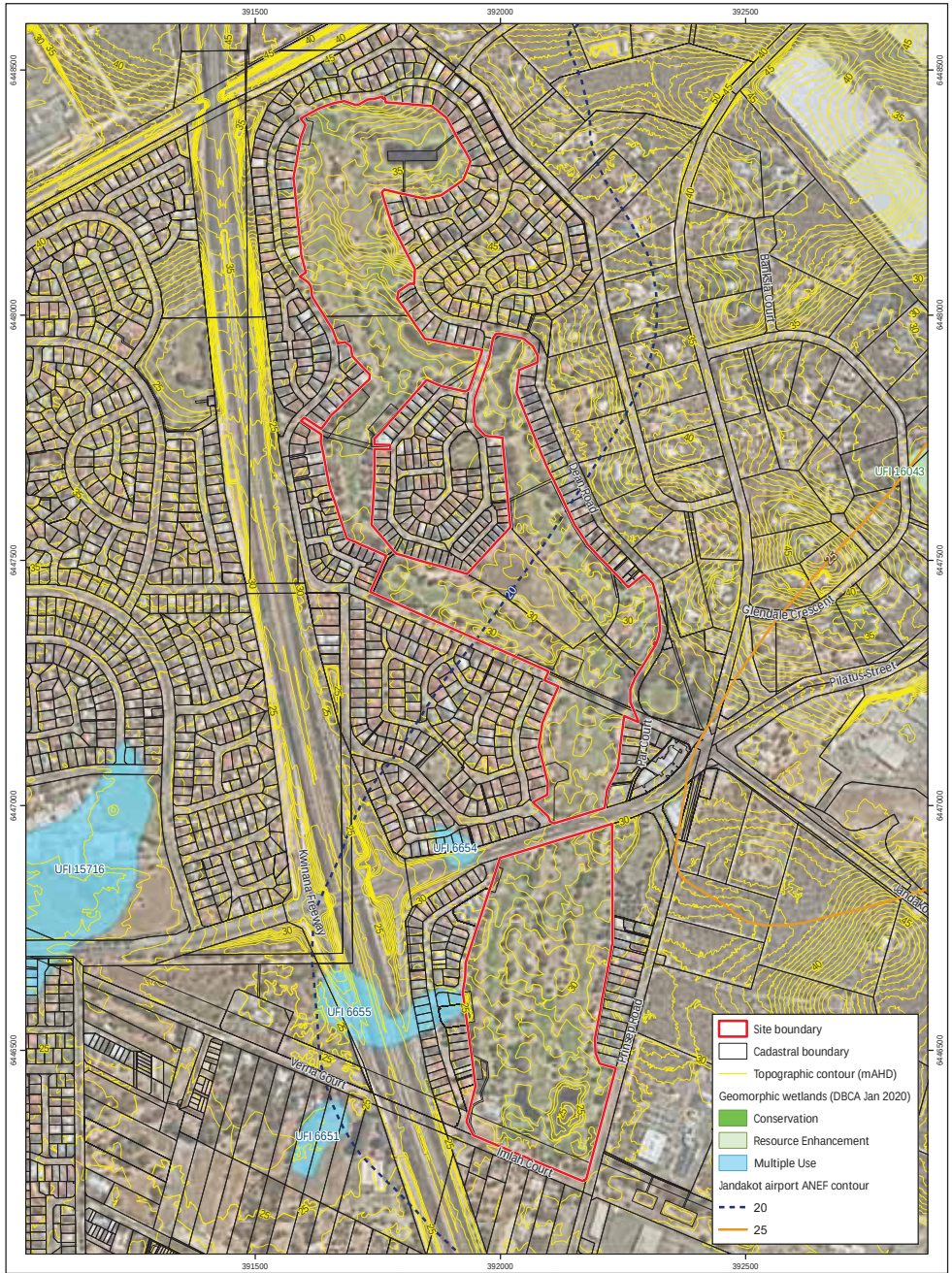

Figure 2: Environmental Features

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Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(09)--F27
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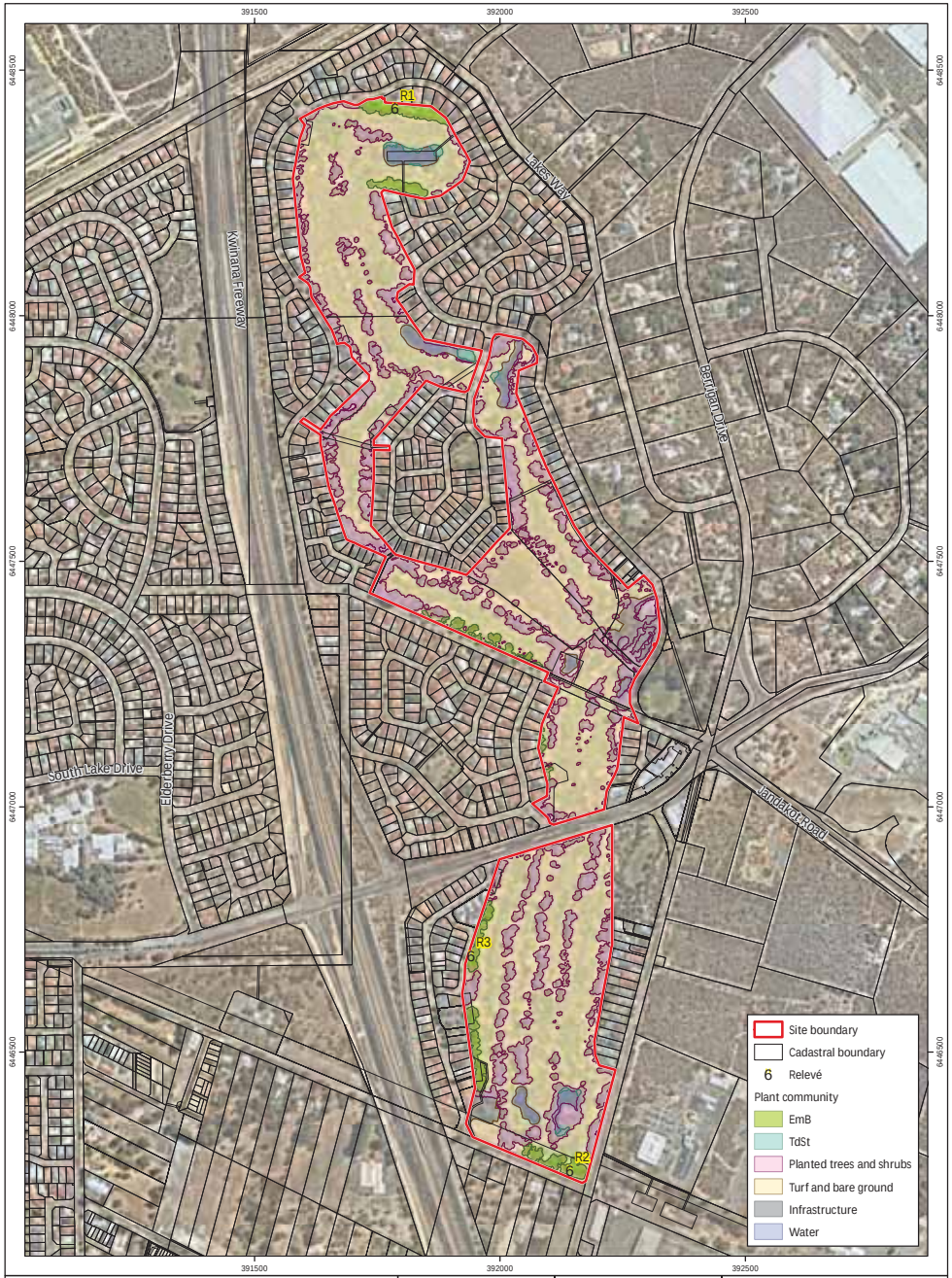

Figure 3: Plant Communities

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Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(09)--F28a
Drawn: GAR
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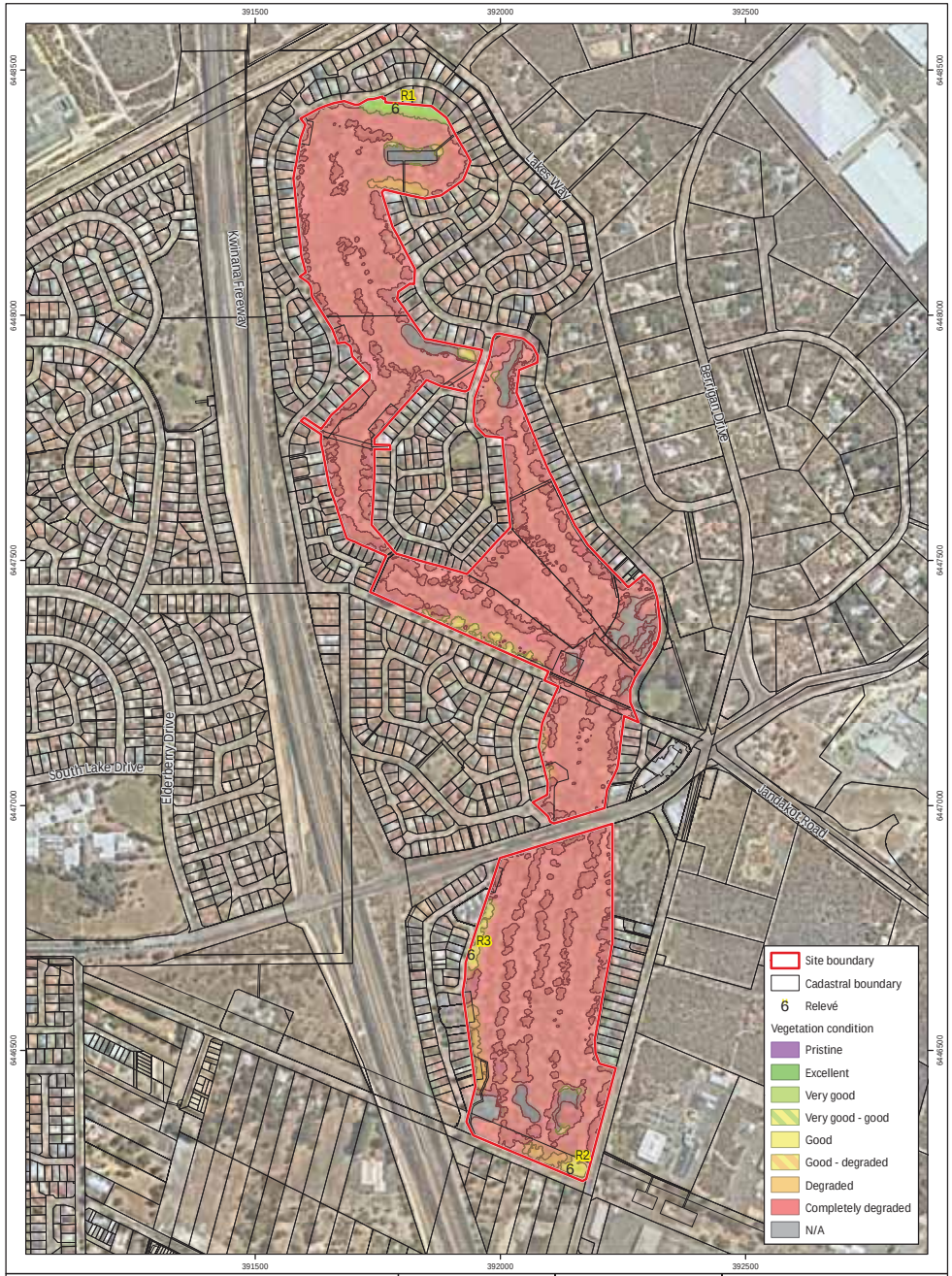

Figure 4: Vegetation Condition

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Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(09)--F50
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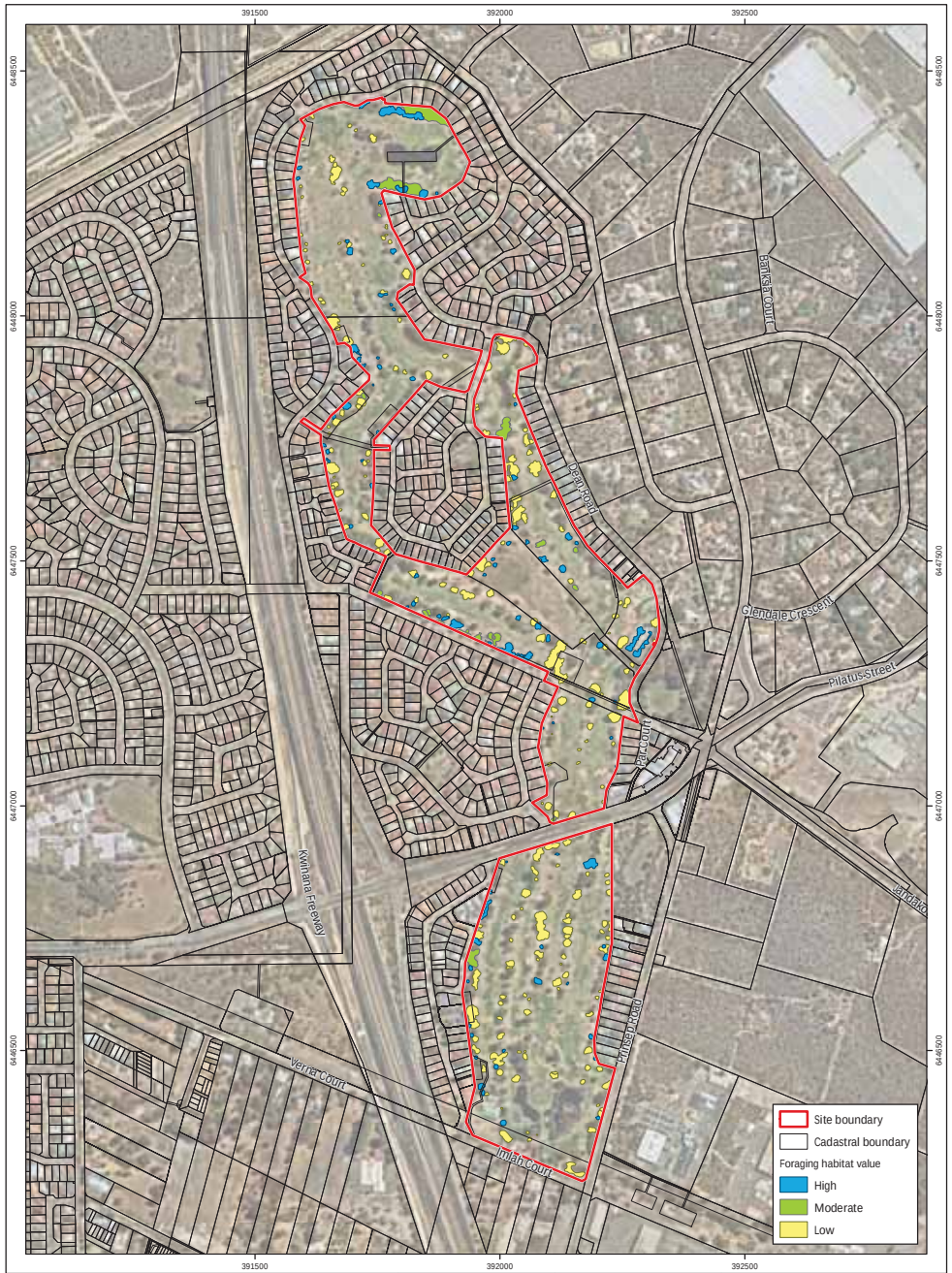

Figure 5: Potential Carnaby's Cockatoo Foraging Habitat

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Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(09)--F38b
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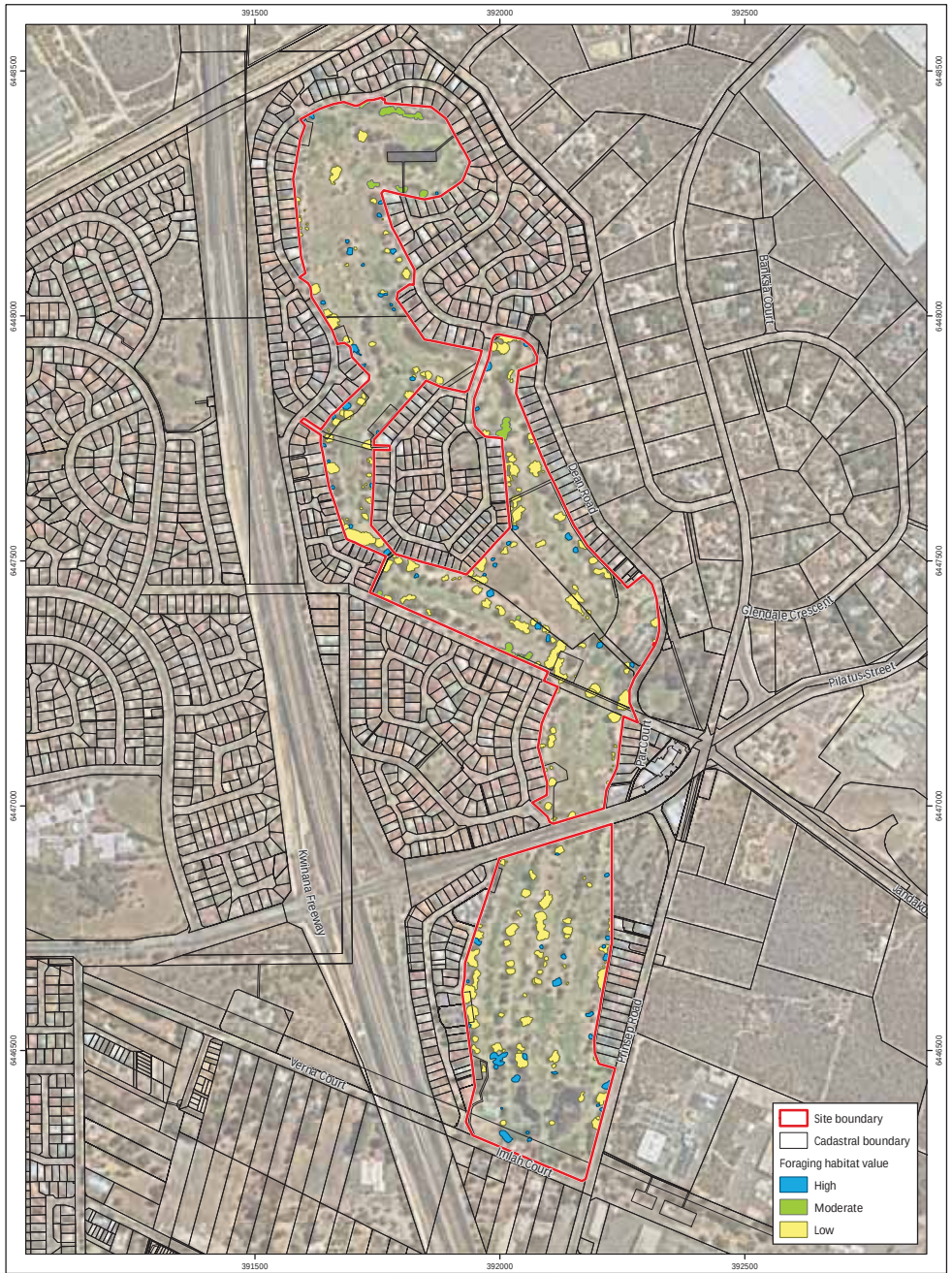

Figure 6: Potential Forest Red-tailed Black Cockatoo Foraging Habitat

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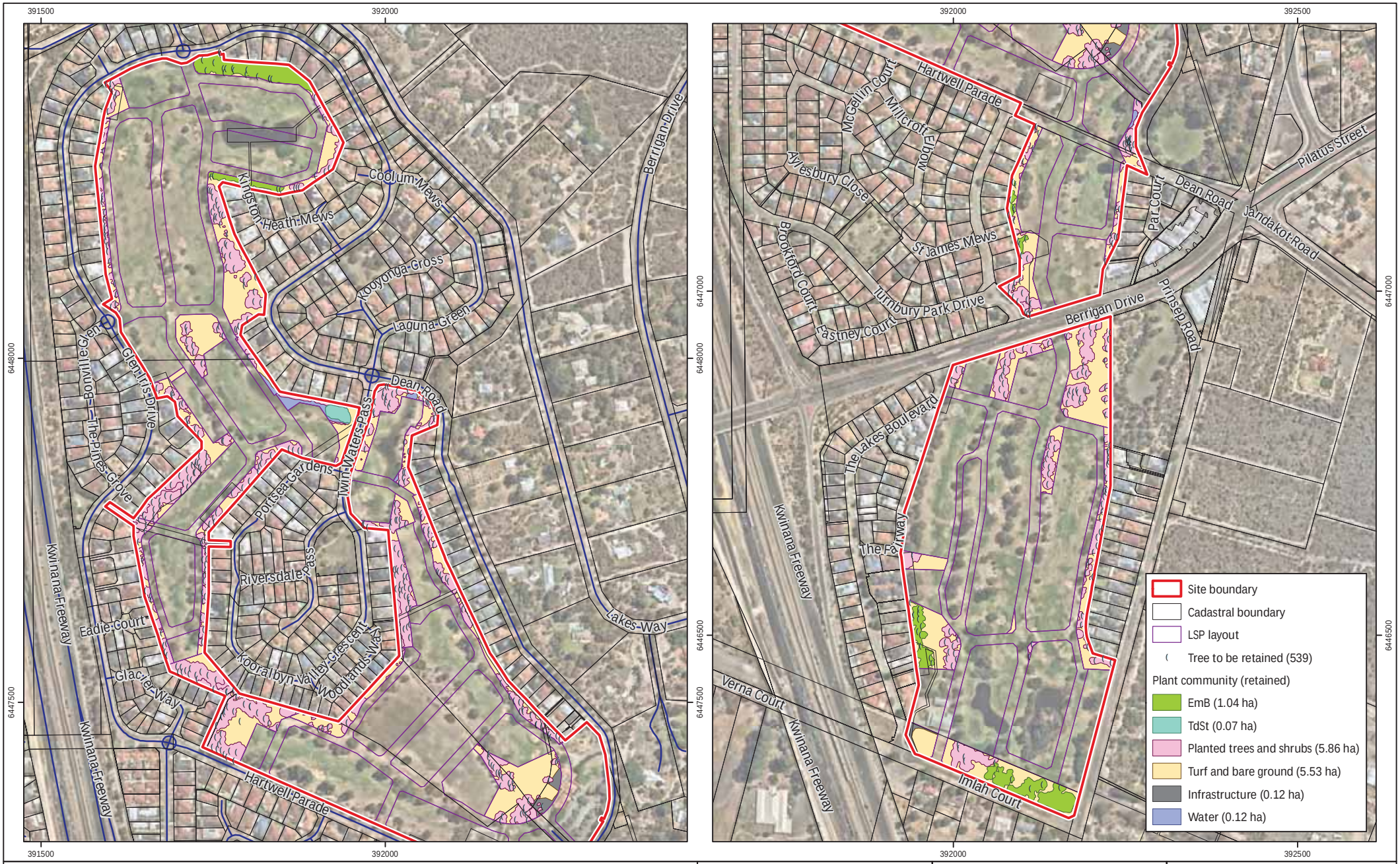

Figure 7: Vegetation and Tree Retention

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Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(09)--F20c
Drawn: GAR
Date: 05/07/2023
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Approved: JDH
Date: 30/08/2023

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Metres
Scale: 1:7,250@A4
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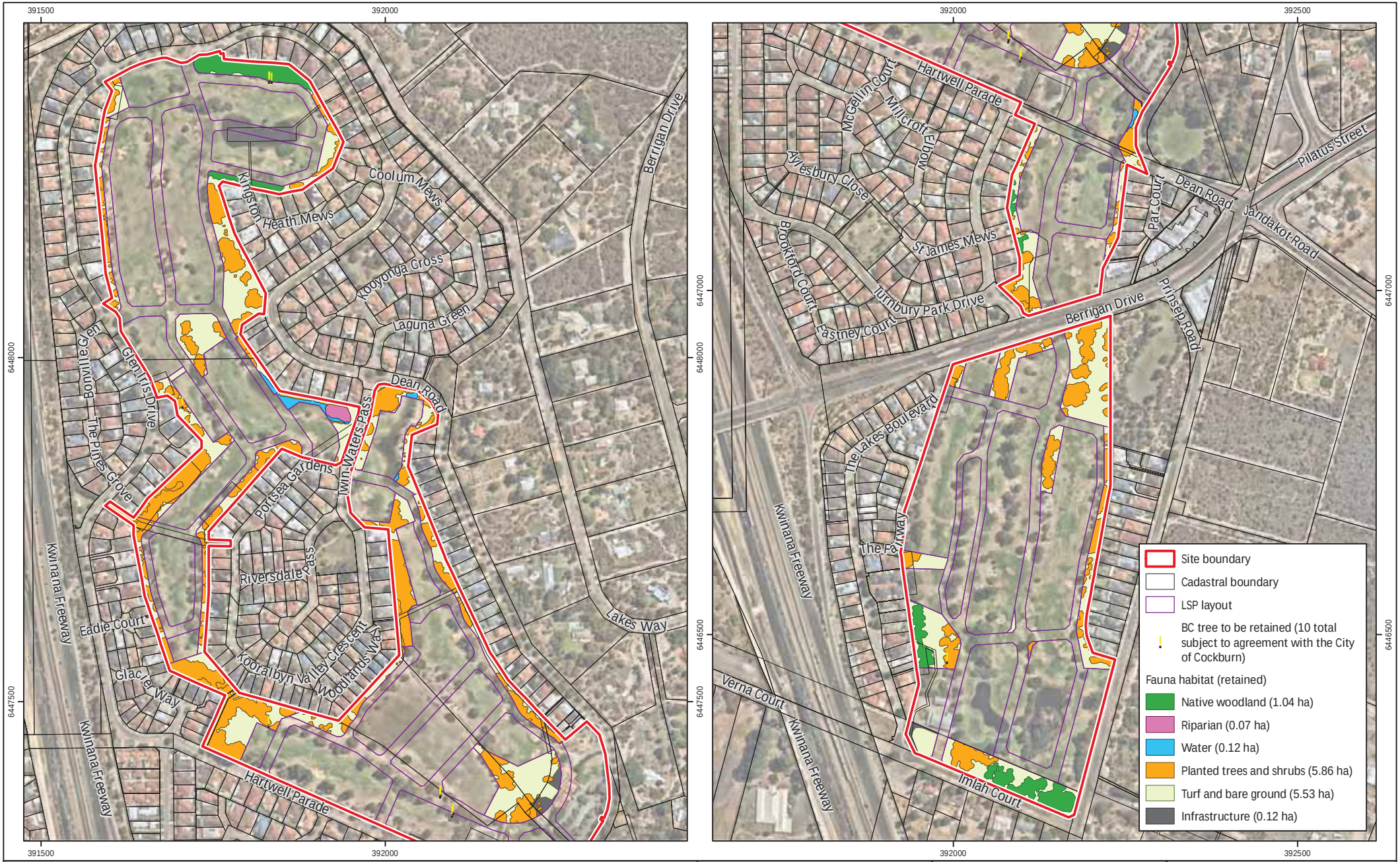

Figure 8: Fauna Habitat Retention

Project: Environmental Assessment and Management Strategy
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(09)--F51a
Drawn: GAR
Date: 05/07/2023
Checked: PPS
Approved: JDH
Date: 30/08/2023

0 100 200 300
Metres
Scale: 1:7,250@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

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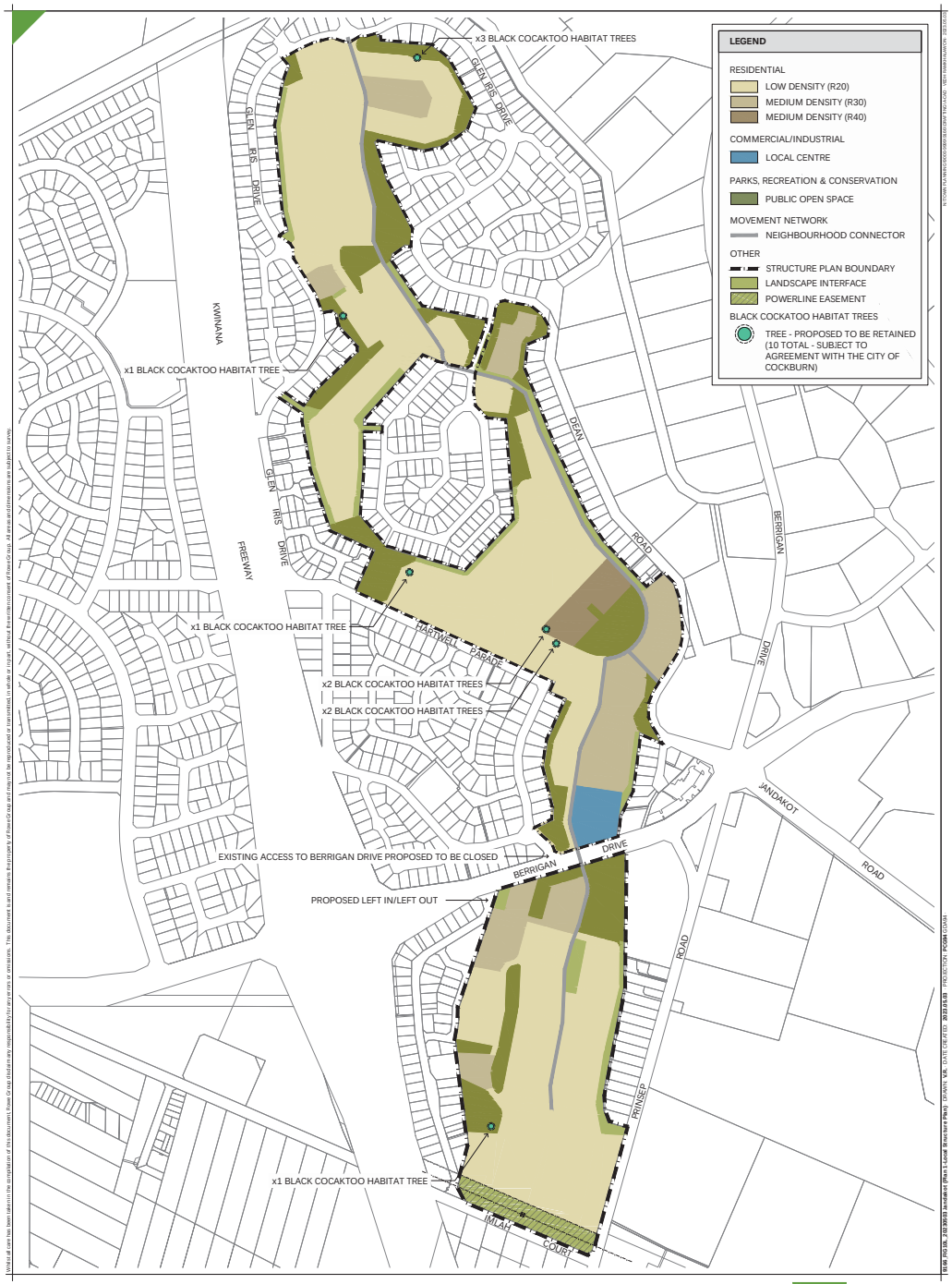
Appendix A

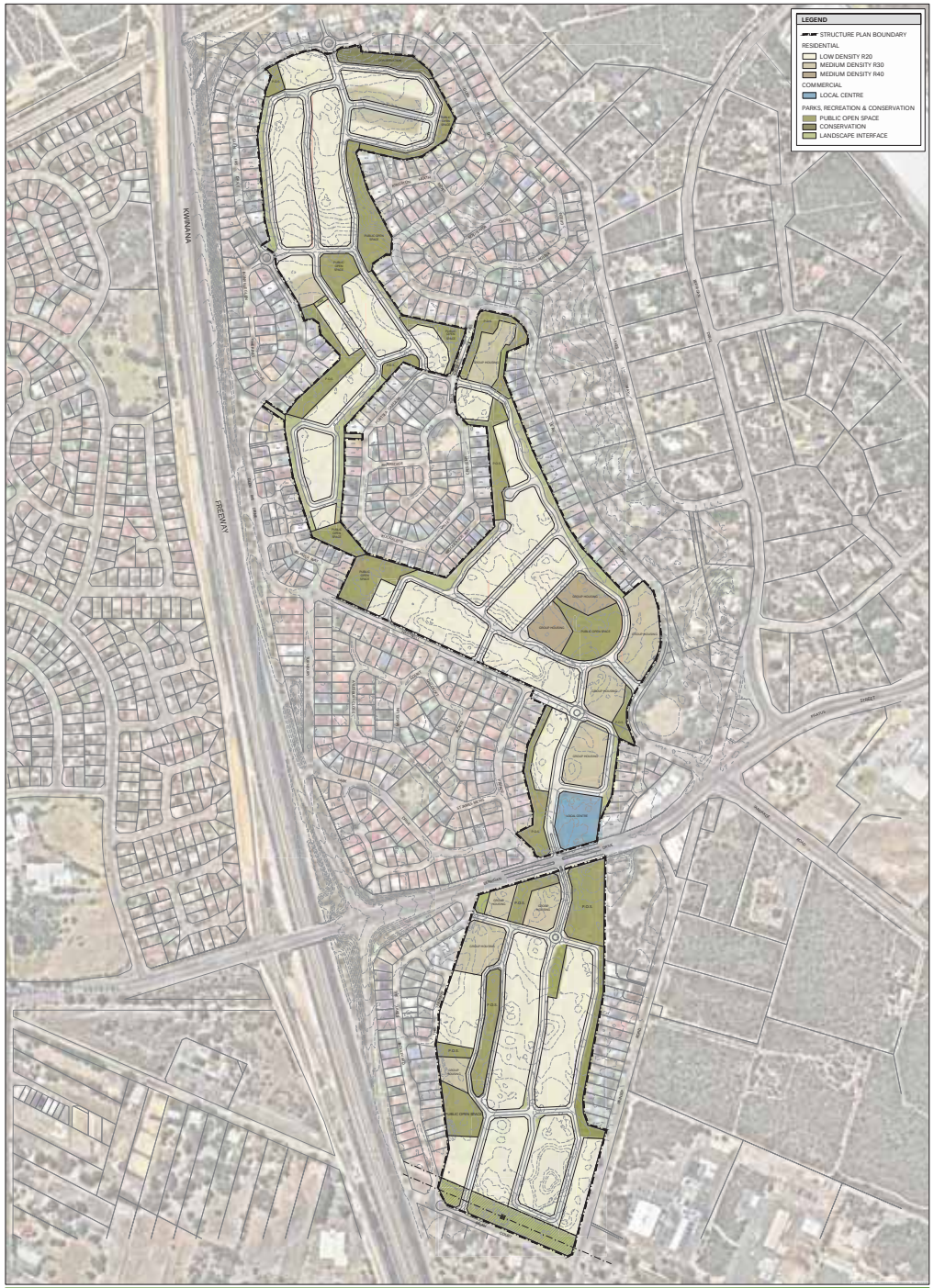
Local Structure Plan and Indicative Subdivision Concept
(Rowe Group Design 2023)



PLAN 1 - LOCAL STRUCTURE PLAN
GLEN IRIS DRIVE
JANDAKOT

SCALE @ A3: 1:6000
9166-FIG-10-L

ROWE GROUP DESIGN



INDICATIVE SUBDIVISION CONCEPT
GLEN IRIS ESTATE
JANDAKOT

SCALE @ A1: 1:3000
9166-CON-12-A

ROWE GROUP DESIGN

Appendix B

Landscape Strategy (Emerge Associates 2023)

Glen Iris Estate

Landscape Strategy for Local Structure Plan
Eastcourt

July 2023

emerge ASSOCIATES

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REVISION	DATE	ISSUE OR AMENDMENT	BY	REVIEWED
A	June 2021	Issued for approval	CN	CN
B	Sept 2021	Issued for approval	CN	CN
C	March 2022	Issued for Text Update to page19	CN	CN
D	April 2022	Issued for Text Update to page 5	CN	CN
E	July 2023	Structure Plan Modifications	XZ	SM

1.1 General

The proposed redevelopment of the former Glen Iris golf course has created the need for a planning design to create residential housing including the provision of considerable areas of landscaped open space in a generally somewhat constrained space. The redevelopment includes planning for between 550 and 600 residential dwellings of varying densities in areas between the existing residential uses adjoining and surrounding the site. The use of landscaped open space is critical in providing for the needs of new and providing additional amenity to all existing residents. The project broadly consists of north, central and southern residential precincts.

It was noted during the extensive community consultation phase of the design process that the opportunity exists for a more diversified and broader accessible open space network than the previous fenced and single use golf course. The planning layout and landscape design have worked together to maximise the access and usability of the open space areas as a broader green link network with the aim of connecting precincts both within the new development and with the existing development surrounding the site.

1.2 Landscape Approach

The nature of the project as an infill redevelopment offers the opportunity to both create new existing open space precincts in its own contemporary style and also to be complimentary and mindful of the retention and expression of the sites existing older character. The overall intent of the landscaped open space design is encompassed below:

- To reflect and respond to the key existing landscape elements and character of the site in order to maintain visual continuity between existing and new precincts wherever reasonably possible. This includes built form and landscape treatments within streetscapes and open space.
- To provide safe external environment for the quiet enjoyment of the residents, guests and the general public.
- To best cater for the lifestyle needs and aesthetic desires of the existing residential community within the bounds of the capacity of the development to do so.
- To best cater for the lifestyle needs and expected desires of the new future residential community in reference to their anticipated demographics.
- To provide integrated public access that links with the existing residential, street and path network with a strong sense of movement opportunity, options and legibility as part of a broader open space green link strategy.
- To retain mature trees where ever reasonable and practical to do so within the bounds of the projects delivery and approval requirements.
- To provide a more environmentally sustainable outcome than the prior land use as a golf course, inclusive of the use of sustainable design practices as applied to new works.
- To consider habitat retention and creation in various methods including vegetation retention and replanting.

- To clearly define various landscape design typologies as applicable to all areas of open space to assist in the provision of facilities and legibility.
- To manage fire risk in a creative and aesthetic manner while meeting required standards and obligations.
- To respond to the local colour palette with either matching or complimentary colours and textures with the aim of visually minimizing visual impacts and blending where possible.

1.3 Private Realm Strategy

The project's private realm consists of landscaped open space within private residential lots in both front and rear yards. In the case of higher density strata development areas, the open space consists of common areas for access and the use of those strata residents as well as private open space to balconies and courtyards in accordance with R-Code requirements.

It is envisaged that landscape guidelines will be provided to residents as part of their purchase process to assist them in making informed landscape choices around design, aesthetics, sustainability and maintenance. In all cases the private realm will be under the care and control of the individual resident or the strata body.

1.4 Public Realm Strategy

Generally the public realm includes primarily the landscaped open space and path network within the proposed development and its linkages to the existing adjacent and surrounding open spaces networks and streetscapes. The landscape design aims to:

- Provide clear, direct, safe and compliant access around and through the proposed development
- Positioned to ensure the retention of a significant number of existing mature trees in new parks and linear interface buffers adjoining existing residences.
- Be designed and installed to integrate and manage fire risk to the required areas of the landscape treatment
- Provide open usable informal grass recreation space for new and existing residents visitors and the general public.
- Provide shaded seating as a point of refuge on the pedestrian and cycle networks
- Provide suitably sized central play facility befitting the character and history of the site.
- Provide small informal play area for general public use.
- Provide shady endemic native and exotic trees for respite.
- Provide signage elements for clarity of pedestrian and cycle movement.
- To cater for a range of demographics, user groups and skill levels.

Braithwaite Park, Emerge Associates

Newhaven, Emerge Associates

Secret Harbour, Emerge Associates

1.5 Changing Demographics

The demographics of the existing Glen Iris locality is generally characterized as a mature suburb with a large proportion of long standing residents. There is a lower than average number of children or adolescents and young people living in the locality. It is understood that grandchildren are somewhat present when visiting the existing residents. The anticipated demographics of new residents is younger than the existing Glen Iris age cohort. New residents will bring a range of children ranging in ages from school age children to older teens as part of a general second and third home buyer profile. It is not currently expected that first home buyers will be significantly present within the new development based on proximity, lot size and anticipated pricing structures.

1.6 Open Space Distribution

The proposed open space typologies are arranged to provide a range of experiences and also a range of facilities within both vehicular and walking proximity to all new and existing residents of Glen Iris and Jandakot generally. The landscape plans attached identify the open space distribution and strategy.

1.7 Open Space Typologies

Broadly the open space areas within the project consist of set landscape and use typologies. These typologies are determined by a number of factors including size of the open space, grade / levels and grade within the open space, the amount and location of gravity surface runoff, tree retention ability, habitat retention and creation, usable and safe walkable linkages.

The four open space typologies include:

1. Focal open space

The proposed design consists of four distributed larger open space areas suitable for community gathering and active informal recreation. These four parks are distributed reasonably evenly throughout the proposed redevelopment. These parks cater for a range of informal active recreation uses and a mix of passive recreation uses. These larger areas of open space have the ability to cater for tree retention and larger areas of surface runoff drainage storage and management.

2. Access open space

The proposed design consists of a series of access open space areas. These open space areas are characterized by providing a strong open space link between other open space typologies. In so doing, these open spaces provide a critical role in creation of a continuous green link option for pedestrian and cycle movement around the redevelopment. The linear nature of these open space links allows for the retention of vegetation, while the width of these open spaces enables the inclusion of series of public facilities accessible for existing and new residents.

3. Pocket park open space

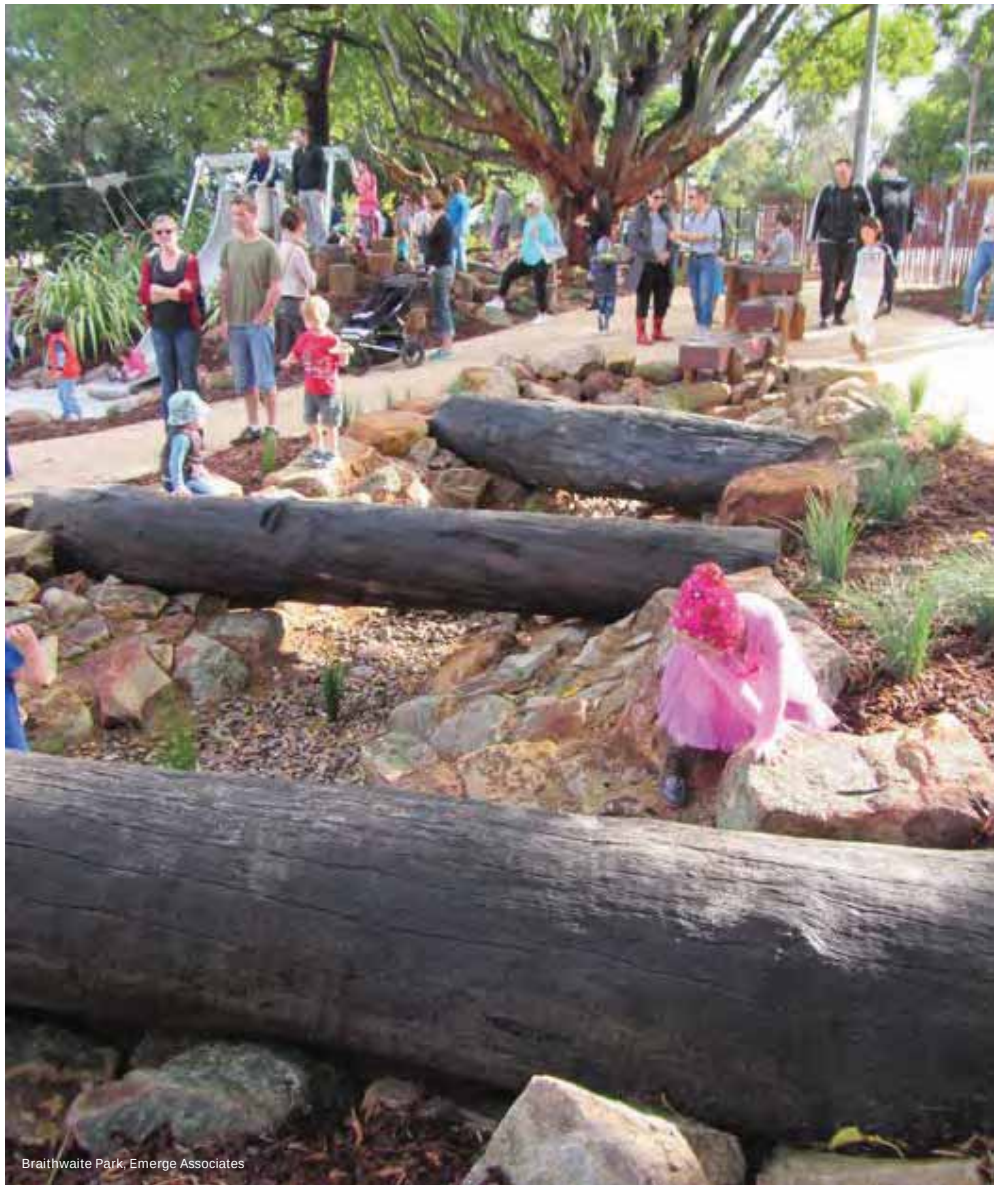
The proposed design locates a number of smaller open space areas set within the residential zone. These smaller open space areas are located to provide a range of localized incidental benefits including visual softening among the residential zone, walkability rest and respite via shade and seating, and in some cases specific associated needs such as low point drainage management and existing landmark specimen tree retention.

4. Buffer and linking open space

The proposal consists of a series of linear open space links. The nature of these open space areas ranges from road reserves with a widened verge to one side, to narrow buffers suitable to cater for a linking path and low planting between existing and new residences. The internal function of these spaces is to act as an access link.

Bibra Lake Regional Playground, Emerge Associates

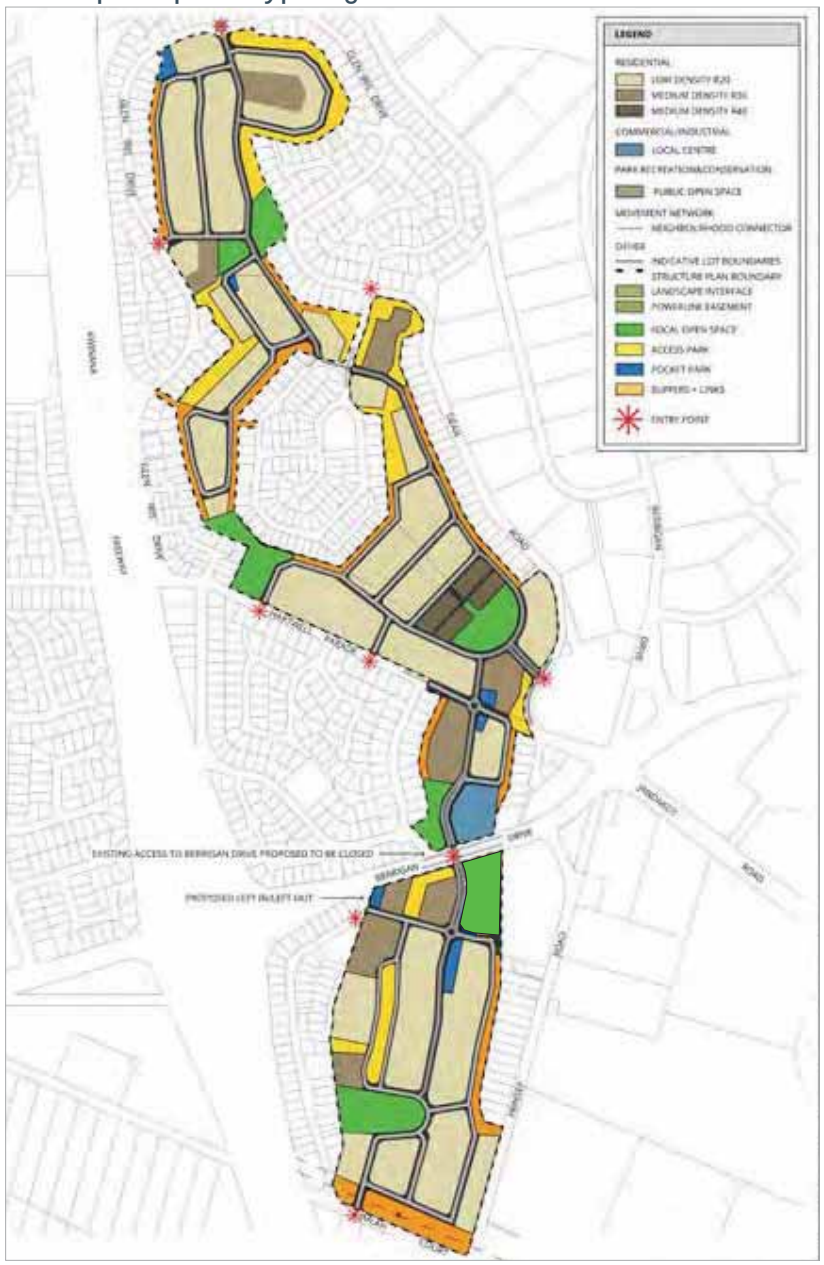
Bibra Lake Regional Playground, Emerge Associates



Braithwaite Park, Emerge Associates

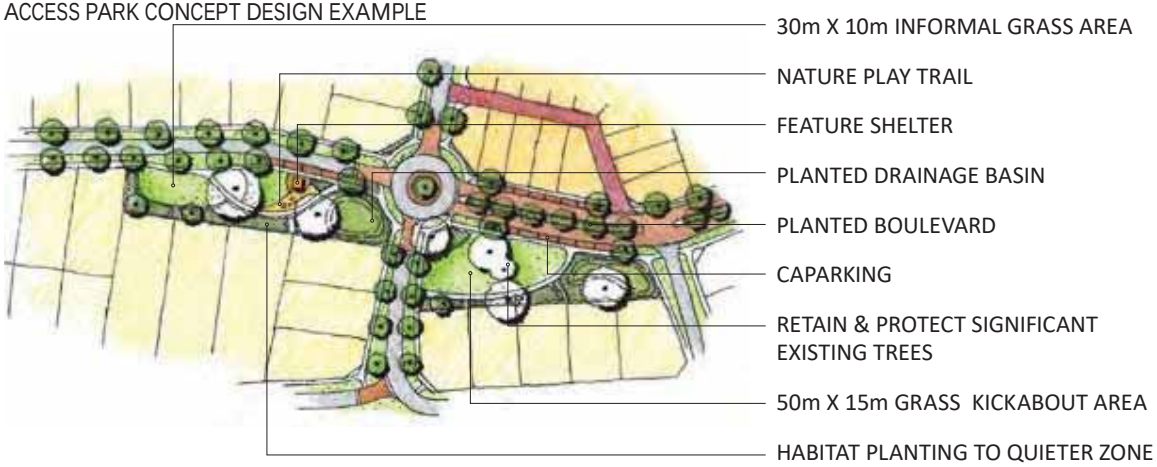
Evermore Heights, Emerge Associates

1.8 Open Space Typologies Visual

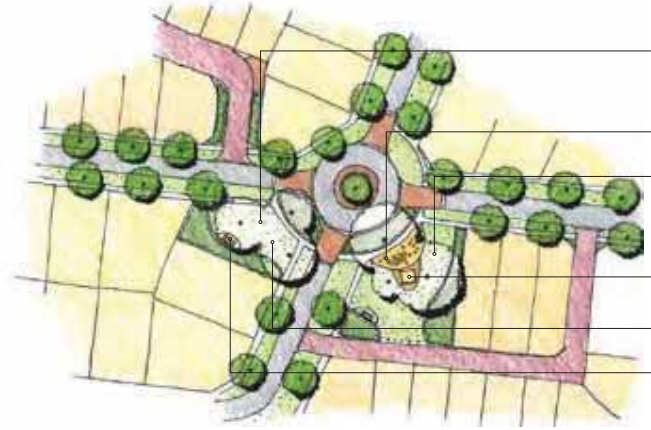


FOCAL OPEN SPACE CONCEPT DESIGN EXAMPLE

ACCESS PARK CONCEPT DESIGN EXAMPLE



POCKET PARK CONCEPT DESIGN EXAMPLE



RETAIN & PROTECT SIGNIFICANT EXISTING TREES

NATURE PLAY TRAIL

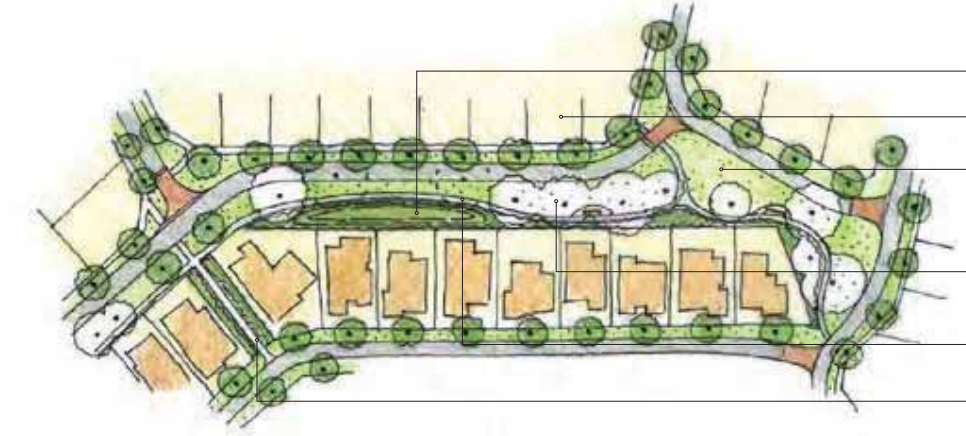
INFORMAL GRASS AREA

FEATURE SHELTER

SHADY GRASS AREA

BENCH SEAT

LANDSCAPE BUFFER WITH ROAD FRONTAGE CONCEPT DESIGN EXAMPLE



PLANTED DRAINAGE BASIN

NEW RESIDENCES

OPEN GRASS AREA

RETAIN & PROTECT SIGNIFICANT EXISTING TREES

PEDESTRIAN FOOTPATH

RIGHT OF WAY PEDESTRIAN CONNECTION

LANDSCAPE BUFFER WITHOUT ROAD FRONTAGE CONCEPT DESIGN EXAMPLE

NEW RESIDENCES

ACTIVE OPEN SPACE

PEDESTRIAN FOOTPATH SET AMONGST LOW SHRUB PLANTNG & GRASS

LIGHTING SET AT LOW PHYSICAL LEVEL

SHADY TREES AT REGULAR INTERVALS

EXISTING RESIDENCES

1.9 Landscape Masterplan

KWINANA FREEWAY
GLEN IRIS DRIVE
PARADE
KOORALBYN VALLEY CRESCENT
FAIRWAY PARK
DEAN ROAD
GLEN IRIS DRIVE
CAPRICORN PARK
LAKES WAY
A
A
B
B
C
C
G
G

1.10 Functional Layout Masterplan

KWINANA FREEWAY
GLEN IRIS DRIVE
PARADE
KOORALBYN
VALLEY
CRESCENT
FAIRWAY PARK
GLEN IRIS DRIVE
CAPRICORN PARK
DEAN ROAD
LAKES WAY

1.11 Public Facilities

The development proposes to build upon existing public facilities whilst catering for new residents via a range of new publicly accessible facilities. The extensive community consultation process and discussions with the City of Cockburn technical staff have identified a number of desirable public facilities including:

1. Informal larger play areas disbursed through the focal parks to cater for informal recreation activities eg: informal touch football, ball games, unstructured training, frisbee, kite flying, dog exercise and the like.
2. Defined personal training areas. It is envisaged that areas set aside for small gatherings of residents and visitors to allow for use/hiring for personal training and bootcamp type events. This is intended to cater for a variety of local age groups and skill levels. The landscape design can provide definition to these areas via small level changes and path and wall layouts.
3. 3. Playground facilities – it is noted that the need for a major regional facility is already catered for externally to the development area. It is proposed that a mid order play facility is located within the development to cater for the expected increase in local use and change in demographics. The aim is to design play elements that complement the existing retained play elements within Glen Iris rather than copy them, this will better provide a range of user experiences.
4. 4. Smaller play elements generally associated with nature play items located in discrete locations along the green links as part of a broader play trail running through the proposed development. This caters for smaller residential local precincts and also acts as a combined whole with each nature play area having a different type of play offering to those retained play elements currently in the Glen Iris.
5. Shelter structures with picnic settings to select locations where residents are encouraged to stop and stay for a while. These are generally associated with play elements and view axis lines from adjacent roads.
6. Electric BBQs are proposed to a couple of select locations as part of a social gathering and mixing initiative catering for smaller family groups and family scaled events.
7. Fitness elements are proposed as part of the broader green link design approach. This is in response to community feedback gained from the community consultation process.
8. Walking trails are proposed to occur through the green link network and are to be denoted via signage and colour coded elements to identify trails of various lengths and difficulty to suit a variety of users (eg: 1km, 3km, 5km, 7km). It is envisaged these trails will form a key tool in encouraging greater social interaction between existing and new residents.
9. Cycle trails are proposed to meander through the proposed development primarily on a path system with suitable signage and in some locations this may also occur partly onto the road system where low vehicle flow is to occur.
10. Dog walking trails and facilities are proposed to be included generally in alignment with the walking trails. These may include rest points in shade, taps and fixed dog bowls and discrete areas containing dog agility elements as part of a broader walking network.
11. A hard surface ball court is proposed to provide an active focus for teens. The final location of these facilities will be subject to detail design to mitigate noise impacts to adjacent residents but also to maintain clear and open view lines for passive surveillance.
12. Embayment carparking is proposed adjacent to the larger areas of open space and along certain streets. The car bays will cater for local visitors and a variety of social events and informal activities.
13. Street furniture is proposed to occur to defined set locations for the comfort of open space users. This will be inclusive of seating, table settings, drink fountains, select bollards and the like.
14. Public art is proposed to occur either as a larger landmark element on key view lines or as smaller discrete art elements to be discovered as part of the green link approach perhaps set into paving or on to low walls and the like.
15. A 3 phase power outlet is proposed for the larger open community gathering grass space to cater for possible periodic larger scaled community events.

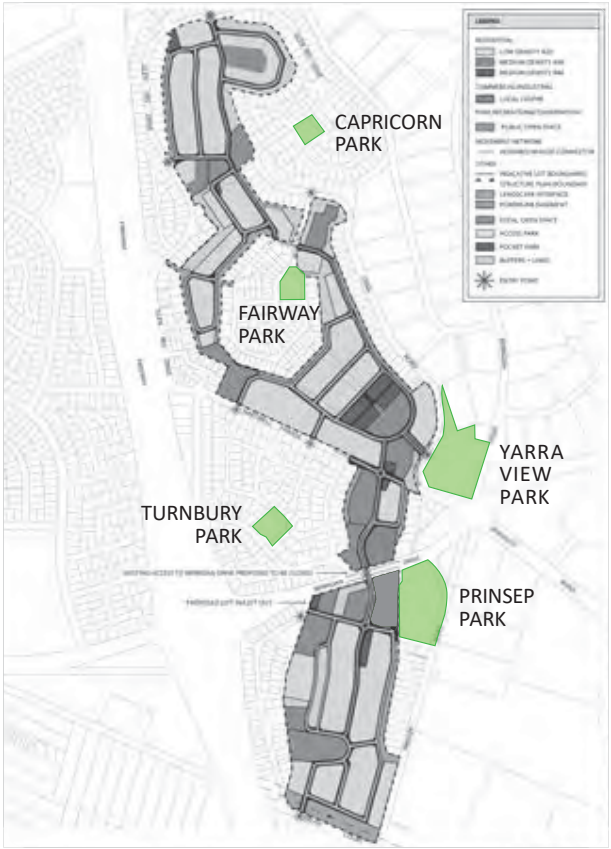
Dalyellup Beach, Emerge Associates

Evermore Heights, Emerge Associates

Osprey Waters, Emerge Associates

1.12 Existing Open Space Facilities

Glen Iris has 5 existing parks that form part of the current local urban layout that are well used and loved by the local community. Each has differing sizes and facilities catering for the local population and visiting public as summarised below. It is not proposed that any reduction in the existing public open space areas is to occur. The new open space network aims to be complimentary to the existing parks and their facilities.



A. Prinsep Park

This is a large neighbourhood scale park with minimal facilities. There is a large open grass kickabout area centrally located to the park bounded by clumps of taller native trees and stands of native bushland shrub vegetation forming bushland. The park appears to be well maintained but somewhat underutilised for its scale with limited public facilities. A simple path system and a shelter and table setting front onto the central grass area. Access into the park is currently difficult as it occurs mainly off major roads and intersections bounding the park.

It is noted that officers from the City of Cockburn have indicated there is the current need for a formal oval playing surface somewhere in the Glen Iris area as part of a broader growing need within Jandakot and Treeby. One possible option suggested by the City is its inclusion by reimagining the existing Prinsep Park on the corner of Berrigan Drive and Prinsep Road given the parks size can cater for an oval. Should the City wish to pursue this option it will be subject to a separate application process led by the City and is not part of the proponents proposal.

B. Yarra View Park

This is a large neighbourhood scale park with numerous facilities including a dedicated carpark for approx 20 cars. Existing native mature trees are located internally within the park with mature exotic street trees located to street edges. There is a large grass kick about area that doubles as a drainage overflow basin. There are 2 off lead fenced dog agility areas that exist with gate access and a variety of dog agility elements that cater for local and visiting dog walkers.

An existing off the shelf plastic playground is set in a sand base which caters for a variety of play and user ages from 4 to 10. Individual standalone small play elements exist in grass outside of the main play area for 2 – 4 year old users. Bench seating is set into the park near existing path system and there is a picnic shelter and table setting overlooking the usable grass area. There is a partly fenced basketball court in a raised area within the park that caters for teens.

C. Turnbury Park

This is a local scale park that is well maintained with central open grass kickabout area and numerous exotic shade trees set in grass. A central off the shelf plastic playground currently caters for 2-10 years of age and includes an off the shelf climbing wall and swings. A small basketball half court caters for teens as active semi formal play. There is a BBQ located in the park but no table setting. There is bench seating located under trees overlooking the grass area.

A large feature brick arbor at the main entry point adds formality and shade but has no particular usability or shaded seating. Hedge planting along the road edge limits some views from Turnbury Park Drive. The park has its own bore. Residents directly side onto the park and view over park inclusive of areas of detailed exotic shrub planting in a domestic character and scale.

D. Fairway Park

Generally the park consists of a central open grass kickabout area bounded by a variety of shrubs and hedges interspersed with a variety of mature native and exotic nature trees. A children's play area caters for toddlers and young children in a fairy garden character inclusive of off the shelf play items and with a small amount of specialised themed equipment for imagination play with a seesaw all set in a white picket fence. The park contains a bore and is well maintained and is overlooked by adjacent residences and bounded in part by a residential scaled road system.

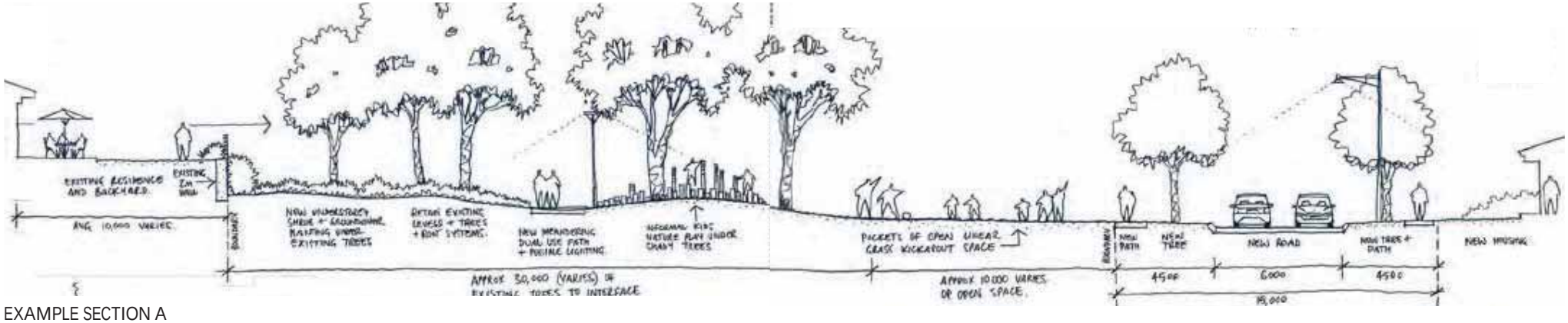
E. Capricorn Park

The park is located on a hilltop location with views to the surrounding area. Pockets of retained mature native vegetation inclusive of mature native trees exist with mature exotic trees located along adjacent street edges. A meandering concrete path is set into pockets of sloped grass set among native planting beds. An off the shelf playground set in a sand surface is nestled into bushland adjacent to residents side boundary fence with a single solar light located nearby. The playground appears well maintained and caters for children 2 - 10yrs and generally the park is in good condition. The park has low passive surveillance and is not particularly safe with limited street visibility. No seating is evident within the park.

Glen Iris Estate

Sunrise, Emerge Associates

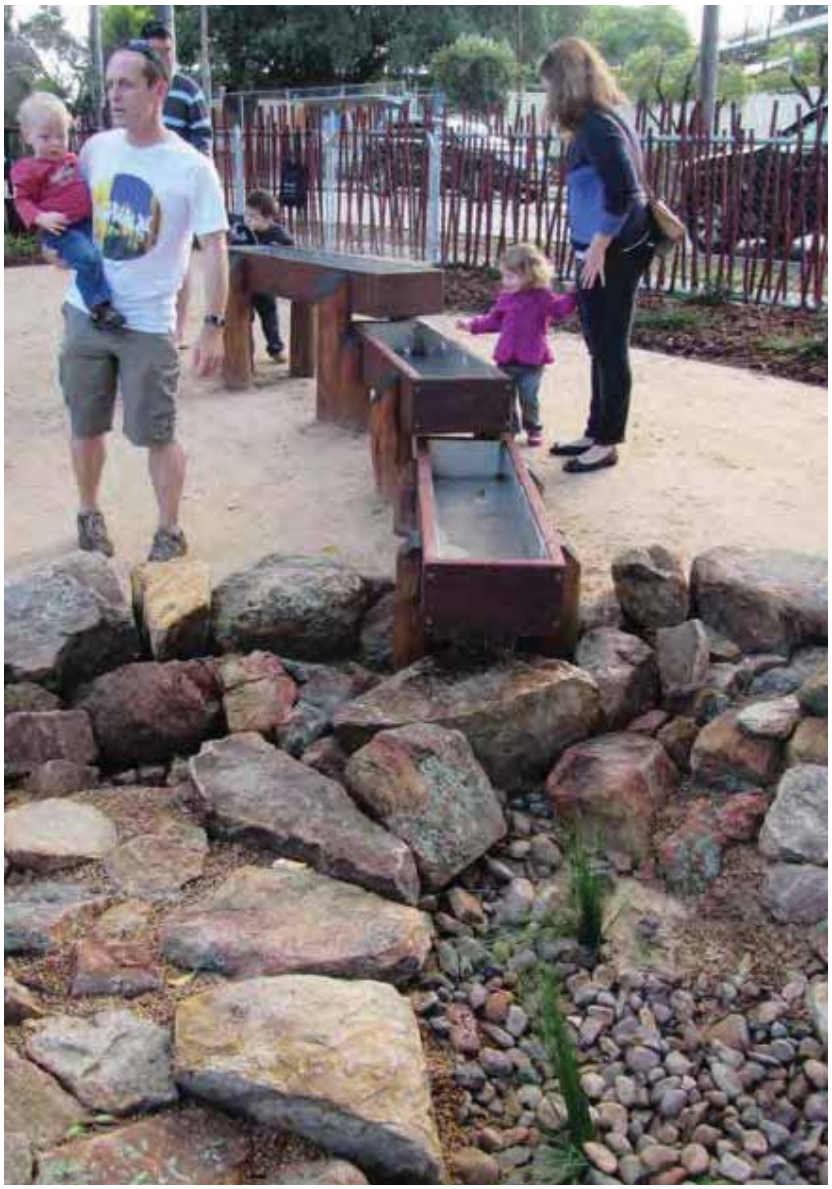
Brighton, Emerge Associates



EXAMPLE SECTION A

Braithwaite Park, Emerge Associates

Spire, Emerge Associates



Braithwaite Park, Emerge Associates

Allara, Emerge Associates

1.13 Interface to Existing Residences

The former golf course was directly backed onto by existing one and two storey residential housing. Some of the adjoining existing residential land is elevated above the subject site. In all instances, private rear fences along the boundary interface generated the safety and security necessary for the respective residence. Under the proposed development approvch the edge treatment between the existing residences and the new development will be managed in a variety of ways including:

- Upgrading to the existing rear wall and fencing where suitable and necessary subject to need, levels and impact with the work to be managed by the developer at 50/50 shared expense in consultation with individual affected adjoining landowners.
- The creation of new walling and/or fencing where suitable and necessary subject to levels and the impact of any alterations proposed by the development.

The design of the interface may be managed in a variety of ways including but not limited to:

- The backing of new housing directly onto the rear of the existing residence creating a typical residential rear boundary interface.
- The creation of a road and streetscape to the rear boundary of the existing residence.
- The creation of open space to the rear boundary of the existing residence.
- The creation of an access and buffer strip to the rear boundary of the existing residence.

1.14 CPTED & Passive Surveillance Approach

The landscape design of open space and streetscapes will take into consideration various crime prevention through environmental design (CPTED) principles. Noting the extent of open space and the connected nature of the path system, passive surveillance over the open space areas is a key part of the developments safety and security approach. The design of the open space landscape treatments combined with orientation of the open space to roads, paths and new and existing residences enables passive surveillance over parks.

The height of rear boundary fencing and possible semi permeable detailing enables interaction. In addition the use of level changes where required allows for some overlooking of open space areas. The location of trees, furnishings, and play elements will be arranged to not impede views to smaller open space areas.

Shrub planting will typically be lower shrubs and groundcovers to minimize the ability for hiding. The location of key facilities will be set ion key view lines from adjacent streets inclusive of car headlights illuminating various elements. The use of lighting has been described elsewhere within this document.

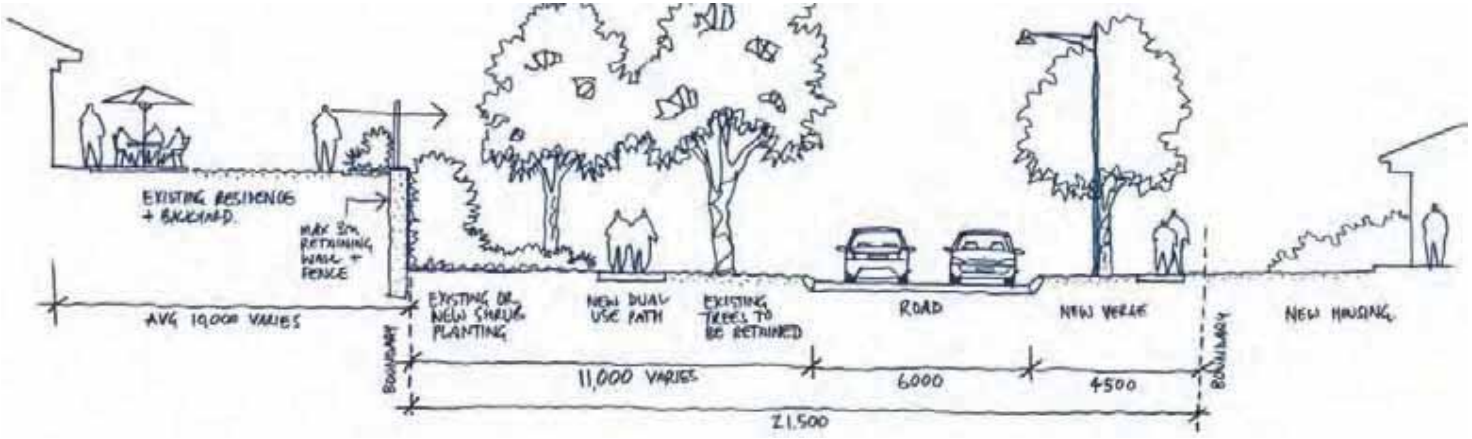
1.15 Existing Adjacent Public Open Space Upgrades

The Glen Iris precinct has a number of existing parks throughout the existing residential areas that are well used and loved by the local community. It is not proposed that any reduction in the existing public open space areas is to occur.

Osprey Waters, Emerge Associates

The Sanctuary, Emerge Associates

The Sanctuary, Emerge Associates



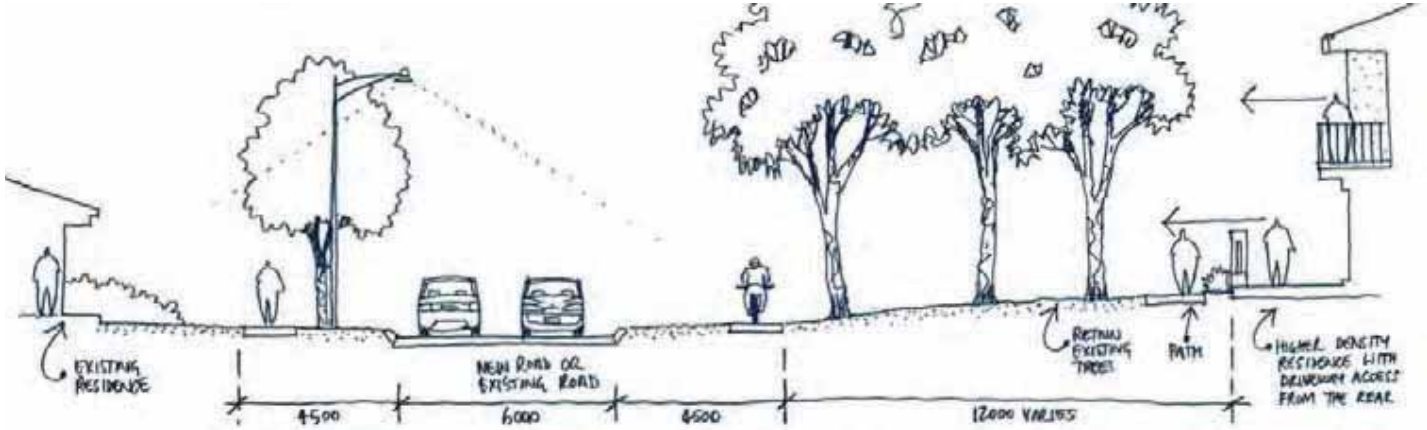
EXAMPLE SECTION B

Glen Iris Estate

The Sanctuary, Emerge Associates

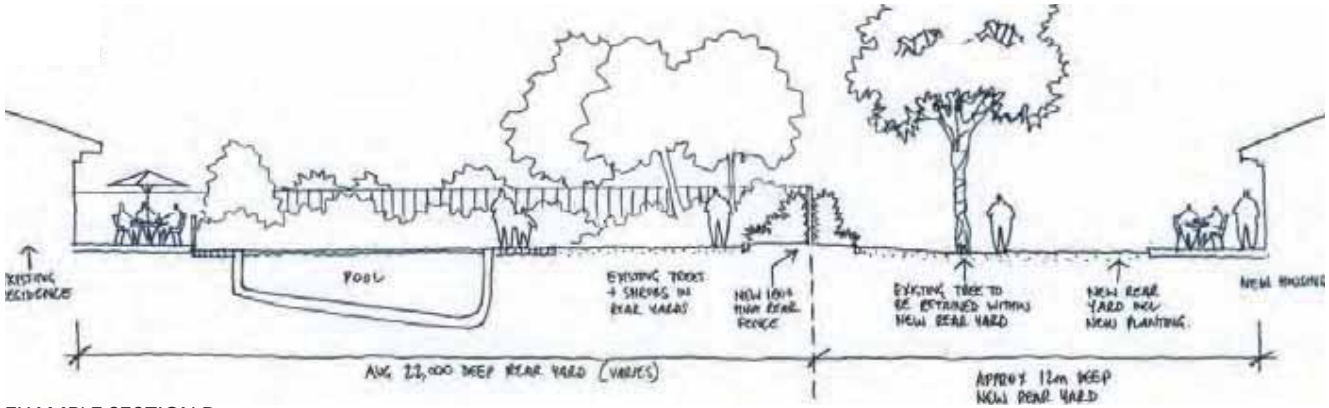
Heritage Park, Emerge Associates

Shoreline, Emerge Associates



EXAMPLE SECTION C

Lakeway, Claremont



EXAMPLE SECTION D

Lakeway, Claremont

1.16 Streetscapes

Road Hierarchy

The proposed road network will consist of a variety of typologies to better define planning legibility to the user, including:

- A series of entry points into the proposed development that will aim to define the edge of the new works without being completely divorced from the character, colour and finish of the existing Glen Iris residential area.
- Collector roads. These will distribute traffic into and out of the proposed development, these will have defined larger future tree stock to recreate the meandering shady drive as the most travelled roads. The opportunity for drainage management exists based on the generally wider road verges.
- Residential streets landscape type 1: These streets are generally longer and more direct in their layout and will have a series of tree species befitting this street type.
- Residential streets landscape type 2: These are smaller shorter residential streets which act as much more localized road element in some cases as cul-de-sacs.

In all cases the provision of shade and canopy cover is paramount and in keeping with urban green canopy coverage aims and the reduction of the urban heat island effect wherever possible.

Existing Streets

The existing streetscapes in Glen Iris are one of its key defining character and landscape features. The intention is to retain the existing streetscapes as is, and to aim to replicate elements of this avenue approach in the proposed streets where possible. It is proposed that in the order of 500 existing mature trees will be retained within the proposed open space areas, and more than 1,000 new trees will be planted across the new development in open space and streetscape areas. This is in addition to the trees to be retained within existing streetscapes in and around the surrounds of the site.

Widened Road Reserves

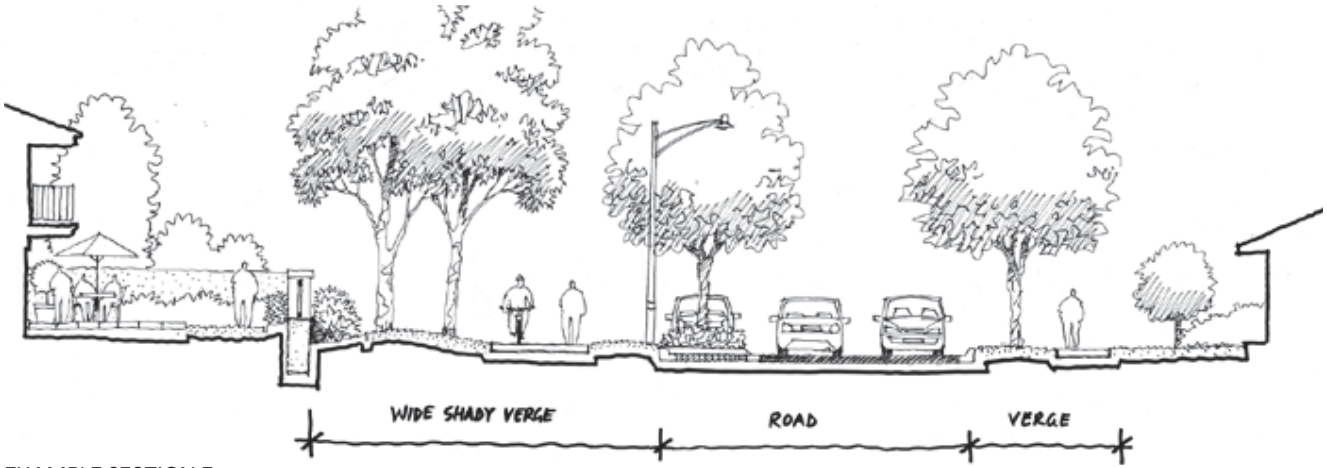
Select streets are proposed to have an offset road carriageway and a widened verge to cater for a widened 2.5m dual use footpath and a shady double tree avenue either side of the path, which will act as a key part of the broader safe and secure green link movement network through the proposed development. This enables access to occur off street and can cater for visitors carparking in select locations in addition to flush kerbing and drainage swales in select locations - subject to future detail design.

New Roads

New road design will cater for street tree planting and the broader safe and secure green link network. Street tree planting will be selective and will be variable to bring a variable character to different streets.

Traffic Calming

In locations of longer lengths of straight residential roads the inclusion of traffic calming may be employed to assist in slowing traffic speeds and allowing crossing points are suitable locations and allow for additional landscape softening. Locations of traffic calming will need to pay due regard to driveways and lot access and footpath road crossings.



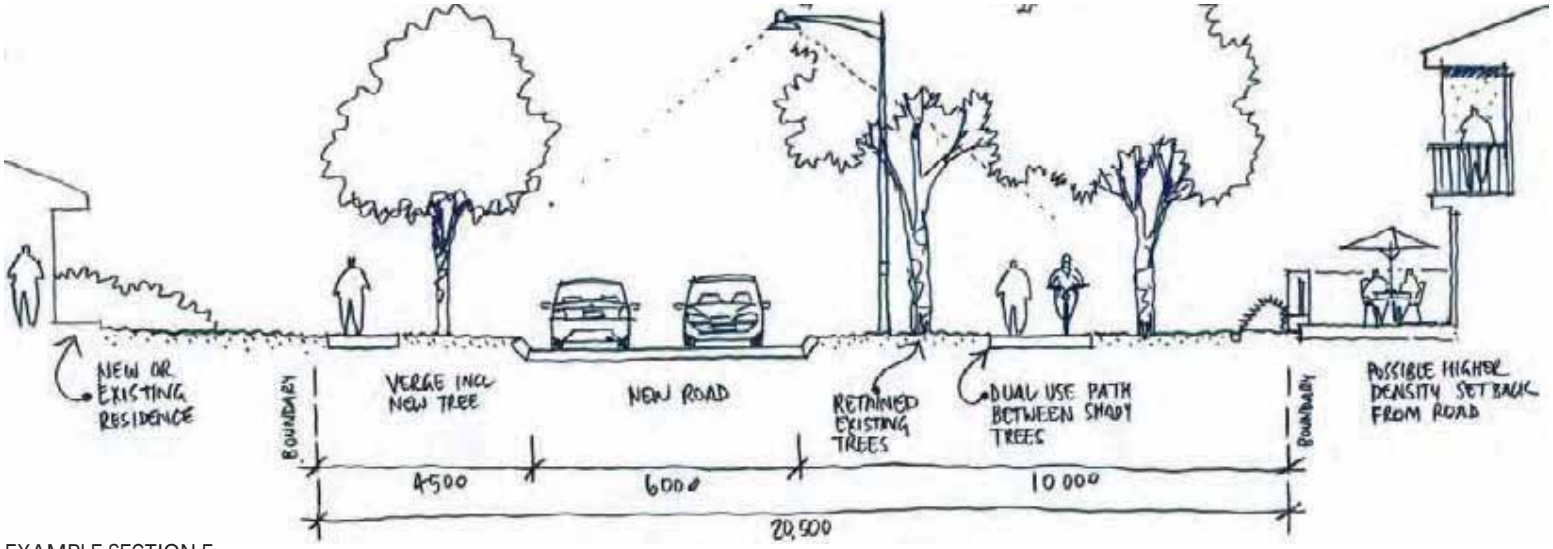
EXAMPLE SECTION E

Jacob's Ridge, Queensland

Lakeway, Claremont

Newhaven, Emerge Associates

Baldivis Town Centre, Emerge Associates

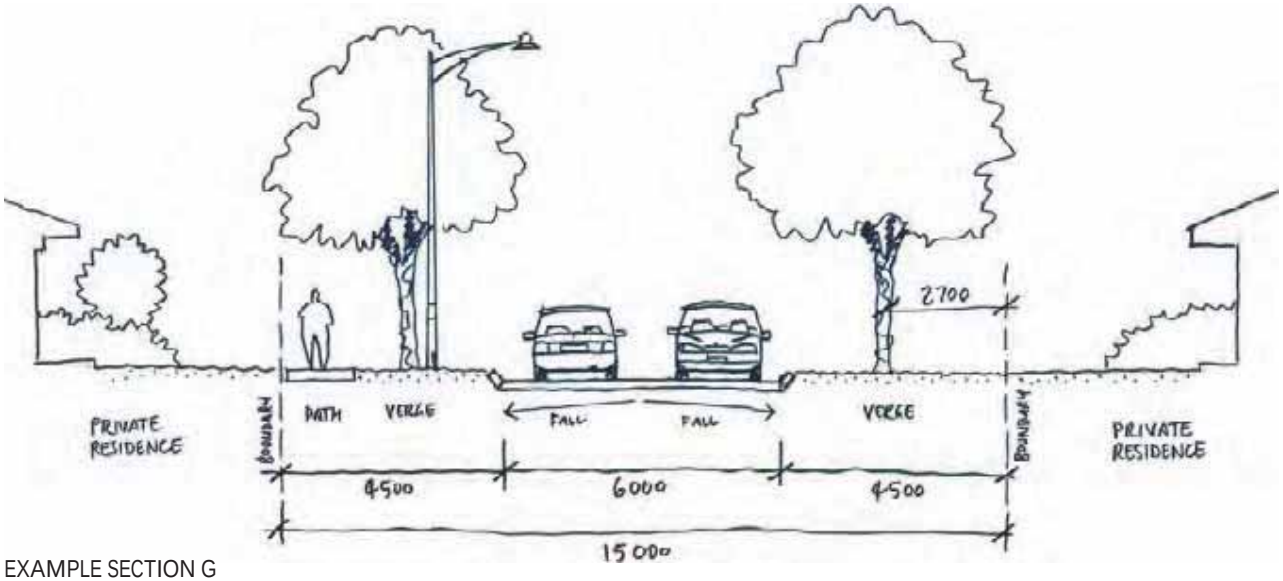


EXAMPLE SECTION F

Baldivis Town Centre, Emerge Associates

Vale, Emerge Associates

Bushmead



EXAMPLE SECTION G

Honeywood, Emerge Associates

Lakeway, Claremont

1.17 Tree and Plant Species

An indicative plant list and select imagery has been included within the attached drawings in support of the proposal. While the list is subject to refinement in consultation with the City of Cockburn, it clearly defines the plant species approach and intent. Planting will consist of a mix of mature stock for specific uses and high profile location purposes, and smaller nursery hardened off stock for mass planting purposes.

The planting strategy consists of the following three principal approaches:

a. Retained trees. The retention of existing trees from the golf course rough areas in between the various former fairways is proposed. This creates instant visual effect, retains shade and habitat and maintains an element of the site's former use.

b. Transplanted trees. The preparation and transplanting of existing trees is possible based on the diversity of species currently located on the site. Existing transplantable trees include but are not limited to: Norfolk Island Pines, Plane trees, Palms of various species, Cape lilacs (subject to approval), WA Peppermints, Liquidambers, casuarinas, ficus species, melaleuca species and grass trees.

c. New tree planting. The proposed development intends on undertaking a new tree planting regime for streetscapes and parkland areas. The final extent and species mix will be subject to approvals and availability. In addition to planting in public areas, the planting of trees is also encouraged in the private realm noting the generally larger sized residential lots proposed for this development.

The new planting selections are aimed at achieving the below criteria:

- Being of local character.
- Preferably being endemic and native to the site area.
- Not being invasive by habit and not containing any declared weed species.
- Being hardy to local soils, wind and salt tolerant and with lower water needs.
- Where required and suitable, being of low fire fuel creation and load as a key part of fire management to the margins of the development.
- Promoting the local ecosystem as habitat for a range of endemic fauna.
- Being of a series of attractive and contrasting foliage, colour and form to enable design based planting and displaying the diversity of the local environment.
- Having a selection of species that ideally enable some to be seasonally flowering at all times of the year.
- Being of suitable form and habit to promote shade where suitable and to either open or screen select views.
- Being of species that are readily commercially accessible and available for future replenishment.

Verge Planting

Scaevola ‘Purple Fanfare’

Melaleuca incana ‘Nana’

Adenanthos cuneatus ‘Coral Carpet’

Hemiandra pungens

Grevillea obtusifolia prostrate

Westringia mundi

Eremophila glabra

Myoporum parvifolium purpurea

Lomandra tanika

Feature Planting

Grevillea obtusifolia prostrate

Beaufortia squarrosa orange

Westringia fruticosa ‘Smokey’

Scaevola ‘Purple Fanfare’

Hemiandra pungens purpurea

Lomandra tanika

Broad Planting

Adenanthos sericea

Pimelia ferruginea

Eremophila nivea ‘Spring Mist’

Grevillea olivacea

Grevilea olivacea

Dampiera linearis

Acacia lasiocarpa

Acacia saligna ‘Green Mulch’

Acacia pulchella

Hemiandra pungens purpurea

Chamelaucium unicnatum

Calothamnus quadrifidus

Hypocalymma angustifolium

Thryptomene baeckeacea

Grevillea thelemanniana

Beaufortia squarrosa orange

Westringia fruticosa ‘Jervis Gem’

Adenanthos cuneatus

Ricinocarpus ‘Bridal Star’

Callistemon phoeniceus

1.18 Habitat Approach

The former fenced golf course created the opportunity for native fauna to use the area as part of a broader habitat area with access to shelter, shade, food and water and some degree of protection. The conclusion of the golf course use may alter aspects of this until such time as the new open space can be created and established. The City has indicated its support for the creation of a series of smaller habitat zones within the proposals open space areas that encourage the survival and retention of native fauna in the area. The final locations will be determined based on existing vegetation, suitable seclusion from humans.

Avian fauna will be able to access the site and use its existing retained trees as it always has done, albeit noting that works may see some degree of disturbance. Ultimately new tree planting will rise to provide generational change to the existing tree stock currently providing habitat. The retention of trees individually, in clumps and in avenues, encourages the retention of existing fauna.

Ground dwelling native fauna will have access to the site noting that construction will occur in stages allowing fauna to adjust to newly created open space areas as the environment transitions over time. As the landscaped areas are installed and mature over time, it is envisaged that native fauna will return to the site from adjacent bushland areas. The proposed retention of two smaller areas of existing banksia bushland provides some continuity for habitat and cover for native fauna.

The landscape design aims to provide areas suitable for fauna to reside and move through the development over time. This will be accomplished by planting types and densities, continuous cover, pockets of refuge for example logs and rocks to lesser used areas of open space, planted drainage basins with infrequent domestic animal and human use. Education of the local existing and new community around risks to native fauna and what individuals can do to promote preservation. An item possibly worthy of examination as part of future detail design is the creation of defined native fauna refuge zones with controlled suitably sized access that limits domestic animal access.

1.19 Sustainability Approach

The landscape approach will have embedded within it a series of sustainable initiatives to be further refined at the detail design stage. These include, but are not limited to:

- Tree retention above and beyond that typical for greenfield development within parks and streetscapes.
- Transplanting of existing mature tree stock saving from destruction and retaining habitat and creating instant shade.
- Larger percentage of open space (22.9% total proposed green space) beyond that typical for greenfield development.
- A variety of storm water management initiative, techniques and inclusions to provide at source recharge including possible subsurface storage tanks.
- Planted detention basins inclusive of nutrient stripping capability in place of sumps.
- A major reduction in the existing long term groundwater draw and licensing needs for public open space maintenance, and significant reduction in the use of fertilizers and herbicides and pesticides.
- Removal of existing lined lakes and their groundwater top up resulting from evaporation and use by the former golf course for irrigation purposes.
- Relocation of native fauna (as may either be temporary or permanent)
- A variety of water wise initiatives applied to the public and private realm inclusive of a new, more efficient irrigation system.
- Retention of two small pockets of existing Banksia woodland.
- Reuse of timber removed from the site as both nature play elements and in mulch and possible select public art elements.
- Preference for use of low embodied energy materials where possible and suitable.
- Use of select LED /and solar lighting where possible and suitable.
- Creation of possible fauna habitat opportunities within open space and retention of trees suitable for avian fauna.
- A maintenance minimisation in design approach to limit cost and time impacts.
- A series of maintenance initiatives to reduce pesticides, herbicides and chemical use generally.
- The aim of creating a continuous tree canopy coverage to limit urban heat island effect and maximise green canopy coverage.
- Use of predominantly native shrub and groundcover vegetation endemic to the Swan coastal plain.

1.20 Wayfinding & Signage Approach

Wayfinding

The design of the development is proposed to be undertaken to encourage intuitive orientation and movement through the development. This is to be undertaken through the use of materials and colours to define particular movement routes, visibility to key features and elements, open viewsheds to desirable destinations and screened viewsheds to assist in directing users and promote privacy where necessary. The design of the path system is aimed at promoting connectivity through the development in an expanded, safe and efficient manner.

Signage

Signage to the development will be unified in its materials and form. Signage is proposed to be located at key decision points including points of arrival, intersections of roads and paths and at reinforcement locations along longer paths.

Signage is proposed to consist of:

- Directional signage to facilitate efficient movement within the precinct.
- Educational signage relating to the local area its habitat, features and history.
- Orientation signage pertaining to direction and distances to local places of interest inclusive of information pertaining to users' fitness and outdoor activities.

1.21 Landscape Materials & Furnishings

Landscape materials will be common to the proposed development area to bring design and character unity to the precinct while also marking quality of the new development area. External landscape materials will be generally selected to be complimentary to the local character in texture, colour and style. The attraction of the local area is intended to be reflected in the materials used. In all instances materials will be robust and fit for purpose with consideration on durability, longevity and maintenance minimization over the longer term inclusive of minimized replacement, local availability and all relevant warranties and guarantees.

Furnishings will all be off the shelf proprietary elements available locally inclusive of parts, replacements, and all suitable guarantees and warranties.

The proposed range of landscape includes:

- Stone paving finish to select higher use and feature areas and to select dry stacked look limestone feature walls befitting of a more handcrafted finish.
- A mix of exposed aggregate and plain concrete finishes to select areas.
- A mix of fencing materials fit for purpose.
- Off form concrete to select feature walls and stairs.
- Metal frames decking and structures with a variety of materials panels and finishes.
- Stabilised gravel paving to select lower use paths.
- Galvanised metal finish to select landscape elements.
- Natural loose gravel paths to select private access points.
- Natural treated timber materials for nature play elements.
- Red asphalt for select paths and higher use road areas.
- A combination of large stone, concrete and steel and/or plastic garden edging.
- Minimal timber to reduce maintenance and extend longevity.
- Low fuel mulches including sand, gravels, select organic mulches to defined areas.

1.22 Landscape Lighting Strategy

Lighting to the landscaped areas will be kept to the minimum necessary to enable safe access to select key routes and areas. The intention is that lighting is subtle but effective, directed rather than broad. There is proposed to be minimal light overspill and light pollution generated by the development.

In the main, landscape lighting will be solar and/or LED or similar low electricity use equivalent and will typically be lower directed lighting to signage, doorways, roads and key paths and access routes as opposed to lighting to all access routes. Street lighting will be managed by the civil design package.

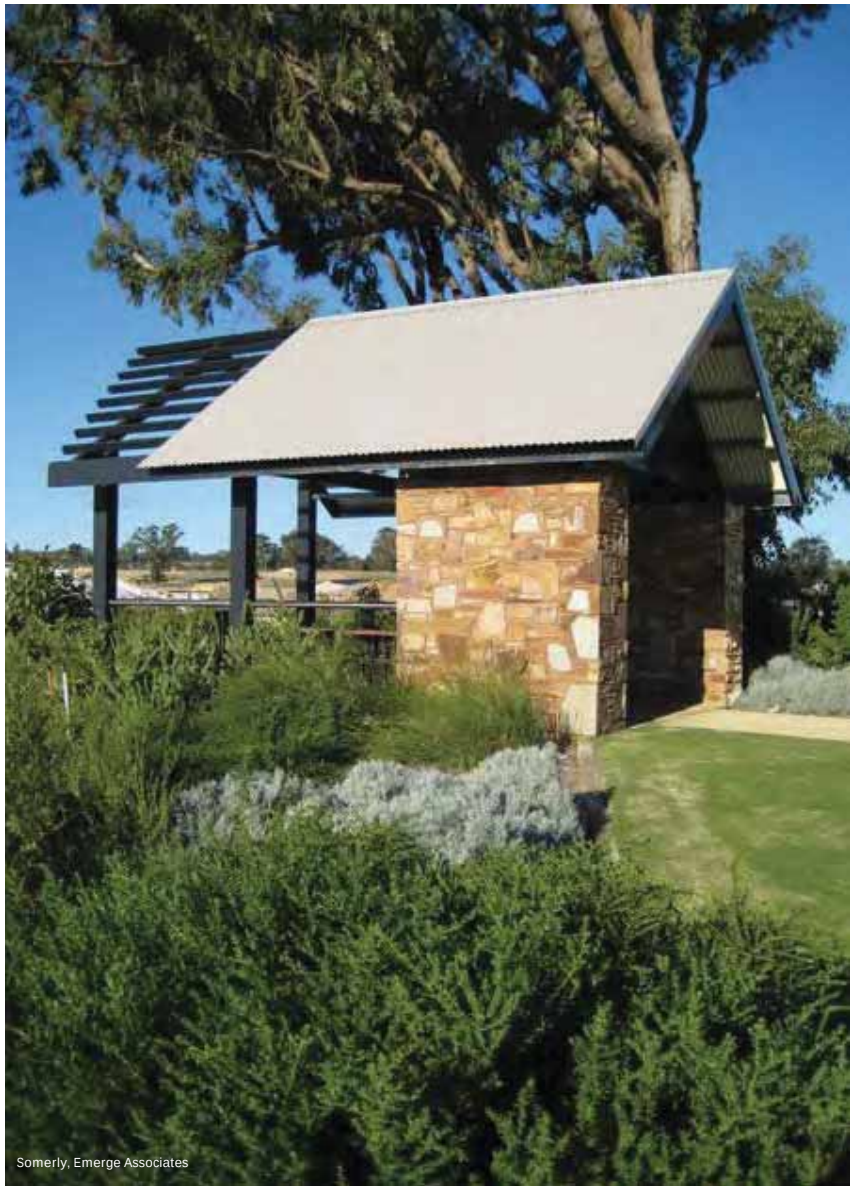
1.23 Bushfire Risk Management Landscape Response

The fire setback zone occurs around most of the margins of the development where they abut a bushland fire threat. Two small areas of existing banksia bushland are proposed to be retained within the design. The resulting landscape design will respond to the projects BAL line in these two smaller defined locations and will employ the use of compliant fire management techniques to meet fire management obligations.

The landscape response will include, but not be limited to, the below in all selected effected fire management zone areas:

- Use of endemic plants and native species identified by the Department of Fire and Emergency Services (DFES) as being low fire fuel species.
- Selection, arrangement and spacing of shrub planting to meet low fire risk principles and requirements.
- Selection, arrangement and spacing of trees to meet low fire risk principles and requirements.
- Use of noncombustible and low combustible landscape materials within the fire setback zone including hard paving, gravels as paths and mulches in select areas, limited organic material, rocks and boulders.
- Provision of access for fire and emergency vehicles.
- Incorporation of a fire setback zone management and maintenance approach inclusive of removal of necessary vegetative fuel and debris at standard required intervals.

The Sanctuary, Emerge Associates



Somerly, Emerge Associates

- Proposed inclusion of irrigation to fire zones for use in advance of fire emergency. Should fire management may require fire mitigation measures in addition to setbacks, the installation of irrigation sprays to defined locations can assist in the suppression of fire prone material and flames within the fire buffer zone.

1.24 Irrigation Strategy

The former golf course has a large irrigation allocation suitable for the preparation and maintenance of healthy greens and fairways over a larger area than that proposed for the new development. This irrigation allocation remains in place.

With the removal of the golf course it is anticipated that the use of ground water will significantly decline. Initial expectations are in the vicinity of up to a 70% reduction in water usage which may be on-sold, traded and / or returned to the groundwater aquifer.

The exiting irrigation system will be removed and replaced with a new integrated irrigation system designed and installed to meet the standards of the City of Cockburn. This may include a system of sprays, drippers and bubblers to suit various circumstances and planting regimes. The existing bores are expected to be reviewed and reworked to maximise water extraction efficiency and to meet new standards. Additional bores may also be considered/ required to better distribute extraction and more efficiently cater for water distribution. Ultimately the groundwater licence and infrastructure required for the new parks will be transferred to the City.

The irrigation water source is proposed to be from the existing (or new) bore system and will be separately metered. The irrigation system will have a range of inbuilt sustainable measures including, but not limited to, rain gauges, water use monitoring, partial drip systems and hydro zoning as part of the design process, inclusive of manual override to respond to periods of excessive rain or lengthy dry periods. Conscious of continuing staged house and road construction, there is also the opportunity to consider a mainline loop system with reverse flow or to be linked to a variety of bores in order to maintain water flow irrespective of any possible future break.

Individual residences may apply for a domestic bore or uitilise mains scheme water as suitable and will be separately metered accordingly. The individual on lot and verge irrigation system will be under the care and control of the resident. In the main, the planting species palette will be local endemic species / native species requiring less water than existing system.

1.25 Landscape Surface Drainage Strategy

Generally the site has a good drainage infiltration rates and good soil permeability reducing the need for extensive drainage and water storage infrastructure. Where possible, the development will opt for at source drainage solutions to distribute drainage throughout. Landscape zones will include planted basins at key low point locations within the development and also will utilize the existing drainage basins where possible. Overflow onto adjacent grass areas may occur to cater for defined irregular larger storm events.

The residential lots and the medium density sites will seek to manage their drainage and infiltration within their lot or strata area. Where open space areas are somewhat limited in space to cater for surface drainage management, underground storage solutions are proposed in accordance with relevant standards and subject to detail design, to ensure maximum open space areas are available for the community.

Roads and paths will be generally graded to sheet drain inclusive of a mix of infiltration basins, raingardens in select locations and swales where suitable. Final drainage design will be subject to detail engineering design. The streetscapes will seek to have flush kerbing in select locations adjacent to grass swales or planted swales inclusive of defined rain gardens to select locations.

Harvest Lakes, Emerge Associates

Vivente, Emerge Associates

1.26 Maintenance Strategy

In all cases, a maintenance regime will be in place inclusive of general maintenance minimization through design practices and will aim to use sustainable maintenance practices. This includes, but is not limited to, defined edges and borders, minimal and preferably alternate approaches to pesticides, controlled and minimized fertilizer use.

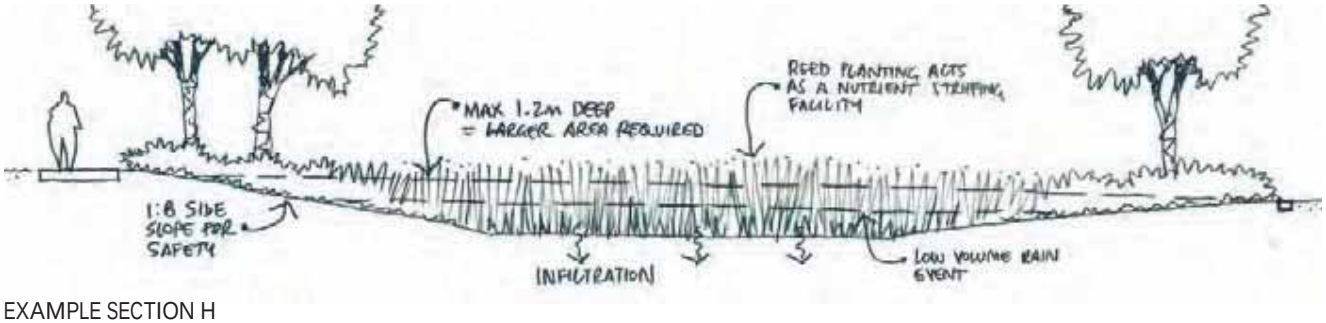
Planted revegetation areas and managed vegetation zones will include a maintenance regime as part of its bushfire management obligations. This will include but is not limited to required periodic removal of natural fuel, review of planting densities to ensure continued compliance with fire regulations and checking and testing of irrigation sprays.

Maintenance will be undertaken via general access to all public accessible areas. Light maintenance vehicles can access all public areas and can adjoin all private areas within the development. This will occur initially via the road system and then by careful access over landscaped grass areas and select areas of the pedestrian path system. Use of removable bollards will limit and control unauthorize access to link areas between roads.

Maintenance will be managed by the development for the first 2 years minimum. The 2 year maintenance timeframe may be extended in certain locations at the developers discretion in liaison with the City.

The increased volume of open space will see additional expenditure occur as necessary in order to maintain the increase in area of open space. This additional cost is somewhat offset by the content of the additional open space (which will mainly be linear widened streetscape areas)

The Sanctuary, Emerge Associates



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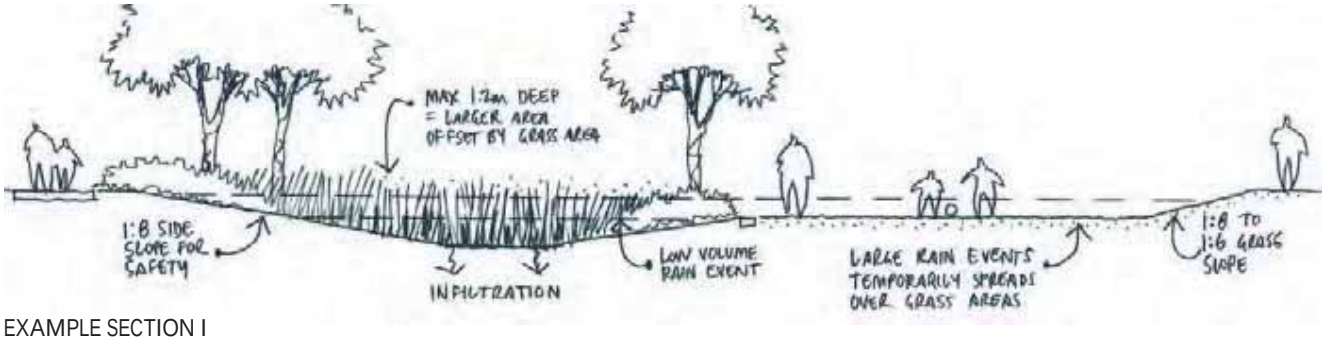

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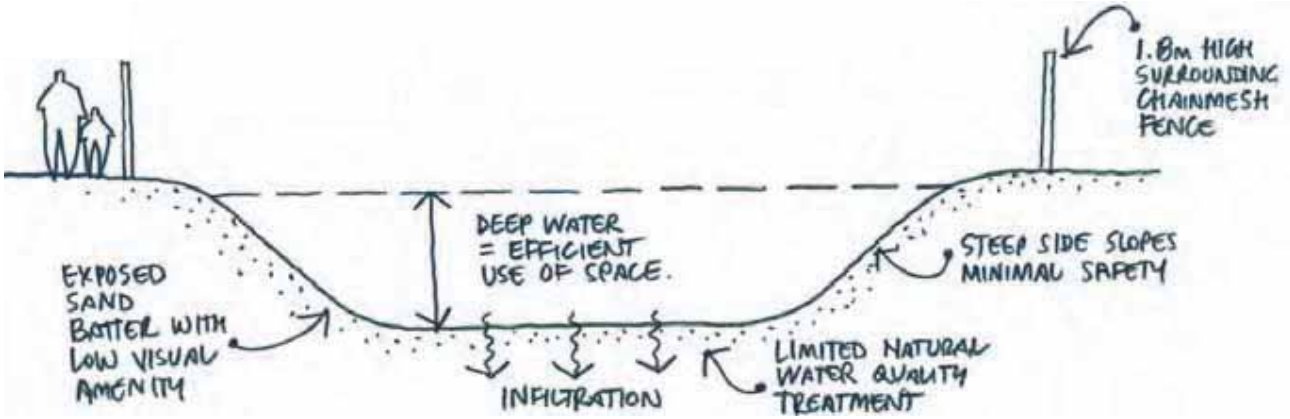


EXAMPLE SECTION J

which will not generally be complex in layout, detail design or material selection thus minimising maintenance costs.

The proponent has been advised by the City that the City's current typical maintenance rate is approximately $2.00/m2. Preliminary calculations indicates that the likely maintenance cost for the proposed design is approximately $2.50/m2 average.

The additional maintenance required to deliver the proposed design may be met by either:

a. The City agreeing to undertake additional maintenance based on the larger volume of open space in response to the existing residents requests and concerns as identified through the community consultation process and the resulting proposed masterplan.

b. The City agreeing to a special area rate to be applied to the new residential lots in addition to their usual rates in order to meet the additional costs over and above Council typical expenditure. This arrangement would be disclosed to the purchasers of new lots at the time of sale and written into the sale contract annexures. This arrangement requires confirmation that the City's expenditure of these funds occurs within the Glen Iris precinct.

Providence, Emerge Associates

Appendix C

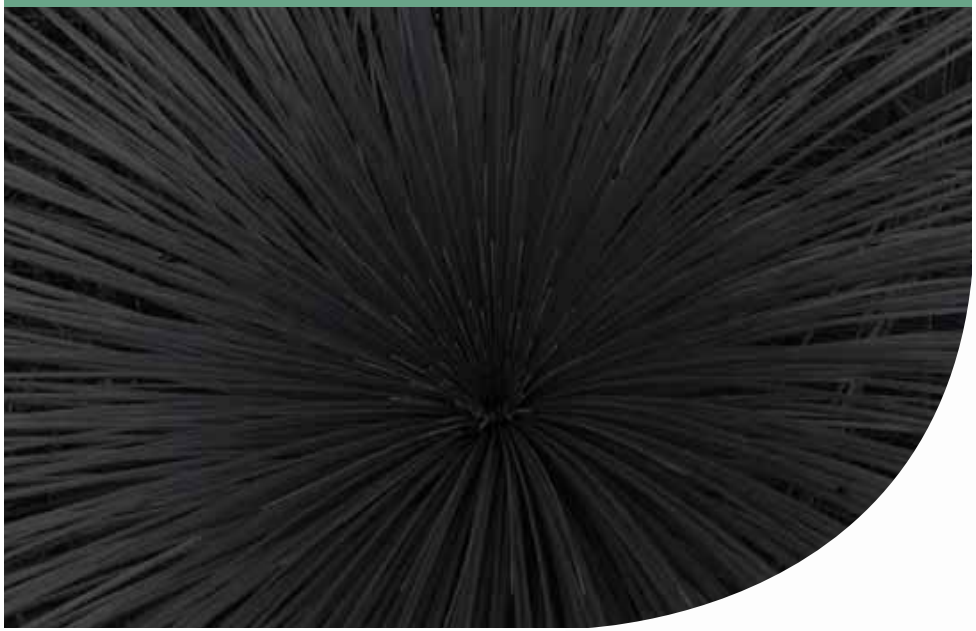
Detailed Flora and Vegetation Assessment

Detailed Flora and Vegetation Assessment

Former Glen Iris Golf Course

Project No: EP20-009(03)

Prepared for ECP Acquisitions 6 Pty Ltd
October 2021



Document Control

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1	June 2020	Rachel Weber	RAW	Tom Atkinson	TAA
	Report prepared for client review				
A	April 2021	Rachel Weber	RAW	Tom Atkinson	TAA
	Minor updates to reflect change in site boundary				
B	June 2021	Rachel Weber	RAW	Tom Atkinson	TAA
	Minor updates to numeric decimal places				
C	September 2021	Sarah Paul	SKP	Tom Atkinson	TAA
	Updated to include targeted spring surveys for conservation significant species				
D	October 2021	Sarah Paul	SKP	Rachel Weber	RAW
	Updated to include additional targeted spring surveys for conservation significant species				

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Executive Summary

Emerge Associates (Emerge) were engaged by ECP Acquisitions 6 Pty Ltd to conduct a 'detailed' and 'targeted' level assessment within the former Glen Iris Golf Course (referred to herein as the 'site') to provide information on the flora and vegetation values.

As part of the assessment a desktop review of relevant background information was completed, and site surveys were undertaken on 11 March 2020, 19 August, 9 September, 7 and 28 October 2021. Outcomes of the flora and vegetation assessment include the following:

- A total of 80 native and 51 non-native (weed) species were recorded in the site.
- Four plant communities were recorded within the site:
  - Plant community EmB extends over 1.9 ha (4% of the site) and comprises remnant native vegetation in 'very good', 'good' and 'degraded' condition. This vegetation occurs as scattered patches and is considered likely to represent floristic community type (FCT) 23a 'Central *Banksia attenuata – B. menziesii* woodlands'.
  - Plant community TdSt extends over 0.2 ha (<1% of the site) and comprises riparian vegetation that is likely planted or a combination of planted and naturally regenerated and was mapped as being in 'good – degraded' condition.
  - Plant community planted trees and shrubs extends over 13.6 ha (25% of the site) and comprises predominantly scattered non-native species in 'completely degraded' condition.
  - Plant community turf and bare ground extends over 35.7 ha (66% of the site) and comprises the previous golf fairway and bare ground in 'completely degraded' condition.
- The remainder of the site comprises artificial lakes, buildings and hardstand which extend over 2.3 ha (4% of the site) and were not assigned to a vegetation condition category.
- No threatened or priority flora species were recorded within the site and none are considered likely to occur.
- No threatened or priority ecological communities occur within the site and none are considered likely to occur.

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Former Glen Iris Golf Course

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Former Glen Iris Golf Course

Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
EPA	Environmental Protection Authority
DBCA	Department of Biodiversity, Conservation and Attractions
DoW	Department of Water (now DWER)
DWER	Department of Water and Environmental Regulation
WALGA	Western Australia Local Government Association

Table A2: Abbreviations – General terms

General terms	
ESA	Environmentally sensitive area
FCT	Floristic community type
IBRA	Interim Biogeographic Regionalisation of Australia
MUW	Multiple use wetland
NVIS	National Vegetation Inventory System (ESCAVI 2003)
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
P5	Priority 5
PEC	Priority ecological community
T	Threatened
TEC	Threatened ecological community
UFI	Unique feature identifier

Table A3: Abbreviations –Legislation

Legislation	
BAM Act	*Biosecurity and Agriculture Management Act 2007*
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
BC Act	*Biodiversity Conservation Act 2016*
BC Regs	*Biodiversity Conservation Regulations 2018*

Table A4: Abbreviations – planning

Planning terms	
MRS	Metropolitan region scheme

Table A5: Abbreviations – units of measurement

Units of measurement	
cm	Centimetre
ha	Hectare
m	Metre
m AHD	m in relation to the Australian height datum
mm	Millimetre

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Detailed Flora and Vegetation Assessment
Former Glen Iris Golf Course

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1 Introduction

1.1 Project background

ECP Acquisitions 6 Pty Ltd intends to develop the former privately run Glen Iris Golf Course into a residential estate. The former Glen Iris Golf Course comprises Lots 6 and 7 Glen Iris Drive, Lots 3, 509 and 512 Dean Road and Lot 139 Imlah Court in Jandakot (referred to herein as the 'site').

The site is located approximately 16 kilometres (km) south of the Perth Central Business District within the City of Cockburn and is zoned 'urban' under the *Metropolitan Region Scheme* (MRS) and 'development contribution area 13 special use 1', 'development contribution area 13 special use 6', 'development contribution area 13 residential-R40' under the City of Cockburn *Town Planning Scheme No. 3*.

The site is approximately 53.7 hectares (ha) in size and is surrounded by residential subdivision, with a railway to the north and Kwinana Freeway to the west. The site comprises two areas separated by Berrigan Drive. The location and extent of the site is shown in Figure 1.

1.2 Purpose and scope of work

Emerge Associates (Emerge) were engaged by Acumen Development Solutions, on behalf of ECP Acquisitions 6 Pty Ltd, to provide environmental consultancy services to support the planning process for the site. The purpose of this survey is to provide sufficient information on the flora and vegetation values within the site to inform this process.

The scope of work was specifically to undertake a flora and vegetation assessment to the standard required of a detailed and a targeted survey with reference to the Environmental Protection Authority's (EPA's) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016).

As part of this scope of work, the following tasks were undertaken:

- Desktop review of relevant background information pertaining to the site and surrounds, including database searches for threatened flora species and ecological communities.
- Compilation of a comprehensive list of flora species recorded as part of the field survey.
- Mapping of conservation significant flora and vegetation, plant communities and vegetation condition.
- Identification of potential habitat for conservation significant flora and vegetation and likelihood of occurrence.
- Targeted searches for conservation significant flora within areas of suitable habitat.
- Documentation of the desktop assessment, survey methodology and results into a report.

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2 Environmental Context

2.1 Climate

Climate has a strong influence on the types of vegetation that grow in a region and the life cycles of the flora present. It is therefore critical for a flora and vegetation survey to respond appropriately to climatic conditions to ensure that surveys are conducted during times when flora species are easiest to detect and identify.

The south-west of Western Australia experiences a Mediterranean climate of hot dry summers and cool wet winters. In Mediterranean type climates some flora species will typically spend part of their lifecycle as either underground storage organs or as seed. This is an adaptation to unfavourable environmental conditions such as excessive heat and drought that occur over the summer period. These species, known as 'geophytes' or 'annuals', tend to re-emerge during winter when favourable conditions return and are most visible during spring, which is the flowering period for a majority of plant species. Therefore, spring is the optimal time to complete flora and vegetation surveys in the south-west of WA.

An average of 719.6 millimetres (mm) of rainfall is recorded annually from the Jandakot Aero weather station, which is the closest weather station, located approximately 2 km east of the site. The majority of this rainfall is received between the months of May and September. Mean maximum temperatures at the Jandakot Aero weather station range from 18.0ºC in July to 31.6ºC in February, while mean minimum temperatures range from 6.9ºC in July to 17.2ºC in February (BoM 2020).

A total of 600.6 mm of rain was recorded between May and August 2021 prior to the surveys which is higher than the combined long-term average of 558.5 mm for the same months (BOM 2021). This high rainfall was considered to have been sufficient to promote the flowering and emergence of native flora.

2.2 Geomorphology and soils

Landform and soils influence vegetation types at regional and local scales. The site occurs on the Swan Coastal Plain, which is the geomorphic unit that characterises much of the Perth metropolitan area.

The Swan Coastal Plain is approximately 500 km long and 20 to 30 km wide and is roughly bound by the Indian Ocean to the west and the Darling Scarp to the east. Broadly the Swan Coastal Plain consists of two sedimentary belts of different origin. Its eastern side has formed from the deposition of alluvial material washed down from the Darling Scarp, while its western side is comprised of three dune systems that run roughly parallel to the Indian Ocean coastline (Seddon 2004). These dune systems, referred to as Quindalup, Spearwood and Bassendean associations, represent a succession of coastal deposition that has occurred since the late Quaternary period (approximately two million years ago) (Kendrick *et al.* 1991) and, as a result, they contain soils at different stages of leaching and formation.

Examination of broad scale soil mapping places the site within the Bassendean soil association (Churchward and McArthur 1980). The Bassendean association comprises sand plains with low dunes and occasional swamps, iron or humus podzols and areas of complex steep dunes.

Finer scale mapping by (Gozzard 2011) also places the site in Bassendean sand (S8) which was later confirmed during the field survey. The Bassendean sands typically very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of eolian origin (Purdie *et al.* 2004).

The site is not known to contain any restricted landforms or unique geological features.

2.3 Topography

The elevation of the site ranges from 25 m in relation to the Australian height datum (mAHD) in the southern portion to 40 mAHD in the northern portion of the site (DoW 2008) (Figure 2).

2.4 Hydrology and wetlands

Wetlands include "areas of seasonally, intermittently or permanently waterlogged soils or inundated land, whether natural or otherwise, fresh and saline, e.g. waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries" (Wetlands Advisory Committee 1977). Wetlands can further be recognised by the presence of vegetation associated with waterlogging or the presence of hydric soils such as peat, peaty sand or carbonate mud (Hill *et al.* 1996).

Wetlands of national or international significance may be afforded special protection under Commonwealth or international agreements. The following lists of important wetlands were checked as part of this assessment:

- *Ramsar List of Wetlands of International Importance* (DBCA 2017b)
- *A Directory of Important Wetlands in Australia* (DBCA 2018).

No Ramsar or listed 'important wetlands' are located within or near the site.

Examination of the Department of Water and Environmental Regulation (DWER) hydrography dataset (DWER 2018) shows that no wetland or water related features are mapped within the site.

On the Swan Coastal Plain DBCA (2017a) have used the geomorphic wetland classification system developed by Semeniuk (1987) and Semeniuk and Semeniuk (1995) to classify wetlands based on the landform shape and water permanence (hydro-period). The Department of Biodiversity, Conservation and Attractions (DBCA) maintains the *Geomorphic Wetlands of the Swan Coastal Plain* dataset (DBCA 2020a), which further categorises geomorphic wetland features into specific management categories to guide land use and conservation. Note that as this dataset was drafted at a regional scale the boundaries of mapped wetland features are often inconsistent with physical wetland boundaries.

A review of the *Geomorphic Wetlands, Swan Coastal Plain* dataset (DBCA 2020a) indicated that no wetland features are mapped within the site. Two 'multiple use' category wetland features (UFIs 6654 and 6655) occur adjacent to the south-western portion of the site.

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The locations of the geomorphic wetlands surrounding the site are shown in Figure 2.

2.5 Regional vegetation

Native vegetation is described and mapped at different scales in order to illustrate patterns in its distribution. At a continental scale the *Interim Biogeographic Regionalisation of Australia* (IBRA) divides the Swan Coastal Plain into two floristic subregions (Environment Australia 2000). The site is contained within the 'SWA02' or Perth subregion, which is characterised as mainly containing *Banksia* low woodland on leached sands with *Melaleuca* swamps where ill-drained; and woodland of *Eucalyptus gomphocephala* (tuart), *E. marginata* (jarrah) and *Corymbia calophylla* (marri) on less leached soils (Beard 1990). This subregion is recognised as a biodiversity hotspot and contains a wide variety of endemic flora and vegetation types.

Variations in native vegetation within the site can be further classified based on regional vegetation associations. Heddle *et al.* (1980) mapping shows the majority of the site as comprising the 'Bassendean central and south' complex, which is described as vegetation ranging from woodland of *Eucalyptus marginata - Allocasuarina fraseriana - Banksia* spp. to low woodland of *Melaleuca* spp. and sedgelands on the moister sites. This complex was determined to have 26.87% remaining in 2019, of which 2.15% is under formal protection (Government of Western Australia 2019).

2.6 Historic land use

Review of historical images available from 1953 (WALIA 2020) onwards shows that the northern and southern portions of the site, separated by Berrigan Drive, have been subject to vegetation clearing at different times.

The northern portion of the site supported native vegetation until construction of the central part of the Glen Iris Golf Course commenced, which is first visible in imagery from 1965. The remainder of the northern portion of the site was cleared of native vegetation by 1995 for further golf course construction. Scattered remnant native trees appear to have been retained between the golf course fairway but the majority of the vegetation was cleared during construction of the golf course.

The southern portion of the site supported native vegetation until construction of the golf course commenced, which is first visible in imagery from 1995. The entirety of the southern portion of the site, except two areas near the southern boundary, were completely cleared of native vegetation for the golf course.

The Glen Iris Golf Course was formally closed by the previous owners in March 2020 and has been in caretaker and maintenance ever since.

2.7 Significant flora and vegetation

2.7.1 Threatened and priority flora

Certain flora taxa that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth level, flora taxa may be listed as 'threatened' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threatened flora species listed under the EPBC Act are assigned a conservation status according to attributes such as population size and geographic distribution. Any action likely to have a significant impact on a taxon listed under the EPBC Act requires Ministerial approval.

In Western Australia flora species may also be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act). Similarly, it is an offence to 'take' or 'disturb' threatened flora listed under the BC Act without Ministerial approval.

Flora species that do not currently meet the criteria for listing as threatened but are potentially rare or threatened may be added to the DBCA's *Priority Flora List*. These species are classified into 'priority' levels based on threat. Whilst priority species are not under direct statutory protection, they are considered during State approval processes. Further information on threatened and priority species and their categories is provided in Appendix A.

2.7.2 Threatened and priority ecological communities

An ecological community is a naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat. An ecological community's structure, composition and distribution are influenced by environmental factors such as soil type, position in the landscape, altitude, climate and water availability (DoEE 2019b). 'Threatened ecological communities' (TECs) are ecological communities that are recognised as rare or under threat and therefore warrant special protection.

Selected TECs are afforded statutory protection at a Commonwealth level under the EPBC Act. Similar to flora species, TECs listed under the EPBC Act are assigned a conservation status. Any action likely to have a significant impact on a community listed under the EPBC Act requires Ministerial approval.

TECs are also listed within Western Australia under the BC Act and the BC Regulations. Their significance is also acknowledged through other state environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

A plant community that is under consideration for listing as a TEC in Western Australia, but does not yet meet survey criteria or has not been adequately defined, may be listed as a 'priority ecological community' (PEC). Listing as a PEC is similarly considered during State approval processes. Further information on categories of TECs and PECs is provided in Appendix A.

2.7.3 Local and regional significance

Flora species and ecological communities may be significant for a number of reasons irrespective of whether they have special protection under policy or legislation.

Two reasons that vegetation within the site may be significant are listed below:

- The vegetation within the site has potential value as habitat for threatened or priority fauna species including, in particular, Carnaby's black cockatoo and the forest red-tailed black cockatoo, which are listed as 'vulnerable' under the EPBC Act and 'endangered' under the BC Act.

- The vegetation supports flora species Listed in *Bush Forever* 'significant flora' list for the Bassendean dunes (Government of WA 2000).

2.7.4 Weeds

The term 'weed' can refer to any plant that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. Many non-native flora species and some native species are considered to be weeds.

A particularly invasive or detrimental weed species may be listed as a 'declared pest' pursuant to Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread. At a National level, the Australian government has compiled a list of 32 *Weeds of National Significance* (WoNS) (DoEE 2019c). Whilst the WoNS list is non-statuatory, many WoNS are also listed under the BAM Act. Further information on categories of declared pests is provided in Appendix A.

Due to historical disturbance weed species are expected to be present at the site.

2.8 Bush Forever

The Government of Western Australia's *Bush Forever* policy is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of *Bush Forever* is to protect comprehensive representations of all original ecological communities by targeting a minimum of 10% of each vegetation complex for protection (Government of WA 2000). *Bush Forever* sites are representative of regional ecosystems and habitat and have a key role in the conservation of Perth's biodiversity.

No *Bush Forever* sites occur within the site. Multiple *Bush Forever* sites occur to the east and west of the site.

2.9 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. This exchange of genetic material between vegetation remnants improves the viability of those remnants by allowing greater access to breeding partners and food sources, refuge from disturbances such as fire and maintenance of genetic diversity of plant communities and populations. Ecological linkages are ideally continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998).

The Perth Biodiversity Project, supported by the Western Australia Local Government Association (WALGA), have identified and mapped regional ecological linkages within the Perth Metropolitan Region (WALGA and PBP 2004).

There are no mapped ecological linkages within the site. One biodiversity ecological linkage (no. 48) is located approximately 800 m to the north of the site and extends to the west and east.

2.10 Previous surveys

No previous flora and vegetation surveys are known to have been undertaken within the site.

3 Methods

3.1 Desktop assessment

3.1.1 Database searches

A search was conducted for threatened and priority flora that may occur or have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2020a) and *NatureMap* (DBCA 2020).

A search was also conducted for TECs and PECs that may occur or have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2020a) and the *Weed and Native Flora Dataset* (Keighery *et al.* 2012).

Prior to undertaking the field survey, information on the habitat preferences of threatened and priority flora species and communities identified from database searches was reviewed. This was compared to existing environmental information available for the site, such as geomorphology, soils, regional vegetation and historic land use, to identify species and communities for which habitat may occur in the site.

3.2 Field survey

An ecologist from Emerge visited the site on 11 March 2020, 19 August, 9 September, 7 and 28 October 2021 to conduct the flora and vegetation field surveys.

3.2.1 Flora and vegetation

The site was traversed on foot and the composition and condition of vegetation was recorded.

Detailed sampling of the vegetation was undertaken using non-permanent relevés. Each relevé was completed over an approximately 10 x 10 m area. A total of three relevés were sampled and the position of each sample location was recorded with a hand-held GPS unit, as shown in Figure 3. The data recorded within each relevé included:

- site details (site name, site number, observers, date, location)
- environmental information (slope, aspect, bare-ground, rock outcropping soil type and colour class, litter layer, topographical position, time since last fire event)
- biological information (vegetation structure and condition, degree of disturbance and species present).

Additional plant taxa not observed within samples were recorded opportunistically as the ecologist traversed the site. Photographs were taken throughout the field visit to show particular site conditions.

The suitability of habitat within the site for conservation significant species identified in the desktop assessment was assessed (refer Section 3.1). Areas of suitable habitat were searched for conservation significant species as required.

All plant specimens collected during the field survey were dried, pressed and then named in accordance with requirements of the Western Australian Herbarium. Identification of specimens occurred through comparison with named material and through the use of taxonomic keys. Flora species not native to Western Australia are denoted by an asterisk ('*') in text and raw data.

Vegetation condition was assigned at each sample and changes in vegetation condition were also noted and mapped across the site. The condition of the vegetation was assessed using methods from Keighery (1994). For vegetation in the site containing *Banksia* spp., the condition scale provided in the conservation advice for the 'banksia Woodlands of the Swan Coastal Plain TEC' (TSSC 2016) was applied in addition to the Keighery scale (as shown in Table 1).

Table 1: Vegetation condition scale applied during the field assessment

Condition category	Definition (Keighery 1994)	Indicator (TSSC 2016)	
		Typical native vegetation composition	Typical weed cover
Pristine	Pristine or nearly so, no obvious signs of disturbance.	Native plant species diversity fully retained or almost so	Zero or close to
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.	High native plant species diversity	Less than 10%
Very good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing	Moderate native plant species diversity	5-20%
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.	Low native plant species diversity	5-50%
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	Very low native plant species diversity	20-70%
Completely degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.	Very low to no native species diversity	Greater than 70%

3.3 Mapping and data analysis

3.3.1 Likelihood of occurrence of conservation significant flora and vegetation

Information on the habitat preferences of threatened and priority flora species and communities identified from database searches was reviewed. Based on existing conditions such as plant community, vegetation condition, land use and disturbance, an assessment of the likelihood of occurrence of threatened and priority flora species and communities within the site was undertaken using the categories outlined in Table 2.

Table 2: Likelihood of occurrence assessment categories and definitions

Likelihood	Definition
Recorded	The species was recorded during the current field survey.
Likely	The site contains suitable habitat for the species and it is likely the species may occur based on presence of a recent historical record within or close to the site.
Possible	The site contains suitable habitat for the species but there is no other information to suggest that the species may occur within or close to the site.
Unlikely	The site does not contain suitable habitat for the species or the site contains suitable habitat for the species within which thorough targeted searches were completed and conclusion has been made that the species is unlikely to be present.

3.3.2 Plant community identification and description

The local plant communities within the site were identified from the sample data collected during the field survey. The vegetation was described according to the dominant species present using the structural formation descriptions of the *National Vegetation Inventory System* (NVIS) (ESCAVI 2003). The identified plant communities were mapped on aerial photography from the sample locations and boundaries were interpreted from aerial photography and notes taken in the field. Vegetation condition was mapped on aerial photography based on the locations and notes recorded during the field survey to define areas with differing condition.

3.3.3 Floristic community type assignment

Where possible, each plant community was assigned a 'floristic community type' (FCT), as defined by Gibson *et al.* (1994). This was determined by comparing the flora species recorded within each sample to those in the regional datasets *A floristic survey of the southern Swan Coastal Plain* Gibson *et al.* (Gibson *et al.* 1994) and *Weed and Native Flora Data for the Swan Coastal Plain* (Keighery *et al.* 2012). No statistical FCT analysis was undertaken due to the high level of disturbance across most of the site and small size of vegetation patches in better quality.

Ultimately the flora species present and contextual information relating to the soils, landforms and known locations of FCTs within the region were used to determine the appropriate FCT for vegetation within the site.

3.3.4 Threatened and priority ecological communities

Areas of native vegetation potentially representing a TEC were assessed against key diagnostic characteristics and, if available, size and/or vegetation condition thresholds provided in the following document:

- *Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community (TSSC 2016).*

3.4 Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in the EPA document *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) is provided in Table 3.

Table 3: Evaluation of survey methodology against standard constraints outlined in EPA (2016)

Constraint	Degree of limitation	Details
Availability of contextual information	No limitation	The broad scale contextual information described in Section 2 is adequate to place the site and vegetation in context.
		No previous relevant surveys are known to have been undertaken within the site.
	No limitation	Regarding assignment of FCTs, the authoritative Gibson *et al.* (1994) dataset was derived from a necessarily limited sample of vegetation from largely publicly owned land which is now more than 20 years out of date. Consequently, it is unknown to what degree official FCTs are appropriate reference to biodiverse vegetation across the Swan Coastal Plain. In lieu of an alternative and as recommended by DBCA, the Gibson *et al.* (1994) dataset was used to assign an FCT where possible. Comparison of species in the patches of vegetation in better condition with the Gibson *et al.* (1994) dataset, in combination with soils, landforms and known locations of FCTs within the region, was sufficient to assign an FCT.
Experience level of personnel	No limitation	This flora and vegetation assessment was undertaken by qualified botanists with 6-11 years of botanical experience in Western Australia. Technical review was undertaken by a senior environmental consultant with 18 years' experience in environmental science in Western Australia.
Suitability of timing	No limitation	The survey was conducted in March 2020 and August, September and October 2021 and thus within the main flowering season. High rainfall was recorded from May to August 2021 in the months preceding the site visits. Therefore, it is likely that most plant species would have been in flower and/or visible at the time of survey. The degraded nature of most of the site limits the potential habitat for native geophytic plants such as orchids and the majority of threatened and priority flora species with potential to occur are perennial species. Nevertheless, some orchid species were recorded and able to be identified to species level. No unidentified specimens were collected. The survey timing was considered adequate to allow the detection of all species for which seasonal timing is critical.
Temporal coverage	No limitation	Comprehensive flora and vegetation assessments can require multiple visits, at different times of year, and over a period of multiple, to enable observation of all species present. The portions of the site containing native vegetation were visited five times over two years and three seasons.

Table 3: Evaluation of survey methodology against standard constraints outlined in EPA (2016) (continued)

Constraint	Degree of limitation	Details
Spatial coverage and access	No limitation	Site coverage was comprehensive (track logged).
	No limitation	All parts of the site could be accessed as required.
Sampling intensity	No limitation	A total of 131 species were recorded, comprising 80 native and 51 non-native species. These species were recorded from three sample locations and opportunistic observations across the site. Considering the high level of disturbance within the majority of the site and the small size of the areas of remnant native vegetation, the number of native species recorded was considered sufficient to classify the vegetation for the purposes of this assessment.
Influence of disturbance	Minor limitation	Time since fire is greater than 60 years as interpreted form aerial imagery and therefore species reliant on fire to emerge may not have been visible. However, this was not considered a limitation in regards to determining the presence of threatened or priority flora species.
	No limitation	Historical ground disturbance was evident in the majority of the site. The disturbance history of the site was considered when undertaking field sampling.
Adequacy of resources	No limitation	All resources required to perform the survey were available.

4 Results

4.1 General site conditions

The site is gently undulating and comprises sandy white-grey soils. The site was recently used as a golf course and the fairways and lakes were irrigated at the time of the survey.

The site has been highly modified for its use as a golf course and is dominated by non-native vegetation and unvegetated areas. Small areas of remnant native vegetation occur as scattered patches of varying quality.

4.2 Flora

4.2.1 Desktop assessment

The database search results identified a total of 16 threatened and 34 priority flora species occurring or potentially occurring within a 10 km radius of the site. Information on these species including their habitat preferences is provided in Appendix B.

Based on background information available for the site, two threatened flora species and five priority flora species were identified as having potential to occur within the site as shown in Table 4.

Table 4: Conservation significant flora species considered to have potential to occur in the site based on known habitat preferences

Species	Level of significance		Life strategy	Habitat	Flowering period
	State	EPBC Act			
Caladenia huegelii	CR	E	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov
Macarthuria keigheryi	E	E	P	Low-lying winter-wet damp grey/white sands in open patches.	Sep-Dec, Feb-Mar
Stenanthemum sublineare	P2	-	P	White sand on coastal plains.	Oct-Dec
Thelymitra variegata	P2	-	PG	Sandy clay, sand, laterite.	Jun-Sep
Phlebocarya pilosissima subsp. *pilosissima*	P3	-	P	White or grey sand, lateritic gravel.	Aug-Oct
Styphelia filifolia	P3	-	P	Brown over pale yellow sand.	Feb-Apr
Jacksonia sericea	P4	-	P	Calcareous and sandy soils on Swan Coastal Plain	Dec-Feb

4.2.2 Species inventory

A total of 80 native and 51 non-native (weed) species were recorded within the site during the field survey, representing 45 families and 103 genera. The dominant families containing native taxa were

Myrtaceae (15 native taxa and 13 weed taxa) and Fabaceae (12 native taxa and four weed taxa). A complete species list is provided in Appendix C.

4.2.3 Threatened and priority flora

No occurrences of threatened or priority flora species were recorded within the site.

The EmB vegetation described in Section 4.3.2 comprises suitable habitat for the threatened and priority flora species identified in Table 4. Targeted searches were undertaken for these species during the optimal survey period and they were not recorded. Therefore, no threatened or priority flora species are considered likely to occur in the site.

The likelihood of occurrence assessment is provided in Appendix B.

4.2.4 Locally and regionally significant flora

No locally or regionally significant flora species were recorded within the site.

4.2.5 Declared pests

No species listed as declared pests pursuant to the BAM Act or weeds of national significance (WoNS) were recorded in the site.

4.3 Vegetation

4.3.1 Desktop assessment

The database search results identified four TECs and three PECs occurring or potentially occurring within a 10 km radius of the site. Information on these communities is provided in Appendix D.

Based geomorphology, soils and regional vegetation patterns, the following one TEC and three PECs were considered to have potential to occur in the site:

- 'Banksia woodlands of the Swan Coastal Plain' TEC which is listed as 'endangered' under EPBC Act.
- 'Banksia woodlands of the Swan Coastal Plain' PEC (P3)
- '*Banksia ilicifolia* woodlands, southern Swan Coastal Plain' PEC (P3)
- 'Northern Spearwood shrublands and woodlands' PEC (P3).

4.3.2 Plant communities

Four plant communities were identified within the site. Plant community EmB exists as scattered patches in the northern, central and south-western portions of the site. Plant community TdSt exists as multiple small patches on the edges of artificial lakes and is considered to be likely planted or a combination of planted and naturally generated vegetation. Plant communities planted trees and shrubs and turf and bare ground exist across the site and were likely previously installed for the sites' historic use as a golf course.

The remainder of the site supports multiple artificial lakes, buildings and hardstand (2.3 ha).

A description and the area of each plant community is provided in Table 5, representative photographs of each are provided in Plate 1 to Plate 4 and raw sample data is provided in Appendix E. The location of each plant community is shown in Figure 3.

Table 5: Description and extent of plant communities identified within the site

Plant community	Description	Area (ha)
EmB	Woodland to open woodland *Eucalyptus marginata* subsp. *marginata*, *Banksia attenuata* and *Banksia menziesii* over mixed shrubland *Xanthorrhoea preissii*, *Allocasuarina humilis* and *Hibbertia hypericoides* over open sedgeland *Mesomelaena pseudostygia* over non-native grassland **Ehrharta calycina* (Plate 1).	1.9
TdSt	Closed sedgeland *Typha domingensis*, *Schoenoplectus tabernaemontani*, **Cortaderia selloana* and *Baumea* sp. (Plate 2).	0.2
Planted trees and shrubs	Predominantly scattered non-native planted trees and shrubs such as **Corymbia* spp., **Eucalyptus* spp., *Melaleuca* spp. and *Grevillea* spp. with occasional native plants (Plate 3).	13.6
Turf and bare ground	Closed non-native grassland (turf) and bare ground (Plate 4).	35.7

Plate 1: Plant community EmB in 'very good' condition

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Plate 2: Plant community TdSt in 'good – degraded' condition

Plate 3: Planted trees and shrubs in 'completely degraded' condition

Plate 4: Turf and bare ground in 'completely degraded' condition

4.3.3 Vegetation condition

Plant community EmB comprises the most intact native vegetation within the site. Some of the EmB vegetation was mapped as being in 'very good' condition as they supported the general structure expected of a banksia woodland community and had moderate native species diversity. The remainder of the EmB vegetation was mapped as being in 'good' and 'degraded' condition where it was more disturbed with an altered structure, lower native species diversity and higher weed cover.

Plant community TdSt was mapped as being in 'good – degraded' condition as it comprises a combination of native and non-native species that only exist in the site due to the presence of the artificial lakes created for the previous golf course.

The planted trees and shrubs and the turf and bare ground communities were mapped as being in 'completely degraded' condition as they are dominated by non-native species or comprise unvegetated areas. The remainder of the site, which comprises artificial lakes, buildings and hardstand, were not assigned a condition category (2.3 ha).

The extent of vegetation by condition category is detailed in Table 6 and shown in Figure 4.

Table 6: Extent of vegetation condition categories within the site

Condition category (Keighery 1994)	Size (ha)
Pristine	0
Excellent	0
Very good	0.43
Good	0.69
Good – degraded	0.22
Degraded	0.80
Completely degraded	49.25

4.3.4 Floristic community types

Plant community EmB was determined to likely represent FCT 23a 'Central *Banksia attenuata – B. menziesii* woodlands'. This FCT is listed as 'well reserved' and 'low risk' by Gibson *et al.* (1994).

The other plant communities in the site were considered too degraded to assign to an FCT.

4.3.5 Threatened and priority ecological communities

The structure and composition of plant community EmB indicates that it has the potential to represent the Commonwealth listed TEC 'banksia woodlands of the Swan Coastal Plain' and the State listed PEC of the same name (P3).

The above TEC, herein referred to as the 'banksia woodland TEC', is listed as 'endangered' under the EPBC Act. Whether a patch of vegetation is considered to represent the banksia woodland TEC depends on a number of diagnostic criteria including geographic location, soils, landform, structure, composition, condition and patch size (DoEE 2016).

As outlined in Table 7, the EmB vegetation does not satisfy the criteria to be considered a patch of the 'banksia woodland TEC' due to the small size of the patches.

Table 7: Criteria for determining presence of Banksia Woodlands of the Swan Coastal Plain TEC adapted from (TSSC 2016)

Criteria	Requirements for meeting criteria	Site implications
1. Must meet key diagnostic characteristics	A variety of factors relating to: • Location • Soils • Structure • Composition	• Site meets location and soils criteria. • The EmB vegetation includes the key diagnostic feature of a tree layer of *Banksia attenuata*, *Banksia menziesii* and *Banksia ilicifolia*. • The EmB vegetation within site also meets structure and composition criterion. It is likely to represent FCT 23a which is identified as one of the FCTs comprising the banksia woodland TEC.
2. Must meet condition thresholds	• A patch should at least meet the 'good' condition category (see Table 1)	• The EmB vegetation is present in 'very good', 'good' and 'degraded' condition, which meets this criterion. The conservation advice indicates that a single patch may include areas of variable condition, meaning the 'degraded' condition may still be considered the TEC. • The patches of EmB vegetation that are adjacent to each other would be considered part of the same patch. Therefore, six 'patches' of EmB vegetation exist within the site.
3. Must meet minimum patch size	Minimum size of patch: • Pristine=no minimum size • Excellent=0.5 ha • Very Good=1 ha • Good=2 ha	• The six patches of EmB vegetation are each less than 1 ha in size and do not meet this criterion.
4. Must incorporate surrounding context	• Breaks (e.g. tracks) < 30 m do not separate vegetation into separate patches • Buffer zones may apply (20-50 m recommended from patch edge) • The site should be thoroughly sampled (2 surveys in same spring). • Survey timing should be appropriate. • Surrounding environment should be considered (e.g. connectivity, conservation values, fauna habitat)	• The patches of EmB vegetation are isolated from other banksia woodland and no relevant surrounding context considerations apply.
Result	The site does not support any vegetation that represents the banksia woodland TEC.	

DBCA's *Priority Ecological Community* list indicates that the description, area and condition thresholds that apply to the Commonwealth-listed TEC of the same name also apply to the 'banksia woodlands of the Swan Coastal Plain' PEC (DBCA 2020b). Since the EmB vegetation does not represent the banksia woodland TEC it also does not represent the PEC.

No other TECs or PECs occur within the site.

4.3.6 Locally and regionally significant vegetation

Plant communities EmB and planted trees and shrubs contain multiple foraging species for threatened species of black cockatoo. In addition, a small number of mature *Corymbia calophylla*, *Eucalyptus marginata* and **Eucalyptus* sp. trees with a diameter at breast height larger than 500 mm are also present within plant communities EmB and planted trees and shrubs. Due to their size these

trees have the potential to provide some value as foraging, roosting and breeding habitat values for black cockatoos, along with other ecological services.

5 Discussion

The site has been highly modified and approximately 92% supports vegetation in 'completely degraded' condition. Native vegetation exists as scattered patches that extend over approximately 4% of the site. The remaining 4% of the site comprises artificial lakes, buildings and hardstand. The highest quality vegetation exists within plant community EmB.

5.1 Threatened and priority flora

Based on the desktop assessment, it was considered that two threatened and five priority flora species had potential to occur within the site. If these species were to occur it was most likely that they would have been found within the EmB vegetation, which, while disturbed, is the most intact remnant vegetation in the site.

Intensive targeted searches were undertaken in August, September and October 2021 across the EmB vegetation and none of the identified threatened or priority flora species were recorded. The absence of the larger perennial species such as *Jacksonia gracillima*, *Verticordia lindleyi* subsp. *lindleyi* and *Andersonia gracilis* was relatively easy to confirm. However, due to their size and seasonal lifeform, smaller annual or geophytic species such as *Drakaea elastica*, *Thelymitra variegata* and *Caladenia huegelii* can be more difficult to detect. Intensive targeted searches were carried out in August, September and October 2021 to search for *Drakaea elastica*, *Thelymitra variegata* and *Caladenia huegelii*. The searches were conducted during the main growing and flowering period for these species and so they would have been visible, if present. Since these species were not recorded the surveys are considered sufficient to conclude that they do not occur in the site.

5.2 Vegetation condition

A vegetation condition score has the greatest implications when the condition of vegetation is close the boundary between 'good' and 'degraded'. This is because good condition is typically accepted as the threshold for conservation significance, while 'degraded' condition implies a low conservation requirement. Separating these two condition categories is further complicated by the fact that good condition is more correctly understood to mean 'average' condition. Applying the Keighery (1994) condition scale good condition vegetation can be expected to be significantly altered, with very obvious disturbance and the presence of aggressive weeds at high density. Therefore, good does not literally mean "good" as the label implies.

The method applied to assess vegetation condition was robust, as it combined the standard qualitative, categorical scheme of Keighery (1994), with the additional indicators for diversity and weed cover outlined in DoEE (2016).

Compound condition categories were applied where the patch of vegetation supported a mosaic of small areas in differing condition and at fine-scale unsuitable for mapping.

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5.3 Floristic community type assignment

Although no statistical FCT analysis was undertaken, the flora species within the EmB vegetation are similar to those recorded within Gibson *et al.* (1994) sites that represent FCT 23a. A total of 15 Gibson *et al.* (1994) and Keighery *et al.* (2012) samples that represent FCT 23a occur within approximately four kilometres of the site and the soils and landform within the site also align with that described for FCT 23a.

5.4 Threatened and priority ecological communities

Arriving at the conclusion that the EmB vegetation does not represent the banksia woodland TEC/PEC was straightforward as the small patches of this vegetation do not meet defined size thresholds.

5.5 Wetlands

The two mapped multiple use wetlands located adjacent to the south-western portion of the site comprise residential lots and extend over portions of the Kwinana Freeway (UFI 6655) and Berrigan Drive (UFI 6654) (Figure 2). Neither of these mapped wetlands contain any native wetland vegetation in proximity to the site.

5.6 Local and regional significance

Suitable habitat for threatened species of black cockatoo were opportunistically recorded within the site. A separate fauna assessment has been undertaken to determine the fauna habitat within the site and whether other fauna species of conservation significance are likely to occur (Emerge Associates 2021).

6 Conclusions

Over 95% of the site has been highly disturbed and modified from its remnant state, with approximately 2.3 ha supporting artificial lakes, buildings and hardstand and 49.2 ha supporting non-native vegetation (planted trees and shrubs and turf and bare ground) in 'completely degraded' condition. The remainder of the site supports remnant native vegetation (1.9 ha) and riparian vegetation that is likely planted or a combination of planted and naturally regenerated (0.2 ha).

No threatened or priority flora species were recorded within the site and none are considered likely to occur.

No TECs or PECs occur within the site and none are considered likely to occur.

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Detailed Flora and Vegetation Assessment
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7 References

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Figures

Figure 1: Site Location

Figure 2: Environmental Features

Figure 3: Plant Communities

Figure 4: Vegetation Condition

Figure 1: Site Location

Project: Detailed Flora and Vegetation Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(03)--F02
Drawn: RAW
Date: 18/05/2020
Checked: RAW
Approved: TAA
Date: 16/06/2020

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Scale: 1:10,000@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used

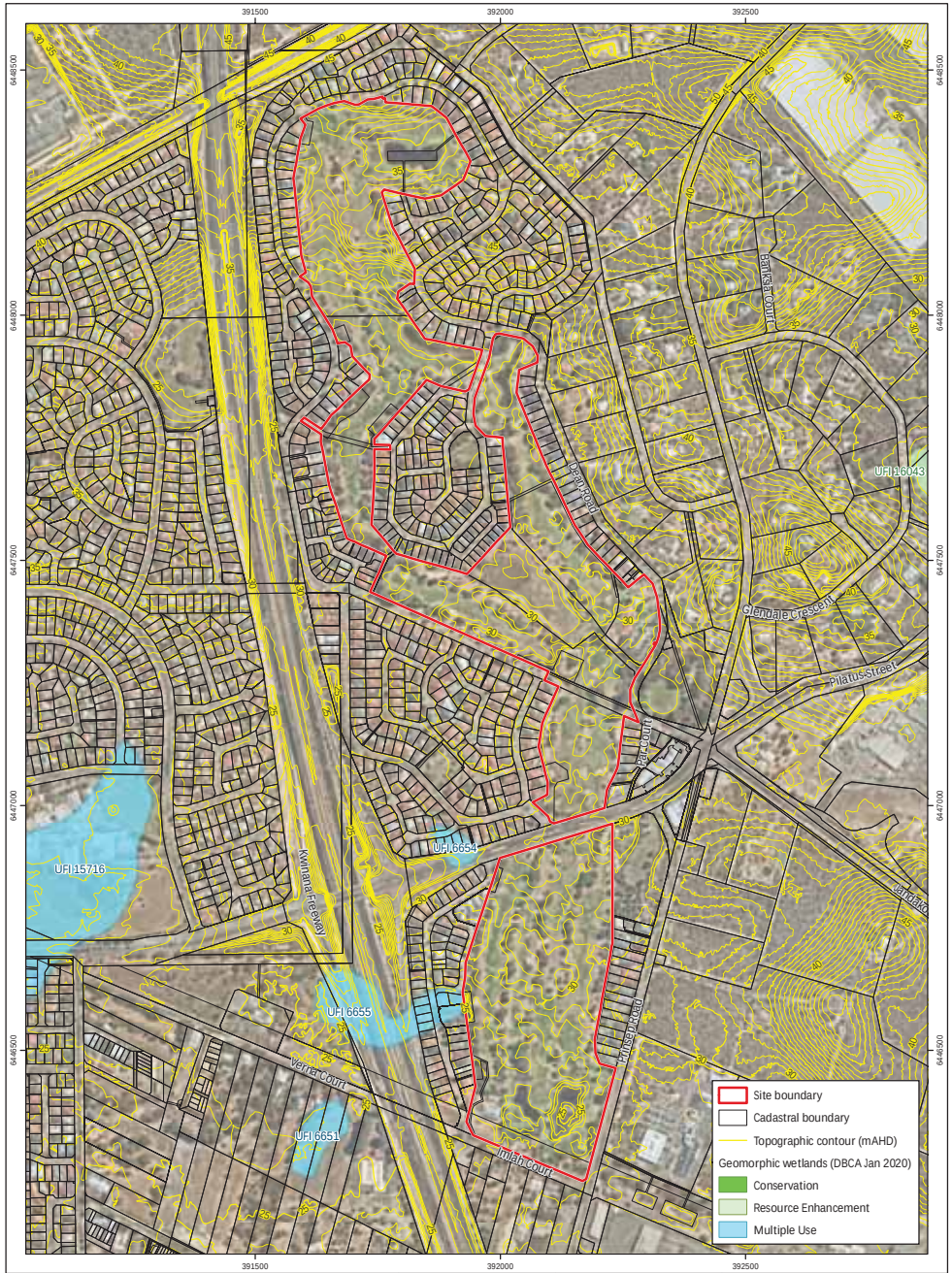

Figure 2: Environmental Features

Project: Detailed Flora and Vegetation Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(03)--F03
Drawn: RAW
Date: 18/05/2020
Checked: RAW
Approved: TAA
Date: 16/06/2020

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GDA 1994 MGA Zone 50

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While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used

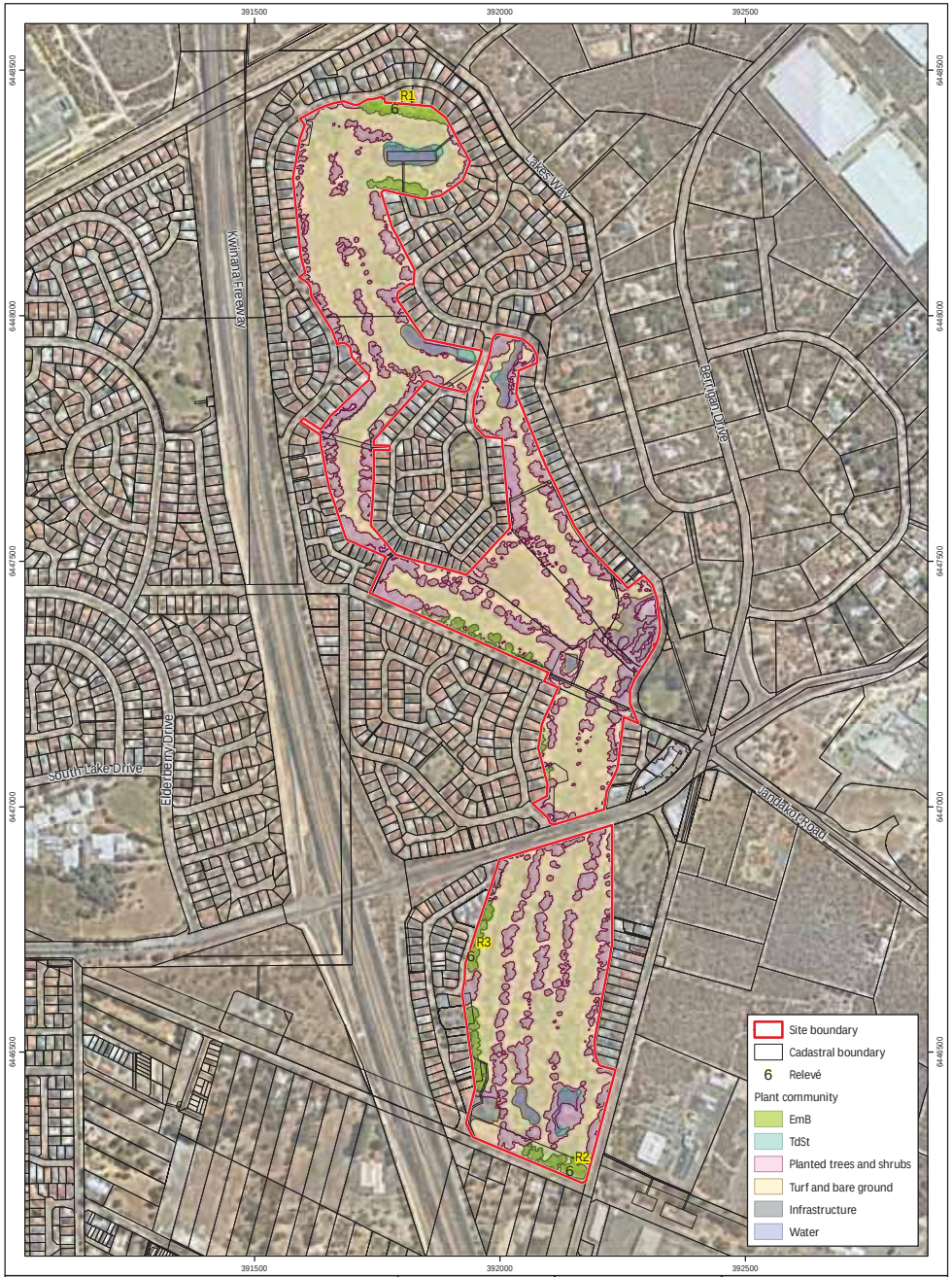

Figure 3: Plant Communities

Project: Detailed Flora and Vegetation Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(03)--F04a
Drawn: GAR
Date: 14/09/2021
Checked: SKP
Approved: TAA
Date: 15/09/2021

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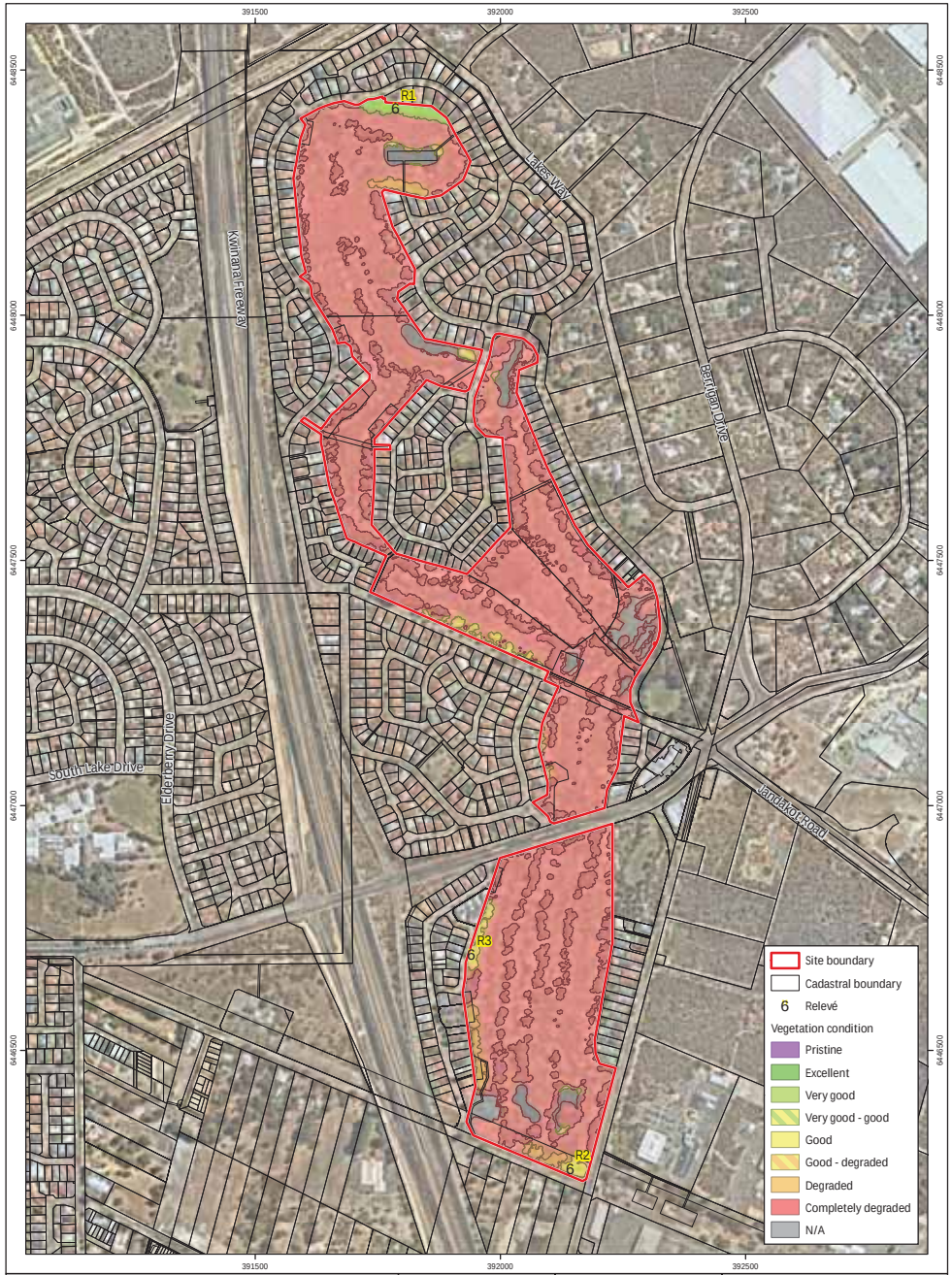

Figure 4: Vegetation Condition

Project: Detailed Flora and Vegetation Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(03)--F05a
Drawn: GAR
Date: 14/09/2021
Checked: SKP
Approved: TAA
Date: 15/09/2021

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Metres
Scale: 1:10,000@A4
GDA 1994 MGA Zone 50

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Appendix A

Additional Information

Conservation Significant Flora and Vegetation

Threatened and priority flora

Flora species considered rare or under threat warrant special protection under Commonwealth and/or State legislation. At the Commonwealth level, flora species can be listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Flora species considered 'threatened' pursuant to Schedule 1 of the EPBC Act are assigned categories according to their conservation status, as outlined in Table 1.

In Western Australia, plant taxa may be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act) which is enforced by Department of Biodiversity Conservation and Attractions (DBCA). Threatened flora species are listed under sections 19(1) and 26(2) of the BC Act. It is an offence to 'take' or disturb threatened flora without Ministerial approval. Section 5(1)1 of the Act defines to take as including "… to gather, pluck, cut, pull up, destroy, dig up, remove, harvest or damage flora by any means" or to cause or permit the same to be done. The definition of threatened flora under the BC Act is provided in Table 1.

Section 43 of the BC Act requires that an occurrence of a threatened species or threatened ecological community is reported to DBCA where the occurrence has been identified as part of field work completed:

- as part of an assessment under Part IV of the *Environmental Protection Act 1986*; or
- in relation to an application for a clearing permit under the *Environmental Protection Act 1986* section 51E(1)(d).

Penalties apply to individuals and organisations that fail to provide accurate reports of threatened species or communities.

The *Biodiversity Conservation Regulations 2018* (BC Regulations 2018) came into effect on January 1 2019. The BC Regulations include provisions for licencing, charges, penalties and other provisions associated with the BC Act.

Flora species that may be threatened or near threatened but lack sufficient information to be listed under the BC Act may be added to the DBCA's *Priority Flora List* (DBCA 2018c). Priority flora species are considered during State approval processes. Priority flora categories and definitions are listed in Table 1.

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Table 1: Definitions of conservation significant flora species pursuant to the EPBC Act and BC Act and on DBCA's Priority Flora List (DBCA 2018c)

Conservation code	Description
EX†	Threatened Flora – Presumed Extinct 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, and have been gazetted as such.
T^†	Threatened Flora – Extant Taxa which are declared to be likely to become extinct or is rare, or otherwise in need of special protection.
CR^	Threatened Flora – Critically Endangered Taxa which are considered to be facing an extremely high risk of extinction in the wild.
EN^	Threatened Flora – Endangered Taxa which are considered to be facing a very high risk of extinction in the wild.
VU^	Threatened Flora – Vulnerable Taxa which are considered to be facing a high risk of extinction in the wild.
P1▯	Priority One – Poorly Known Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat e.g. road verges, urban areas, farmland, active mineral leases etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2▯	Priority Two – Poorly Known 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 (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey.
P3▯	Priority Three – Poorly Known Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but needs further survey.
P4▯	Priority Four – Rare Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

^pursuant to the EPBC Act, †pursuant to the BC Act, ▯on DBCA's *Priority Flora List*

Threatened and priority ecological communities

'Threatened ecological communities' (TECs) are recognised as ecological communities that are rare or under threat and therefore warrant special protection. Selected TECs are afforded statutory protection at a Commonwealth level under section 181 of the EPBC Act. TECs nominated for listing under the EPBC Act are considered by the Threatened Species Scientific Committee and a final decision is made by the Commonwealth Minister for the Environment. Once listed under the EPBC Act, communities are categorised as either 'critically endangered', 'endangered' or 'vulnerable' as defined in Table 2. Any action likely to have a significant impact on a community listed under the EPBC Act requires approval from the Minister for the Environment.

Within Western Australia TECs are determined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee (WATECSAC) and endorsed by the State Minister for the Environment. The WATECSAC is an independent group comprised of representatives from organisations including tertiary institutions, the Western Australian Museum and DBCA. The TECs endorsed by the State Minister are published by DBCA (DBCA 2018b).

TECs are assigned to one of the categories outlined in Table 2 according to their status (in relation to the level of threat). TECs are afforded direct statutory protection at a State level under the BC Act and BC Regulations. Ecological communities are listed under Section 27(1) and 33 of the BC Act. Their significance is also acknowledged through other state environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

Table 2: Categories of threatened ecological communities (English and Blyth 1997; DEC 2009)

Conservation code	Description
PD	Presumably Totally Destroyed An ecological community that has been adequately searched for but for which no representative occurrences have been located.
CE	Critically Endangered An ecological community that has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future.
E	Endangered An ecological community that has been adequately surveyed and is not critically endangered but is facing a very high risk of total destruction in the near future.
V	Vulnerable An ecological community that has been adequately surveyed and is not critically endangered or endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future.

An ecological community that is under consideration for listing as a TEC, but does not yet meet survey criteria or has not been adequately defined may be listed as a 'priority ecological community' (PEC). PECs are categorised as priority category 1, 2 or 3 as described in Table 3. Ecological communities that are adequately known and are rare but not threatened, or meet criteria for 'near threatened', or that have been recently removed from the threatened list, are placed in 'priority 4'. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in 'priority 5' (DEC 2013). Listed PECs are published by DBCA (DBCA 2017b).

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Table 3: Categories of priority ecological communities (DEC 2013)

Priority code	Description
P1	Priority One: Poorly known ecological communities Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2	Priority Two: Poorly known ecological communities Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3	Priority Three: Poorly known ecological communities (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4	Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
P5	Priority Five: Conservation Dependent ecological communities Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Weeds

A number of legislative and policy documents exist in relation to weed management at state and national levels. The *Biosecurity and Agriculture Management Act 2007* (BAM Act) is the principle legislation guiding weed management in Western Australia and lists declared pest species. At a national level, the Australian government has compiled a list of 32 Weeds of National Significance (WoNS) (DoEE 2018), of which many are also listed under the BAM Act.

Declared Pests

Part 2.3.23 of the BAM Act requires a person must not; "*a) keep, breed or cultivate the declared pest; b) keep, breed or cultivate an animal, plant or other thing that is infected or infested with the declared pest; c) release into the environment the declared pest, or an animal, plant or other thing that is infected or infested with the declared pest; or d) intentionally infect or infest, or expose to infection or infestation, a plant, animal or other thing with a declared pest*".

Under the BAM Act, all declared pests are assigned a legal status, as described in Table 4. Species assigned to the 'declared pest, prohibited - s12' category are placed in one of three control categories, as described in Table 5.

The *Biosecurity and Agriculture Management Regulations 2013* specify keeping categories for species assigned to the 'declared pest - s22(2)' category, which relate to the purposes of which species can be kept, as well as the entities that can keep them. The categories are described in Table 6.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act (DPIRD 2020).

Table 4: Legal status of declared pest species listed under the BAM Act (DPIRD 2020)

Category	Description
Declared Pest Prohibited - s12	May only be imported and kept subject to permits. Permit conditions applicable to some species may only be appropriate or available to research organisations or similarly secure institutions.
Declared Pest s22(2)	Must satisfy any applicable import requirements when imported, and may be subject to an import permit if they are potential carriers of high-risk organisms. They may also be subject to control and keeping requirements once within Western Australia

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Table 5: Control categories of declared pest species listed under the BAM Act (DPIRD 2020)

Category	Description
C1	Exclusion Not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2	Eradication Present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3	Management Established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Table 6: Keeping categories of declared pest species listed under the BAM Act (DPIRD 2020)

Category	Description
Prohibited	Can only be kept under a permit for public display and education purposes, and/or genuine scientific research, by entities approved by the state authority.
Exempt	No permit or conditions are required for keeping.
Restricted	Organisms which, relative to other species, have a low risk of becoming a problem for the environment, primary industry or public safety and can be kept under a permit by private individuals.

Wetland Habitat

Geomorphic wetland types

On the Swan Coastal Plain DBCA (2017a) have used the geomorphic wetland classification system developed by Semeniuk (1987) and Semeniuk and Semeniuk (1995) to classify wetlands based on the landform shape and water permanence (hydro-period) as outlined in Table 7.

Table 7: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017a)

Level of inundation	Geomorphology			
	Basin	Flat	Channel	Slope
Permanently inundated	Lake	-	River	-
Seasonally inundated	Sumpland	Floodplain	Creek	-
Seasonally waterlogged	Dampland	Palusplain	-	Paluslope

Wetland management categories

DBCA maintains the *Geomorphic Wetland of the Swan Coastal Plain* dataset (DBCA 2018a), which also categorises individual wetlands into specific management categories as described in Table 8.

Table 8: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017a)

Management category	Description of wetland	Management objectives
Conservation (CCW)	Support high levels of attributes	Preserve wetland attributes and functions through reservation in national parks, crown reserves and state owned land. Protection provided under environmental protection policies.
Resource enhancement (REW)	Partly modified but still supporting substantial functions and attributes	Restore wetland through maintenance and enhancement of wetland functions and attributes. Protection via crown reserves, state or local government owned land, environmental protection policies and sustainable management on private properties.
Multiple use (MUW)	Few wetland attributes but still provide important hydrological functions	Use, development and management considered in the context of water, town and environmental planning through land care.

The management categories of wetland features are determined based on hydrological, biological and human use features. The DBCA document *A methodology for the evaluation of specific wetland types on the Swan Coastal Plain, Western Australia* (DBCA 2017a) details the methodology by which wetlands on the Swan Coastal Plain are assigned management categories based on a two tiered evaluation system, with preliminary and secondary evaluation stages. The preliminary evaluation aims to identify any features of conservation significance that would immediately place the wetland within the CCW management category. Examples of these significant features include presence on significant wetland lists, presence of TECs or PECs (Priority 1 and 2), presence of threatened flora and

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over 90% of vegetation in good or better condition based on the Keighery (1994) scale. If such environmental values are identified the wetland would be categorised as CCW without further evaluation.

Should the preliminary evaluation indicate that no such features occur, the secondary evaluation and site assessment are then applied. In the secondary evaluation, an appropriate management category is determined through the assessment of a range of environmental attributes, functions and values.

Wetland reclassification

DBCA have a protocol for proposing changes to the wetland boundaries and management categories of the existing geomorphic wetland dataset (DEC 2007). The procedure involves a wetland desktop evaluation and site assessment which culminates in a recommended management category. Relevant information should be obtained in the optimal season for vegetation condition and water levels, which is usually spring (DEC 2007). In the case of larger wetlands that have undergone a degree of disturbance, a separate management category may be assigned to parts of the wetland in order to reflect the current values.

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General references

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Appendix B

Conservation Significant Flora Species and Likelihood of Occurrence Assessment

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	CR	CR	P	Low woodland on grey, clayey sand with lateritic pebbles (Pinjarra Plain) near winter wet flats.	Sep-Nov	Unlikely
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	CR	CR	P	Low woodland on grey, clayey sand with lateritic pebbles (Pinjarra Plain) near winter wet flats.	Sep-Nov	Unlikely
Andersonia gracilis	V	E	P	Seasonally damp, black sandy clay flats near or on the margins of swamps.	Sep-Nov	Unlikely
Caladenia huegelii	CR	E	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov	Unlikely
Diuris purdiei	E	E	PG	Sand to sandy clay soils in areas subject to winter inundation.	late Sep-mid-Oct, only after a summer or early autumn fire	Unlikely
Drakaea elastica	CR	E	PG	Bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps.	Late Sep-Oct/Nove (survey Jul-Aug)	Unlikely
Eucalyptus x balanites	CR	E	P	Light coloured sandy soils over laterite. Habitat consists of gently sloping heathlands; open mallee woodland over shrubland (Population 2) or heathland with emergent mallees (population 1)	Oct - Feb	Unlikely
Grevillea curviloba subsp. incurva	EN	E	P	Sand, sandy loam. Winter-wet heath.	Aug-Sep	Unlikely
Lepidosperma rostratum	EN	E	P	Peaty sand and clay amongst low heath, in winter-wet swamps.	May-Jun (survey late Jun-Aug)	Unlikely
Macarthuria keigheryi	E	E	P	Low-lying winter-wet damp gey/white sands in open patches.	Sep-Dec, Feb-Mar	Unlikely
Thelymitra dedmaniarum	CR	E	PG	Red brown sandy loam with dolerite and granite outcrops.	Oct-Nov	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Thelymitra stellata	E	E	PG	Sandy loam, clay or gravel over laterite or gravel.	Sep-Nov	Unlikely
Diuris drummondii	V	V	PG	In low-lying depressions in peaty and sandy clay swamps.	Nov-Jan	Unlikely
Diuris micrantha	V	V	PG	Dark grey-black sandly clay-loam in winter wet depressions or swamps. Often in shallow standing water.	Aug/Sep-early Oct	Unlikely
Drakaea micrantha	E	V	PG	Open sandy patches often adjacent to winter-wet swamps.	Sept- early Oct	Unlikely
Eleocharis keigheryi	V	V	P	Clay or sandy loam in freshwater creeks and transient waterbodies such as seasonally wet clay pans.	Aug-Dec	Unlikely
Austrostipa jacobsiana	CR	-	P	Grey sandy clay.	Nov-Jan	Unlikely
Eremophila glabra subsp. chlorella	EN	-	P	Sandy clay. Winter-wet depressions.	Jul-Nov	Unlikely
Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)	P1	-	P	Grey or black sand over clay in winter wet areas.	May-Aug	Unlikely
Hydrocotyle striata	P1	-	A	Sand and clay in springs and creeklines.	Nov	Unlikely
Acacia benthamii	P2	-	P	Sand, typically on limestone breakaways	Aug - Sept	Unlikely
Poranthera moorokatta	P2	-	A	Sandy or clay soils. Dampland or low sandy dunes.	Oct or Feb	Unlikely
Stenanthemum sublineare	P2	-	P	White sand on coastal plains.	Oct-Dec	Unlikely
Thelymitra variegata	P2	-	P	Sandy clay, sand, laterite.	Jun-Sep	Unlikely
Thysanotus sp. Badgingarra (E.A. Griffin 2511)	P2	-	P	Grey sand with lateritic gravel.	Dec	Unlikely
Angianthus micropodioides	P3	-	A	Saline sandy soils on edge of rivers, depressions and clay pans.	Nov-Dec or Jan-Feb	Unlikely
Byblis gigantea	P3	-	P	Sandy-peat swamps. Seasonally wet areas.	Sep-Jan	Unlikely
Cyathochaeta teretifolia	P3	-	P	Grey sand, sandy clay in swamps and creek edges.	Oct-Jan	Unlikely
Dampiera triloba	P3	-	P	Damp peat/loam soil.	Aug-Dec	Unlikely
Dillwynia dillwynioides	P3	-	P	Winter wet depressions on sandy soils	Aug - Dec	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Jacksonia gracillima	P3	-	P	Sand, often adjacent to winter wet areas	Sep-Dec	Unlikely
Phlebocarya pilosissima subsp. pilosissima	P3	-	P	White or grey sand, lateritic gravel.	Aug-Oct	Unlikely
Pimelea calcicola	P3	-	P	sand, limestone, coastal ridges	Sep-Nov	Unlikely
Schoenus benthamii	P3	-	P	White, grey ands, sandy clay in winter wet flats and swamps	Oct-Nov	Unlikely
Schoenus capillifolius	P3	-	A	Brown mud in claypans	Oct-Nov	Unlikely
Schoenus pennisetis	P3	-	A	Grey or peaty sand in swamps and winter-wet depressions.	Aug-Sep	Unlikely
Stylidium aceratum	P3	-	A	Sandy soils in swamp heathland.	Oct-Nov	Unlikely
Stylidium paludicola	P3	-	P	Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland	Oct-Dec	Unlikely
Styphelia filifolia	P3	-	P	Brown over pale yellow sand.	Feb-Apr	Unlikely
Aponogeton hexatepalus	P4	-	P	Mud. Freshwater: ponds, rivers, claypans.	Jul-Oct	Unlikely
Dodonaea	P4	-	P	Sand, outcropping limestone.	Jul-Oct	Unlikely
Drosera occidentalis	P4	-	P	Flat, brown/white/yellow moist	Oct-	Unlikely
Hydrocotyle	P4	-	A	Floating in swamps.	Aug-Oct	Unlikely
Jacksonia sericea	P4	-	P	Calcareous and sandy soils on Swan Coastal Plain	Dec-Feb	Unlikely
Kennedia beckxiana	P4	-	P	Sand or loam on granite hills and	Sep-Dec	Unlikely
Microtis quadrata	P4	-	PG	Sand, loam or peat in winter wet areas	Oct-Dec	Unlikely
Ornduffia submersa	P4	-	A	Sandy clay in inundated	Aug-Nov	Unlikely
Stylidium longitubum	P4	-	A	Seasonal wetlands.	Oct-Dec	Unlikely
Tripterococcus sp.	P4	-	P	Winter-wet areas on grey sand.	Oct-Feb	Unlikely
Verticordia lindleyi subsp. lindleyi	P4	-	P	Sand and sandy clay in winter wet areas.	May or Nov-Jan	Unlikely

Note: T=threatened, CE=critically endangered, E=endangered, V=vulnerable, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4, P=perennial, PG=perennial geophyte, A=annual. Species considered to potentially occur within the site are shaded green

Appendix C

Flora Species List

Family	Status	Species
Aizoaceae		
	*	*Carpobrotus edulis*
Anacardiaceae		
	*	*Schinus terebinthifolia*
Anarthriaceae		
		Lyginia imberbis
Apocynaceae		
		?Alyxia buxifolia
	*	*Nerium oleander*
Arecaceae		
	*	*Washingtonia filifera*
Asparagaceae		
		Lomandra caespitosa
		Lomandra hermaphrodita
		Sowerbaea laxiflora
Asteraceae		
	*	*Conyza bonariensis*
	*	*Hypochaeris ?glabra*
	*	*Lactuca seriata*
	*	*Sonchus oleraceus*
	*	*Ursinia anthemoides*
Casuarinaceae		
		Allocasuarina fraseriana
		Allocasuarina humilis
Chenopodiaceae		
		Rhagodia baccata subsp. baccata
Colchicaceae		
		Burchardia congesta
Convolvulaceae		
	*	*Ipomoea cairica*
Cupressaceae		
		Callitris preissii
Cyperaceae		
		Baumea sp.
	*	*Cyperus congestus*
		Lepidosperma sp.
		Mesomelaena pseudostygia
		?Schoenus sp.
		Schoenoplectus tabernaemontani
Dasypogonaceae		
		Dasypogon bromeliifolius
Dilleniaceae		
		Hibbertia huegelii
		Hibbertia hypericoides
Droseraceae		
		Drosera erythrorhiza
		Drosera menziesii

Family	Status	Species
Ericaceae		
		Conostephium pendulum
		Leucopogon sp.
		Styphelia propinqua
Fabaceae		
	*	*Acacia baileyana*
	*	*Acacia longifolia*
		Acacia pulchella
		Acacia rostellifera
		Acacia saligna
		Acacia stenoptera
		Bossiaea eriocarpa
		Daviesia nudiflora
		Daviesia triflora
		Gastrolobium capitatum
		Gompholobium tomentosum
		Hardenbergia comptoniana
		Jacksonia furcellata
		Jacksonia sternbergiana
	*	*Robinia sp.*
	*	*Trifolium sp.*
Geraniaceae		
	*	*Pelargonium capitatum*
Goodeniaceae		
		Dampiera linearis
		Lechenaultia biloba
		Scaevola canescens
		Scaevola repens
Haemodoraceae		
		Conostylis aculeata
		Conostylis setigera
		Phlebocarya ciliata
Hemerocallidaceae		
		Arnocrinum preissii
		Corynotheca micrantha var. micrantha
		Tricoryne elatior
Iridaceae		
	*	*Gladiolus caryophyllaceus*
	*	*Patersonia occidentalis*
Juncaceae		
		Juncus pallidus
Lamiaceae		
	*	*Salvia rosmarinus*
Loranthaceae		
		Nuytsia floribunda
Malvaceae		
	*	*Lagunaria patersonia*
Meliaceae		

Family	Status	Species
	*	*Melia azedarach*
Myrtaceae		
		Agonis flexuosa
		?Calytrix sp
		Corymbia calophylla
	*Pl	*Corymbia citriodora*
	*Pl	*Corymbia ficifolia*
	*Pl	*Corymbia maculata*
		Eremaea pauciflora
	*Pl	*Eucalyptus caesia*
	*Pl	*Eucalyptus camaldulensis*
		Eucalyptus gomphocephala var. gomphocephala
	*Pl	*Eucalyptus grandis*
		Eucalyptus marginata subsp. marginata
	*Pl	*Eucalyptus sideroxylon*
	*Pl	*Eucalyptus sp. 1*
	*Pl	*Eucalyptus sp. 2*
		Eucalyptus todtiana
	*Pl	*Eucalyptus utilis*
		Hypocalymma angustifolium
		Hypocalymma robustum
		Kunzea glabrescens
	*	*Leptospermum laevigatum*
	*Pl	*Lophostemon confertus*
	*Pl	*Melaleuca sp.*
		?Melaleuca systena
		Melaleuca thymoides
		Regelia ciliata
		Regelia inops
		Scholtzia involucrata
Nyctaginaceae		
	*	*Bougainvillea sp.*
Oleaceae		
	*Pl	*Olea europaea subsp. europaea*
Orchidaceae		
		Caladenia latifolia
		Microtis media
Pinaceae		
	*Pl	*Pinus sp.*
Poaceae		
	*	*Avena barbata*
	*	*Briza maxima*
	*	*Bromus diandrus*
	*	*Cenchrus clandestinus*
	*	*Cortaderia selloana*
	*	*Cynodon dactylon*
	*	*Ehrharta calycina*
	*	*Eragrostis curvula*

Family	Status	Species
	*	*Lagurus ovatus*
	*	*Paspalum dilatatum*
	*	*Sporobolus africanus*
Portulacaceae		
		Portulaca oleracea
Proteaceae		
		Adenanthos cygnorum
		Banksia attenuata
		Banksia ilicifolia
		Banksia menziesii
	*Pl	*Grevillea sp.*
		Persoonia saccata
		Petrophile linearis
	*Pl	*Protea sp.*
		Stirlingia latifolia
Restionaceae		
		Desmocladus flexuosus
		Hypolaena exsulca
Santalaceae		
		Exocarpos sparteus
Simaroubaceae		
	*	*Ailanthus altissima*
Thymelaeaceae		
		Pimelea suaveolens
Typhaceae		
		Typha domingensis
Violaceae		
		Hybanthus calycinus
Xanthorrhoeaceae		
		Xanthorrhoea preissii
Zamiaceae		
		Macrozamia fraseri

Note: * denotes non-native species, Pl denotes planted

Appendix D

Conservation Significant Communities and Likelihood of Occurrence Assessment

Conservation significant communities known or likely to occur within 10 km of the site

Former Glen Iris Golf Course

Code	Community name	TEC/PEC	Level of significance	
			State	EPBC Act
	Clay pans of the Swan Coastal Plain	TEC	VU/EN	CR
	Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain	TEC	-	CR
SCP22	*Banksia ilicifolia* woodlands, southern Swan Coastal Plain	TEC/PEC	P3	EN (Banksia woodlands of the Swan Coastal Plain)
SCP24	Northern Spearwood shrublands and woodlands	TEC/PEC	P3	
	Banksia woodlands of the Swan Coastal Plain	TEC/PEC	P3	EN
	Subtropical and temperate coastal saltmarsh	TEC	-	VU

Note: TEC=threatened ecological community, PEC=priority ecological community, CR=critically endangered, EN=endangered, VU=vulnerable, P3=priority 3

Appendix E

Sample Data

Sample Name: R1

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R1: Page 2 of 3

Quadrat and landform details

Sample type:	releve	Size:	other
NW corner easting:	391786	NW corner northing:	6448422
Altitude (m):	N/A	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	flat
Time since fire:	> 5 yrs	Disturbance:	moderate - weeds
Soil type/texture	sand/	Bare ground (%):	10
Rocks (%) and type:	No rocks	Soil colour:	brown/white
Litter:	30% (leaves,branches,)	Vegetation condition:	very good

Vegetation Sample Data
Former Glen Iris Golf Course

Sample Name: R1

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R1: Page 2 of 3

Species Data
* denotes non-native species

Status	Confirmed name
	Acacia pulchella
	Acacia stenoptera
	Allocasuarina humilis
	Banksia attenuata
	Banksia menziesii
*	*Carpobrotus edulis*
	Conostephium pendulum
	Conostylis ?aculeata
	Dampiera linearis
	Daviesia nudiflora
	Desmocladus flexuosus
*	*Ehrharta calycina*
*	*Eragrostis curvula*
	Eucalyptus marginata subsp. marginata
	Gastrolobium capitatum
	Gompholobium tomentosum
*Pl	*Grevillea sp.*
	Hardenbergia comptoniana
	Hibbertia hypericoides
	Jacksonia furcellata
	Jacksonia sternbergiana
	Lepidosperma sp.
*	*Leptospermum laevigatum*
	Lyginia imberbis
	Mesomelaena pseudostygia
*	*Nerium oleander*
	Patersonia occidentalis
*	*Pelargonium capitatum*
	Petrophile linearis
	Phlebocarya ciliata
	Scaevola canescens
	Stirlingia latifolia
	Xanthorrhoea preissii
	Pimelea ?suaveolens subsp. suaveolens
	Tricoryne elatior

Sample Name: R1

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R1: Page 3 of 3

Conostylis setigera
Hybanthus calycinus
Sowerbaea laxiflora
Drosera menziesii
Hypocalymma robustum
Lomandra caespitosa

* = non-native, Pl=planted

Sample Name: R2

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R2: Page 2 of 2

Quadrat and landform details

Sample type:	releve	Size:	other
NW corner easting:	392142	NW corner northing:	6446258
Altitude (m):	N/A	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	flat
Time since fire:	no evidence	Disturbance:	moderate - weeds
Soil type/texture	sand/	Bare ground (%):	30
Rocks (%) and type:	No rocks	Soil colour:	brown/white
Litter:	15% (leaves,twigs,)	Vegetation condition:	very good

Sample Name: R2

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R2: Page 2 of 2

Species Data
* denotes non-native species

Status	Confirmed name
*	*Acacia longifolia*
	Allocasuarina fraseriana
	Burchardia congesta
*	*Cynodon dactylon*
	Dasypogon bromeliifolius
*	*Ehrharta calycina*
	Hypolaena exsulca
	Kunzea glabrescens
*	*Lagurus ovatus*
	Lyginia imberbis
	Melaleuca thymoides
	Scholtzia involucrata
	Xanthorrhoea preissii

* = non-native

Sample Name: R3

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R3: Page 2 of 2

Quadrat and landform details

Sample type:	releve	Size:	other
NW corner easting:	391941	NW corner northing:	6446696
Altitude (m):	N/A	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	flat
Time since fire:	> 5 yrs	Disturbance:	moderate - weeds
Soil type/texture	sand/	Bare ground (%):	20
Rocks (%) and type:	No rocks	Soil colour:	brown/white
Litter:	20% (leaves,branches,)	Vegetation condition:	very good

Vegetation Sample Data
Former Glen Iris Golf Course

Sample Name: R3

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R3: Page 2 of 2

Species Data
* denotes non-native species

Status	Confirmed name
	Adenanthos cygnorum
	Allocasuarina humilis
	Banksia attenuata
	Banksia menziesii
	Callitris preissii
*	*Carpobrotus edulis*
	Conostephium pendulum
	Daviesia nudiflora
	Daviesia triflora
*	*Ehrharta calycina*
*Pl	*Eucalyptus caesia*
	Eucalyptus marginata subsp. marginata
	Gastrolobium capitatum
	Gompholobium tomentosum
	Hibbertia hypericoides
	Hypocalymma angustifolium
	Jacksonia furcellata
	Lomandra hermaphrodita
	Lyginia imberbis
	Macrozamia fraseri
	Mesomelaena pseudostygia
	Patersonia occidentalis
*	*Pelargonium capitatum*
	Persoonia saccata
	Scaevola repens
	Scholtzia involucrata
	Stirlingia latifolia
	Styphelia propinqua
	Caladenia latifolia
	Hypocalymma robustum

* = non-native, Pl=planted

Appendix D

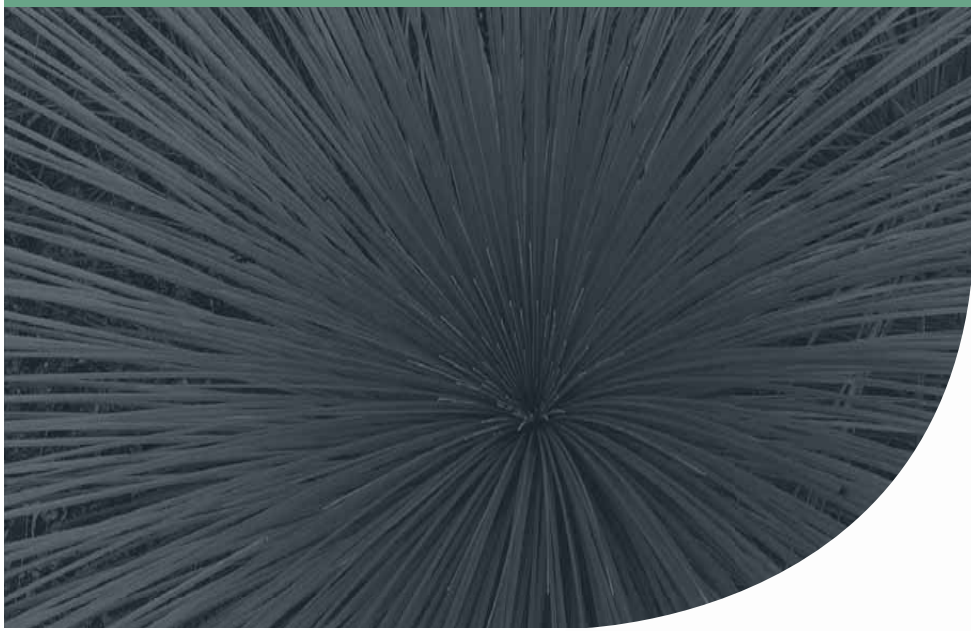
Basic Fauna Assessment

Level 1 Fauna Assessment

Former Glen Iris Golf Course

Project No: EP20-009(04)

Prepared for ECP Acquisitions 6 Pty Ltd
June 2021



Document Control

Doc name:	Level 1 Fauna Assessment Former Glen Iris Golf Course				
Doc no.:	EP20-009(04)--004B RAW				
Version	Date	Author		Reviewer	
1	June 2020	Rachel Weber	RAW	Tom Atkinson	TAA
	Initial report submitted for client review				
A	April 2021	Melanie Schubert	MS	Rachel Weber	RAW
	Minor updates to reflect change in site boundary				
B	June 2021	Rachel Weber	RAW	Tom Atkinson	TAA
	Minor updates to numeric decimal places				

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Executive Summary

ECP Acquisitions 6 Pty Ltd intends to develop the former Glen Iris Golf Course into a residential estate (referred to herein as 'the site'). Emerge were engaged to conduct a 'level 1' fauna assessment to provide information on the fauna values within the site to inform the development.

As part of the assessment a desktop review of relevant background information was completed and a site survey was undertaken on 11 March and 28 May 2020. During the survey an assessment was made on the type and conservation significance of fauna habitat across the site.

Outcomes of the level 1 fauna assessment include the following:

- Five fauna habitats were recorded in the site:
  - The native woodland habitat has the highest fauna habitat values but extends over a small portion of the site (4%) and occurs as scattered patches.
  - The riparian and water habitats, although artificial, also provide habitat for native fauna and occur as small patches (3% of the site).
  - The planted trees and shrubs habitat provides varying habitat values according to the plant species and density and extends over 25% of the site.
  - The remainder of the site (68%) supports turf, bare ground and infrastructure which provide low habitat values for native fauna.
- A total of 15 native and three introduced fauna species were recorded in the site, including Carnaby's cockatoo (threatened under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*) and quenda (Priority 4 in Western Australia).
- The native woodland and planted trees and shrubs habitats support plants known to be foraged by threatened species of black cockatoos including Carnaby's cockatoo. These habitats may also support trees suitable for use by black cockatoos as breeding or roosting habitat. A targeted assessment would be required to confirm the black cockatoo habitat values within the site.
- The portions of the native woodland, planted trees and shrubs and riparian habitats with dense understorey vegetation provide suitable habitat for quenda.
- An additional 45 species of conservation significance have potential to occur in the site. The majority of these species are birds which may only use the site intermittently, if at all. The native woodland habitat also provides a relatively small area of potential habitat for two invertebrates and two reptiles of conservation significance.

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Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
EPA	Environmental Protection Authority
DBCA	Department of Biodiversity, Conservation and Attractions
DAWE	Department of Agriculture, Water and the Environment
WA Museum	Western Australian Museum

Table A2: Abbreviations – General terms

General terms	
T	Threatened
EN	Endangered
EX	Extinct
VU	Vulnerable
MI	Migratory
HT	Habitat tree
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
P5	Priority 5

Table A3: Abbreviations –Legislation

Legislation	
BAM Act	*Biosecurity and Agriculture Management Act 2007*
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
BC Act	*Biodiversity Conservation Act 2016*
BC Regs	*Biodiversity Conservation Regulations 2018*

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Table A4: Abbreviations – planning

Planning terms	
MRS	Metropolitan Region Scheme

Table A5: Abbreviations – units of measurement

Units of measurement	
cm	Centimetre
ha	Hectare
km	Kilometre
m	Metre

1 Introduction

1.1 Project background

ECP Acquisitions 6 Pty Ltd intends to develop the former Glen Iris Golf Course into a residential estate. The former Glen Iris Golf Course comprises Lots 6 and 7 Glen Iris Drive, Lots 3, 509 and 512 Dean Road and Lot 139 Imlah Court in Jandakot (referred to herein as the 'site').

The site is located approximately 16 kilometres (km) south of the Perth Central Business District within the City of Cockburn and is zoned 'urban' under the Metropolitan Region Scheme (MRS) and 'development contribution area 13 special use 1', 'development contribution area 13 special use 6', 'development contribution area 13 residential-R40' under the City of Cockburn *Town Planning Scheme No. 3.*

The site is approximately 53.7 hectares (ha) in size and is surrounded by residential subdivision, with a railway to the north and Kwinana Freeway to the west. The site comprises two areas separated by Berrigan Drive. The location and extent of the site is shown in Figure 1.

1.2 Purpose and scope of work

Emerge Associates (Emerge) were engaged by Acumen Development Solutions, on behalf of ECP Acquisitions 6 Pty Ltd, to provide environmental consultancy services to support the planning process for the site. The purpose of this survey is to provide sufficient information on the fauna values within the site to inform this process.

The scope of work was specifically to conduct a fauna assessment to the standard required of a 'level 1' fauna survey with reference to the Environmental Protection Authority's (EPA's) *Technical Guidance – Terrestrial fauna Surveys* (EPA 2016).

As part of this scope of work, the following tasks were undertaken:

- Desktop review of background information regarding fauna species relevant to the site and surrounds.
- Compilation of a list of fauna species opportunistically recorded as part of the field survey.
- Identification of potential habitat for conservation significant fauna species and likelihood of occurrence.
- Documentation of the desktop assessment, survey methodology and results into a report.

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2 Environmental Context

2.1 Significant fauna

2.1.1 Threatened fauna species

Certain fauna taxa that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth level, fauna taxa may be listed as 'threatened' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Any action likely to have a significant impact on a taxon listed under the EPBC Act requires approval from the Commonwealth Minister for the Environment.

In Western Australia fauna species may also be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act). It is an offence to 'take' or 'disturb' threatened fauna without Ministerial approval.

Threatened fauna species listed under the EPBC Act and/or BC Act are assigned a conservation status according to attributes such as population size and geographic distribution. Further information on threatened species and their categories is provided in Appendix A.

2.1.2 Priority fauna species

Fauna species that do not currently meet the criteria for listing as threatened but are potentially rare or threatened may be added to the Department of Biodiversity, Conservation and Attractions (DBCA) *Priority Fauna List*. These species are classified into 'priority' levels based on threat. Whilst priority species are not under direct statutory protection, they are considered during State approval processes. Further information on priority species and their categories is provided in Appendix A.

2.1.3 Migratory fauna species

Migratory fauna species that migrate to Australia and its external territories, or pass though or over Australian waters during their annual migrations warrant special protection under Commonwealth and State legislation. At a Commonwealth level, migratory fauna taxa may be listed as 'migratory' under *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Any action likely to have a significant impact on a taxon listed under the EPBC Act requires approval from the Commonwealth Minister for the Environment.

In Western Australia migratory fauna taxa may be listed as 'specially protected species' and classed as 'migratory' under the *Biodiversity Conservation Act 2016* (BC Act). Further information on migratory species is provided in Appendix A.

2.1.4 Specially protected fauna species

In Western Australia, fauna species that are of special conservation interest, including migratory species, cetaceans, species subject to international agreement or species otherwise in need of special protection, may be listed as 'specially protected' under the BC Act.

2.1.5 Pest fauna species

The term 'pest fauna' can refer to any animal that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. Many non-native fauna species and some fauna species native to Australia but not Western Australia are considered to be pest fauna.

A particularly invasive or detrimental pest species may be listed as a 'declared pest' pursuant to Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread. Further information on categories of declared pests is provided in Appendix A.

2.2 Bush Forever

The Government of Western Australia's *Bush Forever* policy is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of *Bush Forever* is to protect comprehensive representations of all original ecological communities by targeting a minimum of 10% of each vegetation complex for protection (Government of WA 2000). *Bush Forever* sites are representative of regional ecosystems and habitat and have a key role in the conservation of Perth's biodiversity.

No *Bush Forever* sites occur within the site. Multiple *Bush Forever* sites occur to the east and west of the site.

2.3 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. The movement of fauna and the exchange of genetic material between vegetation remnants improve the viability of those remnants by allowing greater access to breeding partners and food sources, refuge from disturbances such as fire and maintenance of genetic diversity of plant communities and populations. Ecological linkages are ideally continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998).

The Perth Biodiversity Project, supported by the Western Australia Local Government Association (WALGA), have identified and mapped regional ecological linkages within the Perth Metropolitan Region (WALGA and PBP 2004). This study was extended beyond the Perth Metropolitan Region through the South West Biodiversity Project, resulting in the identification and mapping of the South West regional ecological linkages (Molloy *et al.* 2009).

There are no mapped ecological linkages within the site. One biodiversity ecological linkage (No. 48) is located approximately 800 m to the north of the site and extends to the west and east.

2.4 Previous surveys

No previous fauna surveys are known to have been undertaken within the site.

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3 Methods

3.1 Desktop assessment

3.1.1 Database searches

A search was conducted for fauna species that may occur or have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2020) and *NatureMap* (DBCA 2020).

A total number of species with potential to occur within the site was calculated by adding the total count of non-conservation significant species provided by *NatureMap* to the combined number of conservation significant species provided by *NatureMap* and *Protected Matters Search Tool*.

3.1.2 Likelihood of occurrence

Information on habitat preferences and distribution of threatened and priority vertebrate fauna species identified in database searches was reviewed. This was assessed against the general site conditions and fauna habitat types recorded during the field survey.

An assessment of the likelihood of occurrence of threatened and priority fauna species within the site was undertaken and each was assigned to one of the following categories:

- Recorded: The species in question was positively identified as being present within the site during the field survey or from recent literature records.
- Likely: Potentially suitable habitat for the species in question was identified during the field survey and the site lies within the known distribution of the species.
- Possible: Potentially suitable habitat for the species in question was identified but of marginal quality and/or extent. The site lies within or close to the known distribution of the species.
- Unlikely: The site lies outside of the known distribution of the species in question and/or no suitable habitat was identified within the site.

3.2 Field survey

An ecologist from Emerge visited the site on the 11 March 2020 during the day from approximately 10:30 am to 4:30 pm to conduct the level 1 fauna survey field survey.

Another ecologist from Emerge also visited the site on 28 May 2020 during the day from approximately 2:00 pm to 6:00 pm to conduct an additional assessment of the fauna in the artificial lakes within the site.

3.2.1 Level 1 fauna

During both surveys transects were traversed across the site and the characteristics of fauna habitat and presence of fauna species was recorded. Microhabitats such as logs, rocks and leaf litter were investigated and secondary evidence of species presence such as tracks, scats, skeletal remains, foraging evidence or calls was also noted.

A vertebrate fauna list was compiled and fauna habitat values were described, with particular reference to 'threatened' and 'priority' fauna species with potential to occur within the site. Taxonomy and nomenclature for vertebrate fauna species was taken from the *Western Australian Museum Checklist of the Terrestrial Vertebrate Fauna of Western Australia* (Western Australian Museum 2019). Literature listed in Appendix A represent the main publications used to identify fauna species and habitats within the site.

3.3 Data analysis, presentation mapping

3.3.1 Fauna habitat

Fauna habitats were described according to the dominant flora species and vegetation type present, as determined from observations made during the field survey and information provided in the *Reconnaissance Flora and Vegetation Assessment* for the site (Emerge Associates 2020). The identified fauna habitats were mapped on aerial photography with the boundaries interpreted from aerial photography, Emerge Associates (2020) plant communities and notes taken in the field.

Information on specific habitat requirements for conservation significant vertebrate fauna species with potential to occur within the site were compiled as part of the desktop assessment. This information was compared to the fauna habitats identified within the site to determine whether any conservation significant fauna species are considered to have potential to utilise the site.

3.4 Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in the EPA document *Technical Guidance – Terrestrial Fauna Surveys* (EPA 2016) is provided in Table 1.

Table 1: Evaluation of survey methodology against standard constraints outlined in EPA Technical Guidance – Terrestrial Fauna Surveys (EPA 2016)

Constraint	Degree of limitation	Details
Level of survey	No limitation	A level 1 survey (desktop study and field survey) was considered adequate given the relatively low habitat values within the site and the generally good availability of fauna information for the region.
Scope	No limitation	The survey focused on vertebrate fauna and habitat values, with particular focus on conservation significant taxa with potential to occur within the site.
Proportion of fauna identified, recorded and/or collected.	No limitation	All observed vertebrate fauna were identified.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data.	No limitation	Adequate information was available from database searches.

Table 1: Evaluation of survey methodology against standard constraints outlined in EPA Technical Guidance – Terrestrial Fauna Surveys (EPA 2016) (continued)

Constraint	Degree of limitation	Details
The proportion of the task achieved and further work which might be needed.	No limitation	The task was achieved in its entirety.
Experience level of personnel	Minor limitation	The field surveys were undertaken by two qualified ecologists with three years' and 18 years' experience in environmental science. The report was authored by a qualified ecologist with over nine years' experience. Technical review was undertaken by a senior environmental consultant with 18 years' experience in environmental science in Western Australia.
Suitability of timing	Slight limitation	Survey timing is not considered to be of great importance for Level 1 assessments.
Completeness	No limitation	The desktop assessment and field survey components were completed.
Spatial coverage and access	No limitation	Site coverage was comprehensive (track logged).
	No limitation	All parts of the site could be accessed as required.
Survey intensity	No limitation	The intensity of the survey was adequate given the size of the site and the relatively low habitat value present.
Influence of disturbance	No limitation	The site is highly modified due to historical disturbance. However, no recent disturbance was noted that may have affected outcomes of the survey.
Adequacy of resources	No limitation	All resources required to perform the survey were available.

4 Results

4.1 General site conditions

The site is gently undulating and comprises sandy white-grey soils. The fairways within the site were irrigated at the time of the survey. Seven artificial lakes occur within the site that were also sustained by irrigation at the time of the survey.

The site has been highly modified for use as a golf course and is dominated by non-native vegetation and unvegetated areas, with native vegetation present as individuals or small scattered patches. The artificial lakes are surrounded by either turf, riparian vegetation or planted trees and shrubs.

4.2 Fauna habitat

Historical disturbance has significantly compromised habitat values within the site. The majority of the native vegetation has been removed and vegetation now predominantly comprises cleared area, dominated by non-native and weed species with scattered or patches of native and non-native trees and shrubs.

Five fauna habitats were recorded in the site. Native woodland is present as scattered patches and has the highest fauna habitat values due to the presence of native trees, shrubs and ground cover and contains microhabitats such as logs, rocks and leaf litter. The riparian and water habitats provide value for aquatic fauna species and those associated with riparian areas. The planted trees and shrubs habitat mainly provides habitat for avian species as the majority is devoid of understorey vegetation. The turf and bare ground habitat extends over a large portion of the site and has minimal habitat values for native fauna species.

The remainder of the site is not considered to provide fauna habitat as it comprises infrastructure such as buildings and hardstand (0.9 ha).

A description and the area of each habitat is provided in Table 2 and representative photographs of each are provided in Plate 1 to Plate 5 . The location of each habitat is shown in Figure 3.

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Table 2: Fauna habitats identified within the site

Fauna habitat classification	Description	Area (ha)
Native woodland	Woodland to open woodland *Eucalyptus marginata* subsp. *marginata*, *Banksia attenuata* and *Banksia menziesii* over mixed shrubland *Xanthorrhoea preissii*, *Allocasuarina humilis* and *Hibbertia hypericoides* over open sedgeland *Mesomelaena pseudostygia* over non-native grassland **Ehrharta calycina* (Plate 1).	1.9
Riparian	Closed sedgeland *Typha domingensis*, *Schoenoplectus tabernaemontani*, **Cortaderia selloana* and *Baumea* sp. (likely planted or a combination of planted and naturally regenerated) (Plate 2).	0.2
Water	Water in artificial lakes of varying depth (Plate 3).	1.4
Planted trees and shrubs	Predominantly scattered non-native planted trees and shrubs such as **Corymbia* spp., **Eucalyptus* spp., *Melaleuca* spp. and *Grevillea* spp. with occasional native plants (Plate 4).	13.6
Turf and bare ground	Closed non-native grassland (turf) and bare ground (Plate 5).	35.7

Plate 1: Native woodland habitat

Plate 2: Riparian habitat

Plate 3: Water habitat

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Plate 4: Planted trees and shrubs habitat

Plate 5: Turf and bare ground habitat

4.3 Fauna

4.3.1 Desktop assessment

A total of 560[1] fauna species were identified from database searches as occurring or potentially occurring within 10 km of the site, as listed in Appendix B.

Of these, 92 species are of conservation significance, comprising 38 threatened, 14 priority, 39 migratory fauna and one other specially protected species as listed in Appendix C.

4.3.2 Species inventory

A total of 15 native and three introduced fauna species were recorded in the site, including two fauna species of conservation significance which is described in Section 4.3.3.

Two of the introduced fauna species, **Cherax destructor* (yabby) and **Cyprinus rubrofuscus* (koi fish), were recorded on 28 May 2020 within or adjacent to the artificial lakes. Scats of the other introduced fauna species, **Oryctolagus cuniculus* (rabbit) were recorded across the site during both surveys.

A complete species list is provided in Appendix D.

4.3.3 Conservation significant fauna

Two fauna species of conservation significance were recorded in the site: Carnaby's cockatoo which is listed as endangered under the EPBC Act and quenda which is listed as P4 in WA.

Approximately 20 individuals of Carnaby's cockatoo were recorded perching in trees on the 11 March 2020 in the central portion of the site. No signs of foraging or night roosting were opportunistically recorded in the site. The native woodland and planted trees and shrubs habitats support plants known to be foraged by threatened species of black cockatoos including Carnaby's cockatoo. These habitats may also support trees suitable for use as breeding or roosting habitat by black cockatoos.

Diggings of quenda (P4) were recorded in the south eastern portion of the site within the planted trees and shrubs and riparian habitats, within dense understorey vegetation. The following three mapped habitats may comprise suitable habitat for quenda:

- native woodland
- riparian (where it is not inundated)
- planted trees and shrubs (where understorey vegetation is present and dense).

A total of 48 fauna species of conservation significance were considered to have potential to occur in the site, as shown in Table 3. This comprises the two recorded species, one that is considered likely to occur and 45 considered to possibly occur.

The remaining conservation significant fauna species identified in Section 4.3.1 are not considered to occur in the site due to lack of suitable habitat or because the site lies outside of the species known distribution. The likelihood of occurrence assessment for these species is provided in Appendix B.

[1] Includes native and non-native species

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Table 3: Conservation significant fauna species which have potential to occur within the site

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		BC Act	EPBC Act		
Birds					
Actitis hypoleucos	Common sandpiper	MI	MI	Edge of sheltered waters salt or fresh, e.g. estuaries, mangrove creeks, rocky coasts, near-coastal saltlakes (including saltwork ponds), river pools, lagoons, claypans, drying swamps, flood waters, dams and sewage ponds. Preferring situations wherelow perches are available (Johnstone & Storr 1998).	Possible (marginal habitat present)
Apus pacificus	Pacific swift	MI	MI	Aerial, migratory species that is most often seen over inland plains and sometimes above open areas, foothills or in coastal areas. Sometimes occurs over settled areas, including towns, urban areas and cities (Pizzey & Knight 2012).	Possible (may opportunistically occur above the site, potential foraging habitat present)
Ardea alba	Eastern great egret	-	MA	Shallows of rivers, estuaries; tidal mudflats, freshwater wetlands; sewage ponds, irrigation areas and larger dams (Pizzey & Knight 2012).	Possible (potential habitat present)
Ardea ibis	Cattle egret	-	MA	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats, drains (Pizzey & Knight 2012).	Possible (potential habitat present)
Botaurus poiciloptilus	Australasian bittern	EN	EN	In or over water, in tall reedbeds, sedges, rushes, cumbungi, lignum. Also occurs in ricefields, drains in tussocky paddocks and occasionally in saltmarshes and brackish wetlands.	Possible (marginal habitat present)
Calidris acuminata	Sharp-tailed sandpiper	MI	MI	Occurs in tidal mudflats, saltmarshes and mangroves, as well as, shallow fresh,brackish or saline inland wetlands. It is also known from floodwaters, irrigated pastures and crops, sewage ponds, saltfields.	Possible (marginal habitat present)

Table 3: Conservation significant fauna species which have potential to occur within the site (continued)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		BC Act	EPBC Act		
Calidris melanotos	Pectoral sandpiper	MI	MI	Mainly fresh waters (swamps, lagoons, river pools, irrigation channels and sewage ponds); also samphire flats around estuaries and saltlakes (Johnstone & Storr 1998).	Possible (marginal habitat present)
Calidris ruficollis	Red-necked stint	MI	MI	Tidal mudflats, saltmarshes, sandy or shelly beaches, saline and freshwater wetlands (coastal and inland), saltfields, sewage ponds (Pizzey and Knight 2012).	Possible (marginal habitat present)
Calidris subminuta	Long-toed stint	MI	MI	Mainly freshwater swamps (especially when drying and where vegetation is short), river pools, lagoons and claypans; also brackish pools, sewage ponds and samphire flats around estuaries and saltlakes.	Possible (marginal habitat present)
Calyptorhynchus banksii naso	Forest red-tailed black cockatoo	VU	VU	Eucalypt and Corymbia forests, often in hilly interior. More recently also observed in more open agricultural and suburban areas including Perth metropolitan area. Attracted to seeding Corymbia calophylla, Eucalyptus marginata, introduced Melia azdarach and Eucalyptus spp. trees.	Likely (potential habitat present)
Calyptorhynchus latirostris	Carnaby's cockatoo	EN	EN	Mainly proteaceous scrubs and heaths and adjacent eucalypt woodlands and forests; also plantations of Pinus spp. Attracted to seeding Banksia spp., Dryandra spp., Hakea spp., Eucalyptus spp., Corymbia calophylla, Grevillea spp., and Allocasuarina spp. (Johnstone and Storr 1998).	Recorded (suitable habitat present)
Charadrius bicinctus	Double-banded plover	MI	MI	Wide beaches, tidal mudflats, saltmarsh, wide and sparsely vegetated margins of shallow saline and freshwater wetlands, paddocks with sparse vegetation, ploughed fields, airfields.	Possible (potential habitat present)

Table 3: Conservation significant fauna species which have potential to occur within the site (continued)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		BC Act	EPBC Act		
Charadrius dubius	Little ringed plover	MI	MI	Open, muddy or sandy shores of lakes, swamps, tidal areas, sewage ponds or farm dams. Rare but regular summer migrant to Australia (Pizzey & Knight 2012).	Possible (potential habitat present)
Charadrius leschenaultii	Great sand plover	VU	VU (MI)	Wide sandy or shelly beaches, sandpits, tidal mudflats, reefs, sand cays, mangroves, saltmarsh, dune wilderness, bare paddocks, seldom far inland (Pizzey & Knight 2012).	Possible (potential habitat present)
Charadrius ruficapillus	Red-capped plover	-	MA	Broad, sandy and shelly beaches; bare margins of saline wetlands and lakes, inland and coastal; saltmarsh; tidal mudflats and sandflats; adjacent dunes; occasionally shallow freshwater wetlands, inland and coastal (Pizzey & Knight 2012).	Possible (potential habitat present)
Chlidonias leucopterus	White-winged black tern	MI	MI	Vegetated and open wetlands, brackish and saline lakes, saltfields, irrigated lands, sewage ponds and occasionally offshore.	Possible (potential habitat present)
Falco peregrinus	Peregrine falcon	OS	-	Mainly found around cliffs along coasts, rivers, ranges and around wooded watercourses and lakes (Johnstone and Storr 1998).	Possible (marginal habitat present)
Gallinago hardwickii	Latham's snipe	MI	MI	Soft, wet ground or shallow water with tussocks and other green or dead growth, wet parts of paddocks, seepage below dams, irrigated areas, scrub or open woodlandfrom sea level to alpine bogs over 2000 m, samphire on saltmarshes and mangrove fringes. Rare visitor to Western Australia.	Possible (potential habitat present)
Gallinago megala	Swinhoe's snipe	MI	MI	Wet, grassy ground; edges of reedy swamps (Pizzey & Knight 2012).	Possible (potential habitat present)

Table 3: Conservation significant fauna species which have potential to occur within the site (continued)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		BC Act	EPBC Act		
Gallinago stenura	Pin-tailed snipe	MI	MI	Boggy edges of vegetated wetlands; sewage and other ponds; stubbles, grasslands with shrubs, pastures (Pizzey & Knight 2012).	Possible (potential habitat present)
Gelochelidon nilotica	Gull-billed tern	MI	MI	Beaches, mudflats; fresh, brackish wetlands, including far inland; grasslands, crops, ploughed fields, airfields (Pizzey & Knight 2012).	Possible (potential habitat present)
Himantopus himantopus	Black-winged stilt	-	MA	Freshwater and saltwater marshes, mudflats, and the shallow edges of lakes and rivers (Birdlife Australia 2019).	Possible (potential habitat present)
Ixobrychus dubius	Australian little bittern	P4	-	Dense vegetation surrounding/within freshwater pools, swamps and lagoons, well screened with trees. Shelters in dense beds of Typha spp., Baumea spp. and tall rushes in freshwater swamps around lakes and along rivers (Johnstone and Storr 1998).	Possible (marginal habitat present)
Limosa limosa	Black-tailed godwit	MI	MI	Tidal mudflats, estuaries, sewage ponds, shallow river margins, brackish or saline inland lakes, flooded pastures, airfields (Pizzey & Knight 2012).	Possible (potential habitat present)
Merops ornatus	Rainbow bee-eater	-	MA	Open woodlands with sandy, loamy soil; sandridges, sandpits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves, rainforest, woodlands and golf courses (Pizzey & Knight 2012).	Possible (potential habitat present)
Numenius minutus	Little curlew	MI	MI	Dry grasslands, floodplains, margins of drying swamps; tidal mudflats, airfields, playing fields, crops, commercial saltfields, sewage ponds (Pizzey & Knight 2012).	Possible (potential habitat present)
Numenius phaeopus	Whimbrel	MI	MI	Estuaries, mangroves, tidal flats, coral cays, exposed reefs, flooded paddocks, sewage ponds, bare grasslands, sportsgrounds and lawns.	Possible (potential habitat present)

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Table 3: Conservation significant fauna species which have potential to occur within the site (continued)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		BC Act	EPBC Act		
Oxyura australis	Blue-billed duck	P4	-	Mainly deeper freshwater swamps and lakes; occasionally saltlakes and estuaries freshened by flood waters (Johnstone and Storr 1998a).	Possible (marginal habitat present)
Phalaropus lobatus	Red-necked phalarope	MI	MI	Shallow pools in commercial saltfields, tidal mudflats, beaches, saltmarshes, freshwater wetlands.	Possible (marginal habitat present)
Philomachus pugnax	Ruff	MI	MI	Fresh, brackish and saline wetlands; tidal mudflats, saltfields, sewage ponds (Pizzey & Knight 2012).	Possible (marginal habitat present)
Plegadis falcinellus	Glossy Ibis	MI	MI	Shallow and adjacent flats of freshwater lakes and swamps, also river pools, flooded samphire and sewage ponds.	Possible (marginal habitat present)
Pluvialis fulva	Pacific golden plover	MI	MI	Estuaries, mudflats, saltmarshes, mangroves; rocky reefs and stranded seaweed on ocean shores; margins of shallow open inland swamps; sewage ponds, short-grass paddocks, sportsgrounds, airfields, ploughed land (Pizzey & Knight 2012).	Possible (potential habitat present)
Recurvirostra novaehollandiae	Red-necked avocet	-	MA	Estuaries, tidal mudflats; fresh, brackish and salt swamps and lakes; claypans, commercial saltfields and sewage ponds (Pizzey & Knight 2012).	Possible (marginal habitat present)
Rostratula australis	Australian painted snipe	EN	EN	Mainly shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (Marchant and Higgins 1993).	Possible (marginal habitat present)
Thalassarche cauta cauta	Shy albatross	VU	VU (MI)	Scarce visitor (late May to mid-October) to southwestern and western seas. Breeds on islands off Tasmania and south New Zealand (Johnstone and Storr 1998).	Possible (marginal habitat present)

Table 3: Conservation significant fauna species which have potential to occur within the site (continued)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		BC Act	EPBC Act		
Thinornis rubricollis	Hooded plover	P4	VU	Margins and shallows of saltlakes, sandy and seaweedy beaches and estuaries; also dams (Johnstone & Storr 1998).	Possible (marginal habitat present)
Tringa glareola	Wood sandpiper	MI	MI	Mainly shallow fresh waters (lagoons, swamps, claypans, river pools, dams, bore overflows and sewage ponds); occasionally brackish swamps, rarely saltlakes and estuaries.	Possible (potential habitat present)
Tringa nebularia	Common greenshank	MI	MI	Shallow fresh waters (claypans, lagoons, swamps, river pools, dams and sewage ponds) and salt waters (estuaries, mangrove creeks, lakes, samphire flats, reef flats and saltwork ponds).	Possible (potential habitat present)
Tringa stagnatilis	Marsh sandpiper	MI	MI	Mainly shallow fresh or brackish waters: swamps, lakes, river pools, soaks, sewage ponds and bore overflows. Occasionally estuaries and salt ponds, and rarely coasts.	Possible (potential habitat present)
Tringa totanus	Common redshank	MI	MI	Sheltered coastal wetlands such as bays, river estuaries, lagoons, inlets and saltmarsh (with bare open flats and banks of mud or sand). Also found around saltlakes, freshwater lagoons, artificial wetlands and saltworks and sewage farms (Higgins & Davies 1996).	Possible (marginal habitat present)
Tyto novaehollandiae novaehollandiae	Australian masked owl	P3	-	Forests, open woodlands, farmlands with large trees. E.g. river red gums, adjacent cleared country, timbered watercourses, paperbark woodlands and caves (Pizzey & Knight 2012).	Possible (marginal habitat present)
Invertebrates					
Idiosoma sigillatum	Swan Coastal Plain shield-backed trapdoor spider	P3	-	Widely distributed in sandy areas on the Swan Coastal Plain and on Rottnest Island (Prince 2003).	Possible (suitable habitat present, multiple records nearby)

Table 3: Conservation significant fauna species which have potential to occur within the site (continued)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		BC Act	EPBC Act		
Synemon gratiosa	Graceful sunmoth	P4	-	Coastal heathland on Quindalup dunes where it is restricted to secondary sand dunes due to the abundance of the preferred host plant Lomandra maritima. Banksia woodland on Spearwood and Bassendean dunes, where the second known host plant L. hermaphrodita is widespread (DEC 2011).	Possible (hostplant recorded)
Throscodectes xiphos	Stylet bush cricket	P1	-	Species poorly understood and documented. Known from Jandacot area, where it was originally collected in the axial leaf bases of grass trees (Xanthorrhoea preissei) (Invertebrate Solutions 2019).	Possible (suitable habitat present, single record nearby, poor knowledge of species)
Mammals					
Hydromys chrysogaster	Rakali	P4	-	Areas with permanent water, fresh, brackish or marine. Likely to occur in all major rivers and most of the larger streams as well as bodies of permanent water in the lower south west (Christensen et al. 1985).	Possible (marginal habitat present)
Isoodon fusciventer	Quenda	P4	-	Dense scrubby, often swampy, vegetation with dense cover up to one metre high (DEC 2012a)	Recorded (suitable habitat present)
Reptiles					
Lerista lineata	Perth slider	P3	-	Sandy coastal heath and low scrubland. Banksia spp. woodland, Eucalyptus gomphocephala open woodland over deep sands, and coastal dunes immediately adjacent to the beach (Wilson and Swan 2017).	Possible (potential habitat present)
Neelaps calonotos	Black-striped snake	P3	-	Coastal and near-coastal dunes, sandplains supporting heathlands and Banksia spp. woodlands (Bush et al. 2002).	Possible (potential habitat present)

4.3.1 Declared pests

One of the introduced fauna species recorded, **Oryctolagus cuniculus* (rabbit), is listed as a declared pest (C3) pursuant to the BAM Act.

5 Discussion

5.1 Fauna habitat values

Over half of the site (68%) supports turf, bare ground and infrastructure which provide low habitat values for native fauna. The native woodland habitat provides the highest habitat values but extends over a small portion of the site (4%) and occurs as scattered patches. The riparian and water habitats, although artificial, also provide habitat for native fauna and occur as small patches (3% of the site). The remainder of the site supports planted trees and shrubs which provide varying habitat values according to the plant species and density. The majority of the planted trees and shrubs habitat lacks understorey vegetation and would mainly provide habitat for common avian species.

The 15 native and three introduced fauna taxa recorded within the site are common and widespread on the Swan Coastal Plain region, although two of them are of conservation significance as detailed in Section 5.2.

5.2 Conservation significant fauna

Threatened Carnaby's cockatoo were recorded in the site and another threatened black cockatoo, forest red-tailed black cockatoo, is considered likely to occur in the site. The native woodland and planted trees and shrubs habitats support plants known to be foraged by threatened species of black cockatoos including Carnaby's cockatoo and forest red-tailed black cockatoo. These habitats may also support trees suitable for use by black cockatoos as breeding or roosting habitat. Further targeted assessment would be required to confirm the black cockatoo habitat values within the site.

Quenda (P4) diggings were recorded in the site and the native woodland, planted trees and shrubs and riparian habitats are considered to provide suitable habitat for quenda. Quenda inhabit dense scrub/shrub vegetation and therefore only parts of the above habitats with a dense understorey vegetation are considered likely to support this species (DEC 2012). The planted trees and shrubs habitat largely lacks understorey and as such the native woodland and riparian habitats would provide the highest habitat value to quenda in the site.

An additional 45 species of conservation significance have potential to occur in the site. However, the majority of these species are birds which may only use the site intermittently, if at all. The native woodland habitat also provides a relatively small area of potential habitat for two invertebrates and two reptiles of conservation significance.

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Level 1 Fauna Assessment
Former Glen Iris Golf Course

6 Conclusions

The majority of the site supports turf, bare ground and infrastructure which provides low habitat values for native fauna. The native woodland habitat provides the highest relative value but, as this habitat extends over a small portion of the site (4%) and occurs as scattered patches, the importance of this habitat to native fauna is likely limited. Although artificial, the riparian and water habitats also provide habitat for native fauna. The remainder of the site supports planted trees and shrubs which provide varying habitat values depending on plant species and density.

The 15 native and three introduced fauna taxa recorded within the site are all common and widespread across the Swan Coastal Plain region. Two of them are of conservation significance.

Two fauna species of conservation significance were recorded within the site: Carnaby's cockatoo (threatened) and quenda (P4). One other threatened species, forest red-tailed black cockatoo, is considered likely to occur in the site. A targeted assessment would be required to confirm the black cockatoo habitat values within the site.

An additional 45 species of conservation significance have potential to occur in the site. The majority of these species are birds which may only use the site intermittently, if at all. The native woodland habitat also provides a relatively small area of potential habitat for two invertebrates and two reptiles of conservation significance.

7 References

7.1 General references

Alan Tingay and Associates 1998, *A Strategic Plan for Perth's Greenways - Final Report*. December 1998.

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Western Australian Museum 2019, *WA Museum Checklist of the Terrestrial Vertebrate Fauna of Western Australia*, Perth, Western Australia.

7.2 Online references

Department of Parks and Wildlife (DBCA) 2020, *NatureMap,* viewed 27 March 2020 < https://naturemap.dpaw.wa.gov.au/>.

Department of the Environment (DAWE) 2020x, *Protected Matters Search Tool*, viewed 27 March 2020 <https://www.environment.gov.au/epbc/protected-matters-search-tool>.

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Level 1 Fauna Assessment
Former Glen Iris Golf Course

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Figures

Figure 1: Site Location

Figure 2: Environmental Features

Figure 3: Fauna Habitat

Figure 1: Site Location

Project: Level 1 Fauna Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(04)--F07a
Drawn: GAR
Date: 29/03/2021
Checked: RAW
Approved: TAA
Date: 29/03/2021

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emerge ASSOCIATES

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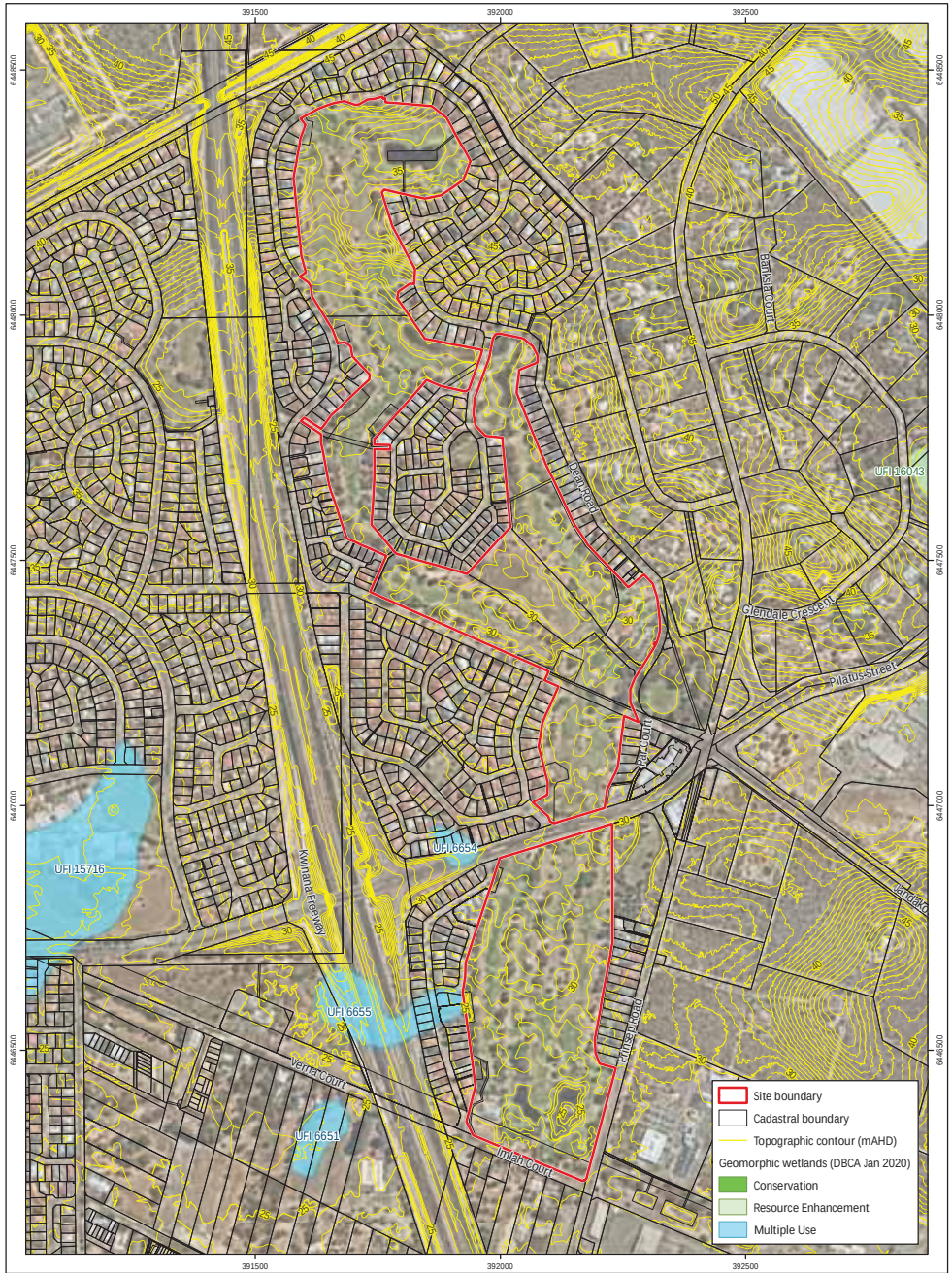

Figure 2: Environmental Features

Project: Level 1 Fauna Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(04)--F08a
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Date: 29/03/2021
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Approved: TAA
Date: 29/03/2021

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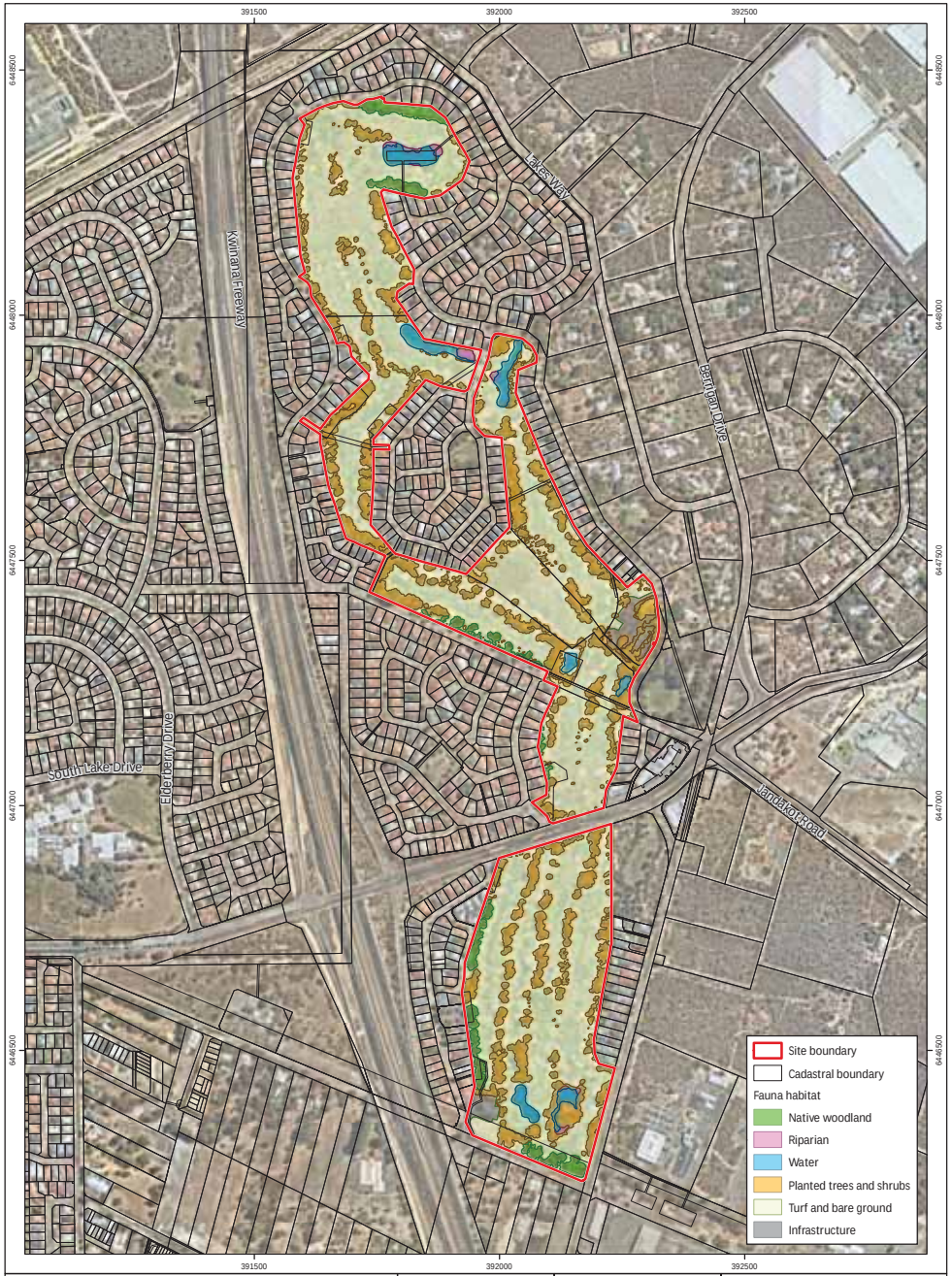

Figure 3: Fauna Habitat

Project: Level 1 Fauna Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number:
EP20-009(04)--F09a
Drawn: GAR
Date: 29/03/2021
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Approved: TAA
Date: 29/03/2021

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Appendix A

Additional Information

Conservation Significant Fauna

Threatened and priority fauna

Fauna species considered rare or under threat warrant special protection under Commonwealth and/or State legislation. At the Commonwealth level, fauna species can be listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Migratory birds may be recognised under international treaties including:

- *Japan Australia Migratory Bird Agreement 1981* (JAMBA)
- *China Australia Migratory Bird Agreement 1998* (CAMBA)
- *Republic of Korea-Australia Migratory Bird Agreement 2007* (ROKAMBA)
- *Bonn Convention 1979* (The Convention on the Conservation of Migratory Species of Wild Animals).

All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as 'matters of national environmental significance' (MNES) under the EPBC Act. Fauna species considered 'threatened' pursuant to Schedule 1 of the EPBC Act are assigned categories as outlined in Table 1.

Table 1: Definitions of conservation significant fauna species pursuant to the EPBC Act

Conservation Code	Category
X	Threatened Fauna –Extinct There is no reasonable doubt that the last member of the species has died.
EW[#]	Threatened Fauna –Extinct in the Wild Taxa which are known only to survive in cultivation, captivity or as a naturalised population outside its past range, or taxa which have not been recorded in its known and/or expected habitat despite appropriate exhaustive surveys.
CR[#]	Threatened Fauna – Critically Endangered Taxa which are considered to be facing an extremely high risk of extinction in the wild.
EN[#]	Threatened Fauna – Endangered Taxa which are considered to be facing a very high risk of extinction in the wild.
VU[#]	Threatened Fauna – Vulnerable Taxa which are considered to be facing a high risk of extinction in the wild.
Migratory[#]	Migratory Fauna All migratory species that are: (i) native species; and (ii) from time to time included in the appendices to the Bonn Convention; and (b) all migratory species from time to time included in annexes established under JAMBA, CAMBA and ROKAMBA; and All native species from time to time identified in a list established under, or an instrument made under, an international agreement approved by the Minister.
Ma	Marine Fauna Species in the list established under s248 of the EPBC Act

[#]matters of national environmental significance (MNES) under the EPBC Act

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Additional Background Information

In Western Australia, fauna taxa may be classed as 'threatened', 'extinct', or 'specially protected' under the *Biodiversity Conservation Act 2016* (BC Act), which is enforced by Department of Biodiversity Conservation and Attractions (DBCA) (DBCA 2019). The definitions of these categories are provided in Table 2.

Table 2: Definitions of specially protected fauna schedules under the BC Act (DBCA 2019)

Category	Conservation Code	Definition
Threatened	CR	Critically endangered Threatened species considered to be facing an extremely high risk of extinction in the wild in the immediate future.
	EN	Endangered Threatened species considered to be facing a very high risk of extinction in the wild in the near future.
	VU	Vulnerable Threatened species considered to be facing a high risk of extinction in the wild in the medium-term future.
Extinct	EX	Extinct Species where there is no reasonable doubt that the last member of the species has died.
	EW	Extinct in the wild Species that is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form. Note that no species are currently listed as EW.
Specially protected	MI	Migratory species Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth Includes birds that subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds.
	CD	Species of special conservation interest (conservation dependent fauna) Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
	OS	Other specially protected species Fauna otherwise in need of special protection to ensure their conservation.

Fauna species that may be threatened or near threatened but lack sufficient information to be legislatively listed may be added to the DBCA's *Priority Fauna List* (DBCA 2018). Species listed under priorities 1-3 comprise possible threatened species that do not meet survey criteria or are otherwise data deficient. Species listed under priority 4 are those that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons (DBCA 2019).

Priority fauna species are considered during State approval processes. Priority fauna categories and definitions are listed in Table 3 (DBCA 2019).

Table 3: Definitions of priority fauna categories on DBCA's Priority Fauna List (DBCA 2019)

Conservation Code	Category
P1	Priority 1 – Poorly known Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	Priority 2 – Poorly known Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	Priority 3 – Poorly known Species that are known from several locations and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	(a) Priority 4 – Rare species Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Priority 4 – Near Threatened Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Priority 4 – Other Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

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Additional Background Information

Pest fauna

A number of legislative and policy documents exist in relation to pest fauna management at state and national levels. The *Biosecurity and Agriculture Management Act 2007* (BAM Act) is the principle legislation guiding pest fauna management in Western Australia and lists declared pest species.

Declared Pests

Part 2.3.23 of the BAM Act requires a person must not; "*a) keep, breed or cultivate the declared pest; b) keep, breed or cultivate an animal, plant or other thing that is infected or infested with the declared pest; c) release into the environment the declared pest, or an animal, plant or other thing that is infected or infested with the declared pest; or d) intentionally infect or infest, or expose to infection or infestation, a plant, animal or other thing with a declared pest*".

Under the BAM Act, all declared pests are assigned a legal status, as described in Table 4. Species assigned to the 'declared pest, prohibited - s12' category are placed in one of three control categories, as described in Table 5.

The *Biosecurity and Agriculture Management Regulations 2013* specify keeping categories for species assigned to the 'declared pest - s22(2)' category, which relate to the purposes of which species can be kept, as well as the entities that can keep them. The categories are described in Table 6.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act (DAFWA 2016).

Table 4: Legal status of declared pest species listed under the BAM Act (DAFWA 2016)

Category	Description
Declared Pest Prohibited - s12	May only be imported and kept subject to permits. Permit conditions applicable to some species may only be appropriate or available to research organisations or similarly secure institutions.
Declared Pest s22(2)	Must satisfy any applicable import requirements when imported, and may be subject to an import permit if they are potential carriers of high-risk organisms. They may also be subject to control and keeping requirements once within Western Australia

Table 5: Control categories of declared pest species listed under the BAM Act (DAFWA 2016)

Category	Description
C1	Exclusion Not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2	Eradication Present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3	Management Established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Table 6: Keeping categories of declared pest species listed under the BAM Act (DAFWA 2016)

Category	Description
Prohibited	Can only be kept under a permit for public display and education purposes, and/or genuine scientific research, by entities approved by the state authority.
Exempt	No permit or conditions are required for keeping.
Restricted	Organisms which, relative to other species, have a low risk of becoming a problem for the environment, primary industry or public safety and can be kept under a permit by private individuals.

Version: EMRG_FReport_Appendix (V011)
Additional Background Information

References

General references

Department of Biodiversity, Conservation and Attractions (DBCA) 2018, *Threatened and Priority Fauna List 15 February 2018*, Perth.

Department of Biodiversity Conservation and Attractions (DBCA) 2019, *Conservation Codes for Western Australian Flora and Fauna - last updated 3 January 2019*.

Appendix B

Database Search Results

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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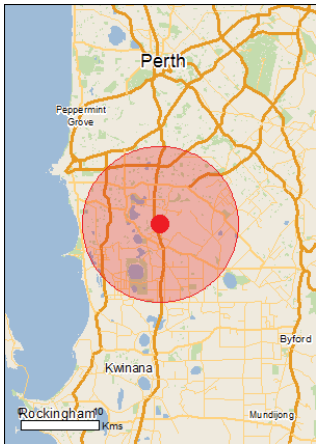
Summary
Details
Matters of NES
Other Matters Protected by the EPBC Act
Extra Information
Caveat
Acknowledgements



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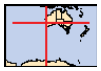

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	54
Listed Migratory Species:	54

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	63
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	15
Regional Forest Agreements:	None
Invasive Species:	42
Nationally Important Wetlands:	4
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Forrestdale and thomsons lakes	Within Ramsar site
Peel-yalgorup system	30 - 40km upstream

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Roosting known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area
Thalassarche cauta cauta Shy Albatross [82345]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Insects		
Neopasiphae simplicior		
A native bee [66821]	Critically Endangered	Species or species habitat likely to occur within area
Mammals		
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Neophoca cinerea		
Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat likely to occur within area
Other		
Westralunio carteri		
Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat may occur within area
Plants		
Andersonia gracilis		
Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Austrostipa jacobsiana		
[87809]	Critically Endangered	Species or species habitat may occur within area
Caladenia huegelii		
King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Diuris drummondii		
Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat known to occur within area
Diuris micrantha		
Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei		
Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat known to occur within area
Drakaea elastica		
Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha		
Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Eleocharis keigheryi		
Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area
Eremophila glabra subsp. chlorella		
[84927]	Endangered	Species or species habitat likely to occur within area
Eucalyptus x balanites		
Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Grevillea curviloba subsp. incurva		
Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
Lepidosperma rostratum		
Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Macarthuria keigheryi		
Keighery's Macarthuria [64930]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696)		
Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
Synaphea sp. Serpentine (G.R. Brand 103)		
[86879]	Critically Endangered	Species or species habitat may occur within area
Thelymitra dedmaniarum		
Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area
Thelymitra stellata		
Star Sun-orchid [7060]	Endangered	Species or species habitat may occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Diomedea amsterdamensis		
Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora		
Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans		
Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur

Name	Threatened	Type of Presence within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Vulnerable*	Species or species habitat likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Migratory Marine Species		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Arenaria interpres Ruddy Turnstone [872]		Foraging, feeding or related behaviour known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Foraging, feeding or related behaviour known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Phalaropus lobatus Red-necked Phalarope [838]		Foraging, feeding or related behaviour known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Foraging, feeding or related behaviour known to occur within area
Pluvialis squatarola Grey Plover [865]		Foraging, feeding or related behaviour known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Foraging, feeding or related behaviour known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Tringa totanus Common Redshank, Redshank [835]		Foraging, feeding or related behaviour known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Foraging, feeding or related behaviour known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Foraging, feeding or related behaviour known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Foraging, feeding or related behaviour known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Diomedea sanfordi		
Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Gallinago megala		
Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura		
Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes		
Grey-tailed Tattler [59311]		Foraging, feeding or related behaviour known to occur within area
Himantopus himantopus		
Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area
Limosa lapponica		
Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa		
Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus		
Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus		
Whimbrel [849]		Foraging, feeding or related behaviour known to occur within area
Pachyptila turtur		
Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus		
Osprey [952]		Breeding known to occur within area
Phalaropus lobatus		
Red-necked Phalarope [838]		Foraging, feeding or related behaviour known to occur within area
Philomachus pugnax		
Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva		
Pacific Golden Plover [25545]		Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Pluvialis squatarola		
Grey Plover [865]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Recurvirostra novaehollandiae		
Red-necked Avocet [871]		Roosting known to occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Sterna dougallii		
Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta		
Shy Albatross [89224]	Vulnerable*	Species or species habitat likely to occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Thinornis rubricollis		
Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa glareola		
Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis		
Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Tringa totanus		
Common Redshank, Redshank [835]		Foraging, feeding or related behaviour known to occur within area
Xenus cinereus		
Terek Sandpiper [59300]		Foraging, feeding or related behaviour known to occur within area
Mammals		
Neophoca cinerea		
Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or

Name	Threatened	Type of Presence
		related behaviour known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Alfred Cove	WA
Balannup Lake	WA
Canning River	WA
Forrestdale Lake	WA
Gibbs Road	WA
Harry Waring Marsupial Reserve	WA
Piara	WA
Swan River	WA
Thomsons Lake	WA
Unnamed WA39752	WA
Unnamed WA44414	WA
Unnamed WA48291	WA
Unnamed WA49362	WA
Unnamed WA49363	WA
Unnamed WA49561	WA

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis		
Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos		
Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis		
European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus		
House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus		
Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis		
Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis		
Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris		
Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula		
Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus		
Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris		
Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii		
Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus		
House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus		
Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus		
Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus		
Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes		
Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia		
Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus		
Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides		
Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus		
Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica		
Para Grass [5879]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		

Name	Status	Type of Presence
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Booragoon Swamp	WA
Gibbs Road Swamp System	WA
Swan-Canning Estuary	WA
Thomsons Lake	WA

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.10414 115.85615

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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NatureMap Species Report

Created By Guest user on 16/06/2020

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 51' 22" E,32° 06' 15" S
Buffer 10km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	24559	*Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*			
2.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
3.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
4.	24262	*Acanthiza inornata (Western Thornbill)*			
5.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
6.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
7.	25536	*Accipiter fasciatus (Brown Goshawk)*			
8.	24283	*Accipiter fasciatus subsp. didimus (Brown Goshawk)*			
9.	24282	*Accipiter fasciatus subsp. fasciatus (Brown Goshawk)*			
10.		*Acentrogobius bifrenatus*			
11.		*Acercella falcipes*			
12.	42368	*Acritoscincus trilineatus (Western Three-lined Skink)*			
13.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
14.	24831	*Acrocephalus australis subsp. gouldi (Australian Reed Warbler)*			
15.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
16.	25544	*Aegotheles cristatus (Australian Owlet-nightjar)*			
17.		*Afurcagobius suppositus*			
18.		*Akamptogonus novarae*			
19.		*Aldrichetta forsteri*			
20.		*Allothereua maculata*			
21.		*Aname mainae*			
22.		*Aname tepperi*			
23.	24310	*Anas castanea (Chestnut Teal)*			
24.	24312	*Anas gracilis (Grey Teal)*			
25.	24313	*Anas platyrhynchos (Mallard)*			
26.		*Anas platyrhynchos subsp. domesticus*			
27.	24315	*Anas rhynchotis (Australasian Shoveler)*			
28.	24316	*Anas superciliosa (Pacific Black Duck)*			
29.	47414	*Anhinga novaehollandiae (Australasian Darter)*			
30.	44629	*Anilios australis*			
31.		*Anoplocapros lenticularis*			
32.	24506	*Anous tenuirostris subsp. melanops (Australian Lesser Noddy)*		T	
33.		*Anser anser*			
34.	24561	*Anthochaera carunculata (Red Wattlebird)*			
35.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
36.		*Aploactisoma milesii*			
37.		*Apogon rueppellii*			
38.	24991	*Aprasia repens (Sand-plain Worm-lizard)*			
39.	25554	*Apus pacificus (Fork-tailed Swift, Pacific Swift)*		IA	
40.	24285	*Aquila audax (Wedge-tailed Eagle)*			
41.		*Arachnura higginsi*			
42.		*Araneus cyphoxis*			
43.		*Araneus eburneiventris*			
44.		*Araneus senicaudatus*			
45.	24337	*Ardea garzetta subsp. nigripes (Little Egret)*			
46.	25558	*Ardea ibis (Cattle Egret)*			
47.	25559	*Ardea intermedia (Intermediate Egret)*			
48.	41324	*Ardea modesta (great egret, white egret)*			
49.	24340	*Ardea novaehollandiae (White-faced Heron)*			
50.	24341	*Ardea pacifica (White-necked Heron)*			
51.	25560	*Ardea sacra (Eastern Reef Egret, Eastern Reef Heron)*			
52.	25736	*Arenaria interpres (Ruddy Turnstone)*		IA	

NatureMap

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
53.		*Arenigobius bifrenatus*			
54.		*Argiope protensa*			
55.		*Argiope trifasciata*			
56.		*Arkys walckenaeri*			
57.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
58.	24352	*Artamus cinereus subsp. melanops (Black-faced Woodswallow)*			
59.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
60.		*Artema atlanta*			
61.		*Artoria flavimana*			
62.		*Artoria linnaei*			
63.		*Artoria taeniifera*			
64.		*Artoriopsis eccentrica*			
65.		*Artoriopsis expolita*			
66.		*Artoriopsis joergi*			
67.		*Atherinomorus vaigiensis*			
68.		*Atherinosoma wallacei*			
69.		*Aurecocrypta lugubris*			
70.		*Austracantha minax*			
71.	47713	*Austronomus australis (White-striped Free-tailed Bat)*			
72.	24318	*Aythya australis (Hardhead)*			
73.		*Backobourkia heroine*			
74.		*Badumna insignis*			
75.		*Ballarra longipalpus*			
76.		*Barnardius zonarius*			
77.	24319	*Biziura lobata (Musk Duck)*			
78.	24345	*Botaurus poiciloptilus (Australasian Bittern)*		T	
79.	42380	*Brachyurophis fasciolatus subsp. fasciolatus (Narrow-banded Shovel-nosed Snake)*			
80.	42381	*Brachyurophis semifasciatus (Southern Shovel-nosed Snake)*			
81.	25713	*Cacatua galerita (Sulphur-crested Cockatoo)*			
82.	25714	*Cacatua pastinator (Western Long-billed Corella)*			
83.	25715	*Cacatua roseicapilla (Galah)*			
84.	25716	*Cacatua sanguinea (Little Corella)*			
85.	24729	*Cacatua tenuirostris (Eastern Long-billed Corella)*	Y		
86.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
87.	24427	*Cacomantis flabelliformis subsp. flabelliformis (Fan-tailed Cuckoo)*			
88.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
89.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
90.	24780	*Calidris alba (Sanderling)*		IA	
91.	25738	*Calidris canutus (Red Knot, knot)*		IA	
92.	24784	*Calidris ferruginea (Curlew Sandpiper)*		T	
93.	24786	*Calidris melanotos (Pectoral Sandpiper)*		IA	
94.	24787	*Calidris minuta (Little Stint)*			
95.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
96.		*Calidris sp.*			
97.	24789	*Calidris subminuta (Long-toed Stint)*		IA	
98.	24790	*Calidris tenuirostris (Great Knot)*		T	
99.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
100.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black Cockatoo)*		T	
101.	24733	*Calyptorhynchus baudinii (Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo)*		T	
102.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)*		T	
103.	48400	*Calyptorhynchus sp. (white-tailed black cockatoo)*		T	
104.		*Carassius auratus*			
105.	34031	*Carcharodon carcharias (Great White Shark)*		T	
106.	25335	*Caretta caretta (Loggerhead Turtle)*		T	
107.		*Cercophonius sulcatus*			
108.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			
109.	24187	*Chalinolobus morio (Chocolate Wattled Bat)*			
110.	25574	*Charadrius dubius (Little Ringed Plover)*		IA	
111.	25575	*Charadrius leschenaultii (Greater Sand Plover)*		T	
112.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
113.		*Cheilodactylus gibbosus*			
114.	43380	*Chelodina colliei (South-western Snake-necked Turtle)*			
115.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
116.	47909	*Cheramoeca leucosterna (White-backed Swallow)*			
117.	33939	*Cherax cainii (Marron)*			
118.		*Cherax destructor*			
119.		*Cherax preissii*			
120.		*Cherax quinquecarinatus*			

NatureMap is a collaborative project of the Department of Biodiversity, Conservation and Attractions and the Western Australian Museum.

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
121.		*Cherax sp.*			
122.	41332	*Chlidonias leucopterus (White-winged Black Tern, white-winged tern)*		IA	
123.	24980	*Christinus marmoratus (Marbled Gecko)*			
124.		*Chroicocephalus novaehollandiae*			
125.	25601	*Chrysococcyx lucidus (Shining Bronze Cuckoo)*			
126.	24432	*Chrysococcyx lucidus subsp. plagosus (Shining Bronze Cuckoo)*			
127.	24288	*Circus approximans (Swamp Harrier)*			
128.	24289	*Circus assimilis (Spotted Harrier)*			
129.	24774	*Cladorhynchus leucocephalus (Banded Stilt)*			
130.		*Clynotis albobarbatus*			
131.		*Cnidoglanis macrocephalus*			
132.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
133.	24399	*Columba livia (Domestic Pigeon)*	Y		
134.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
135.	24362	*Coracina novaehollandiae subsp. novaehollandiae (Black-faced Cuckoo-shrike)*			
136.		*Cormocephalus aurantiipes*			
137.		*Cormocephalus novaehollandiae*			
138.		*Cormocephalus rubriceps*			
139.	24416	*Corvus bennetti (Little Crow)*			
140.	25592	*Corvus coronoides (Australian Raven)*			
141.	24417	*Corvus coronoides subsp. perplexus (Australian Raven)*			
142.	24671	*Coturnix pectoralis (Stubble Quail)*			
143.	25701	*Coturnix ypsilophora (Brown Quail)*			
144.	24673	*Coturnix ypsilophora subsp. australis (Brown Quail)*			
145.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
146.	25595	*Cracticus tibicen (Australian Magpie)*			
147.	24422	*Cracticus tibicen subsp. dorsalis (White-backed Magpie)*			
148.	24423	*Cracticus tibicen subsp. tibicen (Black-backed Magpie)*			
149.	25596	*Cracticus torquatus (Grey Butcherbird)*			
150.	24424	*Cracticus torquatus subsp. torquatus (Grey Butcherbird)*			
151.		*Craterocephalus mugiloides*			
152.	25398	*Crinia georgiana (Quacking Frog)*			
153.	25399	*Crinia glauerti (Clicking Frog)*			
154.	25400	*Crinia insignifera (Squelching Froglet)*			
155.	25401	*Crinia pseudinsignifera (Bleating Froglet)*			
156.		*Cristiceps sp.*			
157.		*Crustulina bicruciata*			
158.	30893	*Cryptoblepharus buchananii*			
159.	25020	*Cryptoblepharus plagiocephalus*			
160.		*Cryptoerithus quobba*			
161.	30899	*Ctenophorus adelaidensis (Southern Heath Dragon, Western Heath Dragon)*			
162.	25027	*Ctenotus australis*			
163.	25039	*Ctenotus fallens*			
164.	25040	*Ctenotus gemmula (Jewelled South-west Ctenotus (Swan Coastal Plain subpop P3), skink)*			
165.	25047	*Ctenotus impar*			
166.		*Cyclosa trilobata*			
167.	24322	*Cygnus atratus (Black Swan)*			
168.	24323	*Cygnus olor (Mute Swan)*	Y		
169.		*Cyrtophora parnasia*			
170.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
171.		*Dactylopus dactylopus*			
172.		*Daphnia carinata*			
173.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
174.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
175.		*Delena cancerides*			
176.	25766	*Delma fraseri (Fraser's Legless Lizard)*			
177.	24999	*Delma grayii*			
178.	25468	*Demansia psammophis (Yellow-faced Whipsnake)*			
179.	25296	*Demansia psammophis subsp. reticulata (Yellow-faced Whipsnake)*			
180.	24324	*Dendrocygna arcuata (Wandering Whistling Duck, Chestnut Whistling Duck)*			
181.	25346	*Dermochelys coriacea (Leatherback Turtle)*		T	
182.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
183.		*Dingosa serrata*			
184.	30836	*Diomedea exulans subsp. exulans (Snowy Albatross)*		T	
185.	44654	*Diplodactylus lateroides (Speckled Stone Gecko)*			
186.	24470	*Dromaius novaehollandiae (Emu)*			
187.	25096	*Egernia kingii (King's Skink)*			
188.	25100	*Egernia napoleonis*			
189.		*Egretta garzetta*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
190.		*Egretta novaehollandiae*			
191.		*Elanus axillaris*			
192.	25540	*Elanus caeruleus (Black-shouldered Kite)*			
193.	24290	*Elanus caeruleus subsp. axillaris (Australian Black-shouldered Kite)*			
194.	25250	*Elapognathus coronatus (Crowned Snake)*			
195.	47937	*Elseyornis melanops (Black-fronted Dotterel)*			
196.		*Eodelena convexa*			
197.		*Eodelena lapidicola*			
198.		*Eolophus roseicapillus*			
199.		*Epinephelus sp.*			
200.	24567	*Epthianura albifrons (White-fronted Chat)*			
201.		*Eriophora biapicata*			
202.		*Ero aphana*			
203.		*Erythracarus decoris*			
204.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			
205.		*Ethmostigmus rubripes*			
206.	24368	*Eurostopodus argus (Spotted Nightjar)*			
207.	25591	*Eurystomus orientalis (Dollarbird)*			
208.	25621	*Falco berigora (Brown Falcon)*			
209.	24471	*Falco berigora subsp. berigora (Brown Falcon)*			
210.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
211.	25623	*Falco longipennis (Australian Hobby)*			
212.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
213.	24189	*Falsistrellus mackenziei (Western False Pipistrelle, Western Falsistrelle)*		P4	
214.	24041	*Felis catus (Cat)*	Y		
215.	25727	*Fulica atra (Eurasian Coot)*			
216.	24761	*Fulica atra subsp. australis (Eurasian Coot)*			
217.	30916	*Funambulus pennanti (Indian Palm Squirrel)*	Y		
218.		*Galaxias maculatus*			
219.	24791	*Gallinago hardwickii (Latham's Snipe, Japanese snipe)*		IA	
220.	24793	*Gallinago stenura (Pin-tailed Snipe)*		IA	
221.	25729	*Gallinula tenebrosa (Dusky Moorhen)*			
222.	24763	*Gallinula tenebrosa subsp. tenebrosa (Dusky Moorhen)*			
223.	25730	*Gallirallus philippensis (Buff-banded Rail)*			
224.	42314	*Gavicalis virescens (Singing Honeyeater)*			
225.		*Gea theridioides*			
226.	24959	*Gehyra variegata*			
227.	47954	*Gelochelidon nilotica (Gull-billed Tern)*		IA	
228.		*Geogarypus taylori*			
229.	24401	*Geopelia cuneata (Diamond Dove)*			
230.	25530	*Gerygone fusca (Western Gerygone)*			
231.	24271	*Gerygone fusca subsp. fusca (Western Gerygone)*			
232.	47962	*Glyciphila melanops (Tawny-crowned Honeyeater)*			
233.	24443	*Grallina cyanoleuca (Magpie-lark)*			
234.		*Gymnapistes marmoratus*			
235.	25627	*Haematopus fuliginosus (Sooty Oystercatcher)*			
236.	24487	*Haematopus longirostris (Pied Oystercatcher)*			
237.	24293	*Haliaeetus leucogaster (White-bellied Sea-Eagle)*			
238.	24295	*Haliastur sphenurus (Whistling Kite)*			
239.	25410	*Heleioporus eyrei (Moaning Frog)*			
240.	25119	*Hemiergis quadrilineata*			
241.		*Henicops dentatus*			
242.	24961	*Heteronotia binoei (Bynoe's Gecko)*			
243.	47965	*Hieraaetus morphnoides (Little Eagle)*			
244.	25734	*Himantopus himantopus (Black-winged Stilt)*			
245.	24775	*Himantopus himantopus subsp. leucocephalus (Black-winged Stilt)*			
246.		*Hippocampus elongatus*			
247.	24491	*Hirundo neoxena (Welcome Swallow)*			
248.		*Hogna crispipes*			
249.		*Holconia westralia*			
250.	24215	*Hydromys chrysogaster (Water-rat, Rakali)*		P4	
251.	25366	*Hydrophis elegans (Elegant Seasnake, Bar-bellied Seasnake)*			
252.	42410	*Hydrophis ornatus (Ornate Reef Seasnake, Sea Snake)*			
253.	43384	*Hydrophis platurus (Yellow-bellied Seasnake)*			
254.	48587	*Hydroprogne caspia (Caspian Tern)*		IA	
255.		*Hyperlophus vittatus*			
256.		*Hyporhamphus regularis*			
257.		*Idiommata blackwalli*			
258.		*Idiosoma hirsutum*			
259.	48935	*Idiosoma sigillatum (Swan Coastal Plain shield-backed trapdoor spider)*		P3	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
260.	48588	*Isoodon fusciventer (Quenda, southwestern brown bandicoot)*		P4	
261.		*Isopeda leishmanni*			
262.	47975	*Ixobrychus dubius (Australian Little Bittern)*		P4	
263.		*Ixodes australiensis*			
264.		*Kangarosa ludwigi*			
265.		*Kangarosa properipes*			
266.		*Lampona brevipes*			
267.		*Lampona cylindrata*			
268.	25637	*Larus novaehollandiae (Silver Gull)*			
269.	24511	*Larus novaehollandiae subsp. novaehollandiae (Silver Gull)*			
270.	25638	*Larus pacificus (Pacific Gull)*			
271.		*Latrodectus hasseltii*			
272.	33982	*Leioproctus contrarius (a short-tongued bee)*		P3	
273.	25128	*Lerista christinae*			
274.	25131	*Lerista distinguenda*			
275.	25133	*Lerista elegans*			
276.	25147	*Lerista lineata (Perth Slider, Lined Skink)*		P3	
277.		*Leucauge dromedaria*			Y
278.	25005	*Lialis burtonis*			
279.	25661	*Lichmera indistincta (Brown Honeyeater)*			
280.	24582	*Lichmera indistincta subsp. indistincta (Brown Honeyeater)*			
281.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
282.	30932	*Limosa lapponica (Bar-tailed Godwit)*		IA	
283.	25741	*Limosa limosa (Black-tailed Godwit)*		IA	
284.	24797	*Limosa limosa subsp. melanuroides (Black-tailed Godwit)*		IA	
285.	25378	*Litoria adelaidensis (Slender Tree Frog)*			
286.	25388	*Litoria moorei (Motorbike Frog)*			
287.	25683	*Lonchura castaneothorax (Chestnut-breasted Mannikin)*			
288.		*Longepi woodman*			
289.		*Lophoictinia isura*			
290.		*Lycosa ariadnae*			
291.		*Lycosa australicola*			
292.		*Lycosa gilberta*			
293.		*Lycosa lacertosa*			
294.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
295.	24326	*Malacorhynchus membranaceus (Pink-eared Duck)*			
296.	25651	*Malurus lamberti (Variegated Fairy-wren)*			
297.	25654	*Malurus splendens (Splendid Fairy-wren)*			
298.	24583	*Manorina flavigula (Yellow-throated Miner)*			
299.		*Maratus pavonis*			
300.	25758	*Megalurus gramineus (Little Grassbird)*			
301.	47997	*Melanodryas cucullata (Hooded Robin)*			
302.	25663	*Melithreptus brevirostris (Brown-headed Honeyeater)*			
303.	24587	*Melithreptus chloropsis (Western White-naped Honeyeater)*			
304.	24736	*Melopsittacus undulatus (Budgerigar)*			
305.	25184	*Menetia greyii*			
306.	24598	*Merops ornatus (Rainbow Bee-eater)*			
307.		*Microcarbo melanoleucos*			
308.	25693	*Microeca fascinans (Jacky Winter)*			
309.	25542	*Milvus migrans (Black Kite)*			
310.		*Missulena granulosa*			
311.		*Missulena occatoria*			
312.		*Mituliodon tarantulinus*			
313.		*Mitzoruga insularis*			
314.		*Molycria vokes*			
315.	25191	*Morethia lineoocellata*			
316.	25192	*Morethia obscura*			
317.	48008	*Morus serrator (Australasian Gannet)*			
318.		*Mugil cephalus*			
319.	24223	*Mus musculus (House Mouse)*	Y		
320.	24042	*Mustela putorius (European Polecat, Ferret)*	Y		
321.		*Myandra bicincta*			
322.	25610	*Myiagra inquieta (Restless Flycatcher)*			
323.	25420	*Myobatrachus gouldii (Turtle Frog)*			
324.	24146	*Myrmecobius fasciatus (Numbat, Walpurti)*		T	
325.		*Nanometa gentilis*			
326.	25248	*Neelaps bimaculatus (Black-naped Snake)*			
327.	25249	*Neelaps calonotos (Black-striped Snake, black-striped burrowing snake)*		P3	
328.	33984	*Neopasiphae simplicior (a short-tongued bee)*		T	
329.	24738	*Neophema elegans (Elegant Parrot)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
330.	24739	*Neophema petrophila (Rock Parrot)*			
331.		*Nephila edulis*			
332.		*Nicodamus mainae*			
333.	25747	*Ninox connivens (Barking Owl)*			
334.	48024	*Notamacropus eugenii subsp. derbianus (Tammar Wallaby, Tammar)*		P4	
335.	48022	*Notamacropus irma (Western Brush Wallaby)*		P4	
336.	25252	*Notechis scutatus (Tiger Snake)*			
337.		*Notiasemus glauerti*			
338.	24798	*Numenius madagascariensis (Eastern Curlew)*		T	
339.	25742	*Numenius phaeopus (Whimbrel)*		IA	
340.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
341.	24194	*Nyctophilus geoffroyi (Lesser Long-eared Bat)*			
342.	24742	*Nymphicus hollandicus (Cockatiel)*			
343.		*Ocrisiona leucocomis*			
344.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
345.		*Oecobius navus*			
346.		*Ommatoiulus moreleti*			
347.		*Ommatoiulus moreletii*			
348.		*Ophisurus serpens*			
349.	24085	*Oryctolagus cuniculus (Rabbit)*	Y		
350.	24328	*Oxyura australis (Blue-billed Duck)*		P4	
351.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
352.	24624	*Pachycephala rufiventris subsp. rufiventris (Rufous Whistler)*			
353.	24692	*Pachyptila belcheri (Slender-billed Prion)*			
354.	48591	*Pandion cristatus (Osprey, Eastern Osprey)*		IA	
355.		*Papillogobius punctatus*			
356.		*Paralamyctes cammooensis*			Y
357.	25253	*Parasuta gouldii*			
358.	25255	*Parasuta nigriceps*			
359.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
360.	25682	*Pardalotus striatus (Striated Pardalote)*			
361.		*Pediana occidentalis*			
362.		*Pegasus volitans*			
363.		*Pelates sexlineatus*			
364.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
365.	48060	*Petrochelidon ariel (Fairy Martin)*			
366.	48061	*Petrochelidon nigricans (Tree Martin)*			
367.	48066	*Petroica boodang (Scarlet Robin)*			
368.	24659	*Petroica goodenovii (Red-capped Robin)*			
369.	24663	*Phaethon rubricauda (Red-tailed Tropicbird)*		P4	
370.	25697	*Phalacrocorax carbo (Great Cormorant)*			
371.	24665	*Phalacrocorax fuscescens (Black-faced Cormorant)*			
372.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			
373.	24666	*Phalacrocorax melanoleucos subsp. melanoleucos (Little Pied Cormorant)*			
374.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
375.	25699	*Phalacrocorax varius (Pied Cormorant)*			
376.		*Phalloceros harpagos*			Y
377.	24409	*Phaps chalcoptera (Common Bronzewing)*			
378.	25587	*Phaps elegans (Brush Bronzewing)*			
379.		*Phenasteron longiconductor*			
380.	24802	*Philomachus pugnax (Ruff, reeve)*		IA	
381.		*Pholcus phalangioides*			
382.	48071	*Phylidonyris niger (White-cheeked Honeyeater)*			
383.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
384.		*Pinkfloydia harveii*			
385.		*Piona cumberlandensis*			
386.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
387.	24842	*Platalea regia (Royal Spoonbill)*			
388.	25720	*Platycercus icterotis (Western Rosella)*			
389.	24747	*Platycercus spurius (Red-capped Parrot)*			
390.	25721	*Platycercus zonarius (Australian Ringneck, Ring-necked Parrot)*			
391.	24750	*Platycercus zonarius subsp. semitorquatus (Twenty-eight Parrot)*			
392.	24843	*Plegadis falcinellus (Glossy Ibis)*		IA	
393.	25509	*Pletholax gracilis (Keeled Legless Lizard)*			
394.	25007	*Pletholax gracilis subsp. gracilis (Keeled Legless Lizard)*			
395.	24382	*Pluvialis fulva (Pacific Golden Plover)*		IA	
396.	24383	*Pluvialis squatarola (Grey Plover)*		IA	
397.	25703	*Podargus strigoides (Tawny Frogmouth)*			
398.	24679	*Podargus strigoides subsp. brachypterus (Tawny Frogmouth)*			
399.	25704	*Podiceps cristatus (Great Crested Grebe)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
400.		*Podykipus collinus*			
401.	25510	*Pogona minor (Dwarf Bearded Dragon)*			
402.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
403.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
404.		*Poltys laciniosus*			
405.	25722	*Polytelis anthopeplus (Regent Parrot)*			
406.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
407.	24767	*Porphyrio porphyrio subsp. bellus (Purple Swamphen)*			
408.	24769	*Porzana fluminea (Australian Spotted Crake)*			
409.	25732	*Porzana pusilla (Baillon's Crake)*			
410.	24770	*Porzana pusilla subsp. palustris (Baillon's Crake)*			
411.	24771	*Porzana tabuensis (Spotless Crake)*			
412.		*Priolepis nuchifasciata*			
413.		*Prionosternum scutatum*			
414.		*Pseudolampona woodman*			
415.	25511	*Pseudonaja affinis (Dugite)*			
416.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
417.	42416	*Pseudonaja mengdeni (Western Brown Snake)*			
418.	25433	*Pseudophryne guentheri (Crawling Toadlet)*			
419.	48085	*Psittacula krameri (Indian Ringnecked Parrot, Rose-ringed Parakeet)*	Y		
420.	24703	*Pterodroma lessonii (White-headed Petrel)*			
421.		*Pterygotrigla polyommata*			
422.	24711	*Puffinus assimilis subsp. assimilis (Little Shearwater)*			
423.	42344	*Purnella albifrons (White-fronted Honeyeater)*			
424.		*Purpureicephalus spurius*			
425.	25008	*Pygopus lepidopodus (Common Scaly Foot)*			
426.	24243	*Rattus fuscipes (Western Bush Rat)*			
427.	24244	*Rattus norvegicus (Brown Rat)*	Y		
428.	24245	*Rattus rattus (Black Rat)*	Y		
429.		*Raveniella arenacea*			
430.		*Raveniella cirrata*			
431.		*Raveniella peckorum*			
432.		*Raveniella subcirrata*			
433.	24776	*Recurvirostra novaehollandiae (Red-necked Avocet)*			
434.	48096	*Rhipidura albiscapa (Grey Fantail)*			
435.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
436.	24454	*Rhipidura leucophrys subsp. leucophrys (Willie Wagtail)*			
437.	48237	*Rostratula australis (Australian Painted Snipe)*		T	
438.		*Scolopendra laeta*			
439.		*Scomberoides lysan*			
440.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
441.		*Servaea melaina*			
442.	24145	*Setonix brachyurus (Quokka)*		T	
443.		*Sillago burrus*			
444.		*Simaetha tenuior*			
445.	25266	*Simoselaps bertholdi (Jan's Banded Snake)*			
446.		*Smeringopus natalensis*			
447.	30948	*Smicrornis brevirostris (Weebill)*			
448.		*Solaenodolichopus pruvoti*			
449.		*Steatoda capensis*			
450.	24526	*Sterna hirundo subsp. hirundo (Common Tern)*		IA	Y
451.	24528	*Sterna hybrida subsp. javanica (Whiskered Tern)*			
452.	48594	*Sternula nereis (Fairy Tern)*			
453.	48595	*Sternula nereis subsp. nereis (Fairy Tern)*		T	
454.	24329	*Stictonetta naevosa (Freckled Duck)*			
455.		*Stigmatopora argus*			
456.	25597	*Strepera versicolor (Grey Currawong)*			
457.	25589	*Streptopelia chinensis (Spotted Turtle-Dove)*	Y		
458.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
459.	30950	*Streptopelia senegalensis subsp. senegalensis (Laughing Turtle-Dove)*	Y		
460.	25518	*Strophurus spinigerus*			
461.	24942	*Strophurus spinigerus subsp. spinigerus*			
462.	24946	*Strophurus strophurus*			
463.		*Supunna funerea*			
464.		*Supunna picta*			
465.	33992	*Synemon gratiosa (Graceful Sunmoth)*		P4	
466.		*Synothele michaelseni*			
467.		*Synothele rastelloides*			
468.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
469.	24682	*Tachybaptus novaehollandiae subsp. novaehollandiae (Australasian Grebe, Black-*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
		throated Grebe)			
470.	24207	*Tachyglossus aculeatus (Short-beaked Echidna)*			
471.	25552	*Tadorna radjah (Radjah Shelduck)*			
472.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
473.		*Tamopsis darlingtoniana*			
474.	24167	*Tarsipes rostratus (Honey Possum, Noolbenger)*			
475.		*Tasmanicosa leuckartii*			
476.		*Tetragnatha demissa*			
477.		*Tetragnatha nitens*			
478.	48597	*Thalasseus bergii (Crested Tern)*		IA	
479.	48135	*Thinornis rubricollis (Hooded Plover, Hooded Dotterel)*		P4	
480.	48136	*Threskiornis moluccus (Australian White Ibis)*			
481.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
482.	33994	*Throscodectes xiphos (Stylet Bush Cricket, Stylet Throsco (Jandakot))*		P1	Y
483.	25203	*Tiliqua occipitalis (Western Bluetongue)*			
484.	25519	*Tiliqua rugosa*			
485.	25204	*Tiliqua rugosa subsp. aspera*			
486.	25207	*Tiliqua rugosa subsp. rugosa*			
487.		*Tinytrema yarra*			
488.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
489.	24309	*Todiramphus sanctus subsp. sanctus (Sacred Kingfisher)*			
490.		*Torquigener pleurogramma*			
491.	48141	*Tribonyx ventralis (Black-tailed Native-hen)*			
492.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
493.	24755	*Trichoglossus haematodus subsp. moluccanus (Rainbow Lorikeet)*	Y		
494.	24754	*Trichoglossus haematodus subsp. rubritorquis (Red-collared Lorikeet)*			
495.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			
496.	24158	*Trichosurus vulpecula subsp. vulpecula (Common Brushtail Possum)*			
497.	24803	*Tringa brevipes (Grey-tailed Tattler)*		P4	
498.	24806	*Tringa glareola (Wood Sandpiper)*		IA	
499.	24808	*Tringa nebularia (Common Greenshank, greenshank)*		IA	
500.	24809	*Tringa stagnatilis (Marsh Sandpiper, little greenshank)*		IA	
501.	48147	*Turnix varius (Painted Button-quail)*			
502.	24851	*Turnix velox (Little Button-quail)*			
503.	24852	*Tyto alba subsp. delicatula (Barn Owl)*			
504.	24855	*Tyto novaehollandiae subsp. novaehollandiae (Masked Owl (southwest))*		P3	
505.		*Urocampus carinirostris*			
506.		*Urodacus novaehollandiae*			
507.	25577	*Vanellus miles (Masked Lapwing)*			
508.	24386	*Vanellus tricolor (Banded Lapwing)*			
509.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			
510.	25225	*Varanus rosenbergi (Heath Monitor)*			
511.		*Venator immansueta*			
512.		*Venatrix pullastra*			
513.	24206	*Vespadelus regulus (Southern Forest Bat)*			
514.	24040	*Vulpes vulpes (Red Fox)*	Y		
515.	34113	*Westralunio carteri (Carter's Freshwater Mussel)*		T	
516.		*Westrarchaea sinuosa*			
517.	41351	*Xenus cinereus (Terek Sandpiper)*		IA	
518.		*Zachria flavicoma*			
519.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Appendix C

Conservation Significant Species and Likelihood of Occurrence Assessment

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Birds					
Actitis hypoleucos	Common sandpiper	MI	MI	Edge of sheltered waters salt or fresh, e.g. estuaries, mangrove creeks, rocky coasts, near-coastal saltlakes (including saltwork ponds), river pools, lagoons, claypans, drying swamps, flood waters, dams and sewage ponds. Preferring situations wherelow perches are available (Johnstone & Storr 1998).	Possible (marginal habitat present)
Anous stolidus	Common noddy	MI	MI	Tropical and subtropical seas, cayes, reefs, buoys and piles (Pizzey & Knight 2012).	Unlikely (no suitable habitat)
Anous tenuirostris melanops	Australian lesser noddy	EN	VU	Very common in blue-water seas around the Abrolhos (endemic to this area, accidental occurrences on lower west coast of Australia) (Johnstone and Storr 1998).	Unlikely (no suitable habitat)
Apus pacificus	Pacific swift	MI	MI	Aerial, migratory species that is most often seen over inland plains and sometimes above open areas, foothills or in coastal areas. Sometimes occurs over settled areas, including towns, urban areas and cities (Pizzey & Knight 2012).	Possible (may opportunitcally occur above the site, potential foraging habitat present)
Ardea alba	Eastern great egret	-	MA	Shallows of rivers, estuaries; tidal mudflats, freshwater wetlands; sewage ponds, irrigation areas and larger dams (Pizzey & Knight 2012).	Possible (potential habitat present)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Ardea ibis	Cattle egret	-	MA	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats, drains (Pizzey & Knight 2012).	Possible (potential habitat present)
Ardenna carneipes	Flesh-footed shearwater	VU	MI	Marine species that breeds on islands off south coast from near Cape Leeuwin (Johnstone and Storr 1998).	Unlikely (no suitable habitat)
Arenaria interpres	Ruddy turnstone	MI	MI	Tidal mud and reef flats, sheltered rocky coasts, stony and seaweedy beaches and sandpits, dry coral ridges (Abrolhos) and pebbly shores of near-coastal saltlakes (including saltwork ponds) (Johnstone and Storr 1998).	Unlikely (no suitable habitat)
Botaurus poiciloptilus	Australasian bittern	EN	EN	In or over water, in tall reedbeds, sedges, rushes, cumbungi, lignum. Also occurs in ricefields, drains in tussocky paddocks and occasionally in saltmarshes and brackish wetlands.	Possible (marginal habitat present)
Calidris acuminata	Sharp-tailed sandpiper	MI	MI	Occurs in tidal mudflats, saltmarshes and mangroves, as well as, shallow fresh,brackish or saline inland wetlands. It is also known from floodwaters, irrigated pastures and crops, sewage ponds, saltfields.	Possible (marginal habitat present)
Calidris alba	Sanderling	MI	MI	Mainly steeply shelving sandy beaches exposed to ocean swell. Also sandy inlets, estuarine sandbanks and near-coastal saltlakes (including saltwork ponds) (Johnstone & Storr 1998).	Unlikely (no suitable habitat)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Calidris canutus	Red knot	EN	EN (MI)	Mud and sand flats in estuaries and on sheltered coasts. Also near-coastal saltlakes, including saltwork ponds.	Unlikely (no suitable habitat)
Calidris ferruginea	Curlew sandpiper	CR	CR (MI)	Mainly shallows of estuaries and near-coastal saltlakes (including saltwork ponds) and drying near-coastal freshwater lakes and swamps. Also beaches and near-coastal sewage ponds.	Unlikely (no suitable habitat)
Calidris melanotos	Pectoral sandpiper	MI	MI	Mainly fresh waters (swamps, lagoons, river pools, irrigation channels and sewage ponds); also samphire flats around estuaries and saltlakes (Johnstone & Storr 1998).	Possible (marginal habitat present)
Calidris ruficollis	Red-necked stint	MI	MI	Tidal mudflats, saltmarshes, sandy or shelly beaches, saline and freshwater wetlands (coastal and inland), saltfields, sewage ponds (Pizzey and Knight 2012).	Possible (marginal habitat present)
Calidris subminuta	Long-toed stint	MI	MI	Mainly freshwater swamps (especially when drying and where vegetation is short), river pools, lagoons and claypans; also brackish pools, sewage ponds and samphire flats around estuaries and saltlakes.	Possible (marginal habitat present)
Calidris tenuirostris	Great knot	CR	CR (MI)	Mud or sand flats in estuaries and on sheltered coasts. Also near-coastal saltlakes, including saltwork ponds.	Unlikely (no suitable habitat)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Calyptorhynchus banksii naso	Forest red-tailed black cockatoo	VU	VU	Eucalypt and Corymbia forests, often in hilly interior. More recently also observed in more open agricultural and suburban areas including Perth metropolitan area. Attracted to seeding Corymbia calophylla, Eucalyptus marginata, introduced Melia azdarach and Eucalyptus spp. trees.	Likely (potential habitat present)
Calyptorhynchus baudinii	Baudin's cockatoo	EN	EN	Mainly eucalypt forests. Attracted to seeding Corymbia calophylla, Banksia spp., Hakea spp., and to fruiting apples and pears (Johnstone and Storr 1998).	Unlikely (outside of modelled distribution, limited foraging habitat)
Calyptorhynchus latirostris	Carnaby's cockatoo	EN	EN	Mainly proteaceous scrubs and heaths and adjacent eucalypt woodlands and forests; also plantations of Pinus spp. Attracted to seeding Banksia spp., Dryandra spp., Hakea spp., Eucalyptus spp., Corymbia calophylla, Grevillea spp., and Allocasuarina spp. (Johnstone and Storr 1998).	Recorded (potential habitat present)
Charadrius bicinctus	Double-banded plover	MI	MI	Wide beaches, tidal mudflats, saltmarsh, wide and sparsely vegetated margins of shallow saline and freshwater wetlands, paddocks with sparse vegetation, ploughed fields, airfields.	Possible (potential habitat present)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Charadrius dubius	Little ringed plover	MI	MI	Open, muddy or sandy shores of lakes, swamps, tidal areas, sewage ponds or farm dams. Rare but regular summer migrant to Australia (Pizzey & Knight 2012).	Possible (potential habitat present)
Charadrius leschenaultii	Great sand plover	VU	VU (MI)	Wide sandy or shelly beaches, sandpits, tidal mudflats, reefs, sand cays, mangroves, saltmarsh, dune wilderness, bare paddocks, seldom far inland (Pizzey & Knight 2012).	Possible (potential habitat present)
Charadrius mongolus	Lesser sand plover	EN	EN (MI)	Sandy beaches and tidal estuarine flats. Also near-coastal saltlakes, including saltwork ponds (Johnstone & Storr 1998).	Unlikely (no suitable habitat)
Charadrius ruficapillus	Red-capped plover	-	MA	Broad, sandy and shelly beaches; bare margins of saline wetlands and lakes, inland and coastal; saltmarsh; tidal mudflats and sandflats; adjacent dunes; occasionally shallow freshwater wetlands, inland and coastal (Pizzey & Knight 2012).	Possible (potential habitat present)
Chlidonias leucopterus	White-winged black tern	MI	MI	Vegetated and open wetlands, brackish and saline lakes, saltfields, irrigated lands, sewage ponds and occasionally offshore.	Possible (potential habitat present)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Diomedea amsterdamensis	Amsterdam albatross	CR	EN (MI)	The Amsterdam albatross is a marine, pelagic seabird. It nests in open patchy vegetation (among tussocks, ferns or shrubs) near exposed ridges or hillocks (Weimerskirch et al. 1985). It sleeps and rests on ocean waters when not breeding (Marchant and Higgins 1990)	Unlikely (no suitable habitat)
Diomedea epomophora	Southern royal albatross	VU	VU (MI)	Rare visitor to Western Australian seas; it breeds on subantarctic islands south of New Zealand (Johnstone and Storr 1998).	Unlikely (no suitable habitat)
Diomedea exulans	Wandering albatross	VU	VU (MI)	Marine, pelagic and aerial species. It breeds on Macquarie Island and feeds in Australian portions of the Southern Ocean (DoE 2018).	Unlikely (no suitable habitat)
Diomedea sanfordi	Northern royal albatross	EN	EN	Species is marine, pelagic and aerial. Habitat includes subantarctic, subtropical, and occasionally Antarctic waters (Marchant & Higgins 1990). Rare visitors to south Western Australian waters.	Unlikely (no suitable habitat)
Falco peregrinus	Peregrine falcon	OS	-	Mainly found around cliffs along coasts, rivers, ranges and around wooded watercourses and lakes (Johnstone and Storr 1998).	Possible (marginal habitat present)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Gallinago hardwickii	Latham's snipe	MI	MI	Soft, wet ground or shallow water with tussocks and other green or dead growth, wet parts of paddocks, seepage below dams, irrigated areas, scrub or open woodlandfrom sea level to alpine bogs over 2000 m, samphire on saltmarshes and mangrove fringes. Rare visitor to Western Australia.	Possible (potential habitat present)
Gallinago megala	Swinhoe's snipe	MI	MI	Wet, grassy ground; edges of reedy swamps (Pizzey & Knight 2012).	Possible (potential habitat present)
Gallinago stenura	Pin-tailed snipe	MI	MI	Boggy edges of vegetated wetlands; sewage and other ponds; stubbles, grasslands with shrubs, pastures (Pizzey & Knight 2012).	Possible (potential habitat present)
Gelochelidon nilotica	Gull-billed tern	MI	MI	Beaches, mudflats; fresh, brackish wetlands, including far inland; grasslands, crops, ploughed fields, airfields (Pizzey & Knight 2012).	Possible (potential habitat present)
Haliaeetus leucogaster	White-bellied sea-eagle	-	MA	Coasts, islands, estuaries, inlets, large rivers, inland lakes and reservoirs (Pizzey & Knight 2012).	Unlikely (no suitable habitat)
Heteroscelus brevipes	Grey-tailed tattler	P4 (M	MI	Tidal mud and reef flats, sheltered rocky coasts, stony and seaweedy beaches and sandpits, dry coral ridges (Abrolhos) and pebbly shores of near-coastal saltlakes (including saltwork ponds) (Johnstone and Storr 1998).	Unlikely (no suitable habitat)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Himantopus himantopus	Black-winged stilt	-	MA	Freshwater and saltwater marshes, mudflats, and the shallow edges of lakes and rivers (Birdlife Australia 2019).	Possible (potential habitat present)
Hydroprogne caspia	Caspian tern	MI	MI	Mainly sheltered areas, estuaries (when not laden with silt) and tidal creeks; occasionally near-coastal saltlakes (including saltwork ponds) and brackish pools in lower courses of rivers; rarely fresh waters.	Unlikely (no suitable habitat)
Ixobrychus dubius	Australian little bittern	P4	-	Dense vegetation surrounding/within freshwater pools, swamps and lagoons, well screened with trees. Shelters in dense beds of Typha spp., Baumea spp. and tall rushes in freshwater swamps around lakes and along rivers (Johnstone and Storr 1998).	Possible (marginal habitat present)
Leipoa ocellata	Mallefowl	VU	VU	Scrubs and thickets of Eucalyptus spp., Melaleuca lanceolata and Acacia linophylla; also other dense litter-forming shrublands. Attracted to fallen wheat in stubbles and along roads (Johnstone and Storr 1998).	Unlikely (locally extinct, no suitable habitat)
Limosa lapponica	Bar-tailed godwit	MI (&	MI	Estuarine sand and mudflats and sandy beaches with loads of seaweed; also reef flats and near-coastal saltlakes (including saltwork ponds) (Johnstone and Storr 1998).	Unlikely (no suitable habitat)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Limosa lapponica baueri	Bar-tailed godwit	VU	VU	Estuarine sand and mudflats and sandy beaches with loads of seaweed; also reef flats and near-coastal saltlakes (including saltwork ponds) (Johnstone and Storr 1998).	Unlikely (no suitable habitat)
Limosa lapponica menzbieri	Bar-tailed godwit	CR	CR	Mainly coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. Has also been recorded in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats (Higgins and Davies 1996).	Unlikely (no suitable habitat)
Limosa limosa	Black-tailed godwit	MI	MI	Tidal mudflats, estuaries, sewage ponds, shallow river margins, brackish or saline inland lakes, flooded pastures, airfields (Pizzey & Knight 2012).	Possible (potential habitat present)
Macronectes giganteus	Southern giant-petrel	MI	EN (MI)	Breeds on southern subantarctic and antarctic islands. May visit Western Australian waters from February to December (mostly June to September) (Johnstone and Storr 1998).	Unlikely (no suitable habitat)
Macronectes halli	Northern giant petrel	MI	VU (MI)	Breeds on subantarctic islands. May visit Western Australian water from February to September (Johnstone and Storr 1998).	Unlikely (no suitable habitat)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Merops ornatus	Rainbow bee-eater	-	MA	Open woodlands with sandy, loamy soil; sandridges, sandpits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves, rainforest, woodlands and golf courses (Pizzey & Knight 2012).	Possible (potential habitat present)
Motacilla cinerea	Grey wagtail	MI	MI	Mainly banks and rocks in fast-running fresh water habitats: rivers, creeks, streams and around waterfalls, both in forest and open country.	Unlikely (no suitable habitat)
Numenius madagascariensis	Eastern curlew	CR	CR (MI)	Mainly tidal mudflats; also reef flats, sandy beaches and rarely near-coastal lakes (including saltwork ponds) (Johnstone and Storr 1998).	Unlikely (no suitable habitat)
Numenius minutus	Little curlew	MI	MI	Dry grasslands, floodplains, margins of drying swamps; tidal mudflats, airfields, playing fields, crops, commercial saltfields, sewage ponds (Pizzey & Knight 2012).	Possible (potential habitat present)
Numenius phaeopus	Whimbrel	MI	MI	Estuaries, mangroves, tidal flats, coral cays, exposed reefs, flooded paddocks, sewage ponds, bare grasslands, sportsgrounds and lawns.	Possible (potential habitat present)
Oxyura australis	Blue-billed duck	P4	-	Mainly deeper freshwater swamps and lakes; occasionally saltlakes and estuaries freshened by flood waters (Johnstone and Storr 1998a).	Possible (marginal habitat present)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Pachyptila turtur subantarctica	Fairy prion	-	VU	Breeds on subantarctic islands and is presumed to frequent subtropical waters during non-breeding period (TSSC 2015).	Unlikely (no suitable habitat)
Pandion cristatus	Osprey	MI	MI	Coasts, estuaries, bays, inlets, islands, and surrounding waters; coral atolls, reefs, lagoons, rock cliffs, stacks (Pizzey & Knight 2012).	Unlikely (no suitable habitat)
Phaethon rubricauda	Red-tailed tropicbird	P4 (M	MI	Spend most of their lives at sea and rarely venture near land. This bird is normally found in tropical and subtropical seas around northern Australia. Though rarely seen in colder areas, a few pairs breed on Sugarloaf Rock, south of Cape Naturaliste (DPAW 2017b).	Unlikely (no suitable habitat)
Phalaropus lobatus	Red-necked phalarope	MI	MI	Shallow pools in commercial saltfields, tidal mudflats, beaches, saltmarshes, freshwater wetlands.	Possible (marginal habitat present)
Philomachus pugnax	Ruff	MI	MI	Fresh, brackish and saline wetlands; tidal mudflats, saltfields, sewage ponds (Pizzey & Knight 2012).	Possible (marginal habitat present)
Plegadis falcinellus	Glossy Ibis	MI	MI	Shallow and adjacent flats of freshwater lakes and swamps, also river pools, flooded samphire and sewage ponds.	Possible (marginal habitat present)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Pluvialis fulva	Pacific golden plover	MI	MI	Estuaries, mudflats, saltmarshes, mangroves; rocky reefs and stranded seaweed on ocean shores; margins of shallow open inland swamps; sewage ponds, short-grass paddocks, sportsgrounds, airfields, ploughed land (Pizzey & Knight 2012).	Possible (potential habitat present)
Pluvialis squatarola	Grey Plover	MI	MI	Mudflats, saltmarsh, tidal reefs and estuaries, rarely inland (Pizzey and Knight 2012).	Unlikely (no suitable habitat)
Puffinus carneipes	Flesh-footed shearwater	MI	MI	Marine species that breeds on islands off south coast from near Cape Leeuwin (Johnstone and Storr 1998).	Unlikely (no suitable habitat)
Recurvirostra novaehollandiae	Red-necked avocet	-	MA	Estuaries, tidal mudflats; fresh, brackish and salt swamps and lakes; claypans, commercial saltfields and sewage ponds (Pizzey & Knight 2012).	Possible (marginal habitat present)
Rostratula australis	Australian painted snipe	EN	EN	Mainly shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (Marchant and Higgins 1993).	Possible (marginal habitat present)
Rostratula benghalensis	Painted snipe	-	EN	Well vegetated shallows and margins of wetlands, dams, sewerage ponds, wet pastures, marshy areas, irrigation systems, lignum, tea tree scrub, open timber. Requires dense low cover (Morcombe 2004).	Unlikely (no suitable habitat)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Sterna dougallii	Roseate tern	MI	MI	Offshore waters, islands, coral reefs, sand cays, beaches, tidal inlets (Pizzey & Knight 2012).	Unlikely (no suitable habitat)
Sterna hirundo hirundo	n/a	MI	MI	Offshore waters, beaches, reefs, bays, estuaries, sandflats, saltfields, sewage ponds, freshwater wetlands.	Unlikely (no suitable habitat)
Sternula nereis nereis	Australian fairy tern	VU	VU	Sheltered blue-water seas close to land, estuaries (when free of silt) and near-coastal lakes (Johnstone and Storr 1998).	Unlikely (no suitable habitat)
Thalassarche cauta cauta	Shy albatross	VU	VU (MI)	Scarce visitor (late May to mid-October) to southwestern and western seas. Breeds on islands off Tasmania and south New Zealand (Johnstone and Storr 1998).	Possible (marginal habitat present)
Thalassarche cauta steadi	White-capped albatross	VU	VU (MI)	Scarce visitor (late May to mid-October) to southwestern and western seas. Breeds on islands off Tasmania and south New Zealand (Johnstone and Storr 1998).	Unlikely (no suitable habitat)
Thalassarche impavida	Campbell albatross	VU	VU (MI)	Scarce visitor to south western and western seas. Breeds on Campbell island.	Unlikely (no suitable habitat)
Thalassarche melanophris	Black-browed albatross	EN	VU (MI)	Seas of south and west coasts. Visitor to Western Australian mainland from January to early November (mostly May to September). Breeds on southern subantarctic and antarctic islands (Johnstone and Storr 1998).	Unlikely (no suitable habitat)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Thalassarche steadi	White-capped albatross	VU	VU (MI)	Marine species that occurs in subantarctic and subtropical waters. It reaches tropical areas associated with the cool Humboldt Current off South America (Marchant & Higgins 1990). The species has been noted in shelf-waters around breeding islands and over adjacent rises. During the non-breeding season, birds have been observed over continental shelves around continents. The species occurs both inshore and offshore (Marchant 1977) and enters harbours and bays (Jehl 1973). Birds gather to scavenge at commercial fishing grounds.	Unlikely (no suitable habitat)
Thalasseus bergii	Crested tern	MI	MI	Mainly blue-water seas (especially within 3 km of land), including southern estuaries in summer and autumn (when free of silt); also tidal creeks in north, but not penetrating far into larger estuaries.	Unlikely (no suitable habitat)
Thinornis rubricollis	Hooded plover	P4	VU	Margins and shallows of saltlakes, sandy and seaweedy beaches and estuaries; also dams (Johnstone & Storr 1998).	Possible (marginal habitat present)
Tringa brevipes	Grey-tailed tattler	P4 (M	MI	Tidal mud and reef flats, sheltered rocky coasts, stony and seaweedy beaches and sandpits, dry coral ridges (Abrolhos) and pebbly shores of near-coastal saltlakes (including saltwork ponds) (Johnstone and Storr 1998).	Unlikely (no suitable habitat)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Tringa glareola	Wood sandpiper	MI	MI	Mainly shallow fresh waters (lagoons, swamps, claypans, river pools, dams, bore overflows and sewage ponds); occasionally brackish swamps, rarely saltlakes and estuaries.	Possible (potential habitat present)
Tringa nebularia	Common greenshank	MI	MI	Shallow fresh waters (claypans, lagoons, swamps, river pools, dams and sewage ponds) and salt waters (estuaries, mangrove creeks, lakes, samphire flats, reef flats and saltwork ponds).	Possible (potential habitat present)
Tringa stagnatilis	Marsh sandpiper	MI	MI	Mainly shallow fresh or brackish waters: swamps, lakes, river pools, soaks, sewage ponds and bore overflows. Occasionally estuaries and salt ponds, and rarely coasts.	Possible (potential habitat present)
Tringa totanus	Common redshank	MI	MI	Sheltered coastal wetlands such as bays, river estuaries, lagoons, inlets and saltmarsh (with bare open flats and banks of mud or sand). Also found around saltlakes, freshwater lagoons, artificial wetlands and saltworks and sewage farms (Higgins & Davies 1996).	Possible (marginal habitat present)
Tyto novaehollandiae novaehollandiae	Australian masked owl	P3	-	Forests, open woodlands, farmlands with large trees. E.g. river red gums, adjacent cleared country, timbered watercourses, paperbark woodlands and caves (Pizzey & Knight 2012).	Possible (marginal habitat present)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Xenus cinereus	Terek sandpiper	MI	MI	Tidal mudflats, estuaries; shores and reefs of islands; coastal swamps, commercial saltfields (Pizzey & Knight 2012).	Unlikely (no suitable habitat)
Invertebrates					
Idiosoma sigillatum	Swan Coastal Plain shield-backed trapdoor spider	P3	-	Widely distributed in sandy areas on the Swan Coastal Plain and on Rottnest Island (Prince 2003).	Possible (suitable habitat present. multiple records nearby.)
Synemon gratiosa	Graceful sunmoth	P4	-	Coastal heathland on Quindalup dunes where it is restricted to secondary sand dunes due to the abundance of the preferred host plant Lomandra maritima. Banksia woodland on Spearwood and Bassendean dunes, where the second known host plant L. hermaphrodita is widespread (DEC 2011).	Possible (hostplant recorded)
Throscodectes xiphos	Stylet bush cricket	P1	-	Species poorly understood and documented. Known from Jandacot area, where it was originally collected in the axial leaf bases of grass trees (*Xanthorrhoea preissei*) (Invertebrate Solutions 2019).	Possible (suitable habitat present, single record narby, poor knowledge of species exists.)
Leioproctus contrarius	a short-tongued bee	P3	-	Life history and habits are poorly documented/ unknown. It has been recorded only on flowers of Goodeniaceae and possibly Lechenaultia stenosepala (Bamford 2003).	Unlikely (hostplants not recorded, one record in the wider area)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Westralunio carteri	Carter's freshwater mussel	VU	VU	Occurs in greatest abundance in slower flowing streams with stable sediments that are soft enough for burrowing amongst woody debris and exposed tree roots. Salinity tolerance quite low (Morgan et al. 2011).	Unlikely (no suitable habitat)
Neopasiphae simplicior	a short-tongued bee	EN	CR	This species of native bee has been collected on flowers of Goodenia filiformis, Lobelia tenuior, Angianthus preissianus and Velleia sp. (Houston 2000).	Unlikely (hostplants not recorded. one record in the wider area)
Mammals					
Hydromys chrysogaster	Rakali	P4	-	Areas with permanent water, fresh, brackish or marine. Likely to occur in all major rivers and most of the larger streams as well as bodies of permanent water in the lower south west (Christensen et al. 1985).	Possible (marginal habitat present)
Isoodon fusciventer	Quenda	P4	-	Dense scrubby, often swampy, vegetation with dense cover up to one metre high (DEC 2012a)	Recorded (potential habitat present)
Falsistrellus mackenziei	Western false pipistrelle	P4	-	High rainfall forests dominated by jarrah, karri, marri, and tuart. Occupies hollow logs for breeding and resting (Van Dyck and Strahan 2008). Also known to utilise Banksia woodland on the Swan Coastal Plain (Hosken and O'Shea 1995).	Unlikely (no suitable habitat)

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Notamacropus eugenii derbianus	Tammar wallaby	P4	-	Dry sclerophyll forest, Banksia spp. woodlands and shrublands, typically favouring dense low vegetation that provides dense cover (Christensen and Strahan 1983).	Unlikely (no suitable habitat)
Notamacropus irma	Western brush wallaby	P4	-	Dry sclerophyll forest, Banksia spp. woodlands and shrublands, typically favouring dense low vegetation that provides dense cover (Christensen and Strahan 1983).	Unlikely (no suitable habitat)
Dasyurus geoffroii	Chuditch	VU	VU	Wide range of habitats from woodlands, dry sclerophyll forests, riparian vegetation, beaches and deserts. Appears to utilise native vegetation along road sides in the wheatbelt (DEC 2012b).	Unlikely (no suitable habitat, now mostly restircted to darling scarp)
Myrmecobius fasciatus	Numbat	EN	EN	Generally dominated by Eucalyptus spp. that provide hollow logs and branches for shelter and termites for food (van Dyck & Strahan 2008).	Unlikely (no suitable habitat, locally extinct)
Pseudocheirus occidentalis	Western ringtail possum	CR	CR	On the Swan Coastal Plain in Agonis flexuosa woodlands and Agonis flexuosa/ Eucalyptus gomphocephala forests. Also Eucalyptus marginata forests (DBCA 2017).	Unlikely (locally extinct, no suitable habitat)
Setonix brachyurus	Quokka	VU	VU	On the mainland mostly dense streamside vegetation or shrubland and heath areas, particularly around swamps (Cronin 2007).	Unlikely (locally extinct, no suitable habitat)
Reptiles					

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Lerista lineata	Perth slider	P3	-	Sandy coastal heath and low scrubland. Banksia spp. woodland, Eucalyptus gomphocephala open woodland over deep sands, and coastal dunes immediately adjacent to the beach (Wilson and Swan 2017).	Possible (potential habitat present)
Neelaps calonotos	Black-striped snake	P3	-	Coastal and near-coastal dunes, sandplains supporting heathlands and Banksia spp. woodlands (Bush et al. 2002).	Possible (potential habitat present)

Note: CE=critically endangered, EN=endangered, VU=vulnerable, CD=conservation dependent, MI=migratory, OS=other specially protected, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4. Species recorded or considered to potentially occur within the site are shaded green.

Appendix D

Species List

Fauna List
Former Glen Iris Golf Course

Category	Status	Species name	Common name	Record type
Birds				
		Anthochaera carunculata	Red wattlebird	Sight
	EN	*Calyptorhynchus latirostris*	Carnaby's cockatoo	Sight
		Chenonetta jubata	Australian wood duck	Sight
		Corvus coronoides	Australian raven	Sight
		Cracticus tibicen	Australian magpie	Sight
		Fulica atra	Eurasian coot	Sight
		Grallina cyanoleuca	Magpie-lark	Call
		Phaps chalcoptera	Common bronzewing	Sight
		Phylidonyris novaehollandiae	New Holland honeyeater	Sight
		Rhipidura leucophrys	Willie wagtail	Sight
		Threskiornis spinicollis	Straw-necked ibis	Sight
		Trichoglossus haematodus	Rainbow lorikeet	Call
		Zosterops lateralis	Grey-breasted white-eye	Call
Crustacean				
	*	*Cherax destructor*	Yabby	Shell
Fish				
	*	*Cyprinus rubrofuscus*	Koi fish	Sight
Mammals				
	P4	*Isoodon fusciventer*	Quenda	Diggings
	*DP	*Oryctolagus cuniculus*	Rabbit	Scat, diggings
Reptiles				
		Chelodina colliei	Snake-necked turtle	Sight

Note: * denotes introduced fauna species, DP=declared pest under the BAM Act, EN=Endangered under the EPBC Act, P4=Priority 4 in WA

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Appendix E

Targeted Black Cockatoo Assessment

Targeted Black Cockatoo Assessment

Former Glen Iris Golf Course

Project No: EP20-009(13)

Prepared for ECP Acquisitions 6 Pty Ltd
June 2021

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Executive Summary

ECP Acquisitions 6 Pty Ltd engaged Emerge Associates (Emerge) to conduct a 'targeted' threatened black cockatoo assessment in the former Glen Iris Golf Course which comprises Lots 6 and 7 Glen Iris Drive, Lots 3, 509 and 512 Dean Road and Lot 139 Imlah Court in Jandakot (referred to herein as the 'site').

As part of the assessment a desktop assessment of relevant background information was completed and a field survey was undertaken across the site on 11 March and 12 November 2020. During the field survey an assessment of habitat for threatened black cockatoo species was completed.

Outcomes of the survey include the following:

- The site occurs within the modelled distribution of Carnaby's cockatoo and forest red-tailed black cockatoo, but outside of the modelled distribution of Baudin's cockatoo. The site is also within the breeding range of forest red-tailed black cockatoo. Therefore, the habitat in the site is most relevant to Carnaby's cockatoo and forest red-tailed black cockatoo.
- Carnaby's cockatoo were recorded in the site. Both Carnaby's cockatoo and forest red-tailed black cockatoo are likely to occur within the site.
- Forest red-tailed black cockatoo nests have been recorded within 6 km of the site at Bibra Lake and Murdoch, with the most recent breeding record occurring in spring 2020 (BirdLife Australia 2021). The site contains 11 habitat trees of which none contain hollows suitable for use by black cockatoos for breeding. Therefore, the site does not currently provide breeding habitat for forest red-tailed black cockatoo black cockatoo.
- White-tailed black cockatoo (likely Carnaby's cockatoo) and forest red-tailed black cockatoo roosts have been recorded at 42 locations within 12 km of the site (BirdLife Australia 2021). No roosts or evidence of roosting by any species of black cockatoo was recorded within the site. Tall native and non-native trees within the site represent suitable roosting habitat.
- Extensive areas of native and non-native vegetation that provides foraging habitat for Carnaby's cockatoo and forest red-tailed black cockatoo occurs immediately adjacent to the site and in the wider area. A total of 4.76 ha of foraging habitat for Carnaby's cockatoo was mapped within the site of which 0.96 ha (20%) provides a high value resource, 0.16 ha (14%) provides a moderate value resource and 3.13 ha (66%) provides a low value resource. A total of 4.88 ha of foraging habitat for forest red-tailed black cockatoo was mapped in the site of which 0.59 ha (12%) provides a high value resource, 0.39 ha (8%) provides a moderate value resource and 3.90 ha (80%) provides a low value resource.
- Overall habitat quality was scored at three out of ten (low quality) for Carnaby's cockatoo with foraging habitat being the highest scoring component. Overall black cockatoo habitat quality was scored at five out of ten (moderate quality) for forest red-tailed black cockatoo with foraging habitat being the highest scoring component.

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Former Glen Iris Golf Course

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Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
EPA	Environmental Protection Authority
DBCA	Department of Biodiversity, Conservation and Attractions
DPaW	Department of Parks and Wildlife (now DBCA)
DAWE	Department of Agriculture, Water and the Environment
WA Museum	Western Australian Museum

Table A2: Abbreviations – General terms

General terms	
EN	Endangered
VU	Vulnerable

Table A3: Abbreviations – Legislation

Legislation	
BC Act	*Biodiversity Conservation Act 2016*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*

Table A4: Abbreviations – units of measurement

Units of measurement	
DBH	Diameter at breast height
cm	Centimetre
ha	Hectare
km	Kilometre
m	Metre

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1 Introduction

1.1 Project background

Emerge Associates (Emerge) were engaged by ECP Acquisitions 6 Pty Ltd to characterise the black cockatoo habitat values within the former Glen Iris Golf Course which comprises Lots 6 and 7 Glen Iris Drive, Lots 3, 509 and 512 Dean Road and Lot 139 Imlah Court in Jandakot (referred to herein as the 'site'). These lots are located approximately 6 kilometres (km) south of the Perth Central Business District within the City of Cockburn.

The site is approximately 53.7 hectares (ha) in size and is surrounded by residential subdivision, with a railway to the north and Kwinana Freeway to the west. The site comprises two areas separated by Berrigan Drive. The location and extent of the site is shown in Figure 1.

1.2 Purpose and scope of work

The scope of work was specifically to conduct a terrestrial vertebrate fauna assessment to the standard required of a 'targeted' black cockatoo survey with reference to the Environmental Protection Authority's (EPA's) technical guidance (EPA 2020) and the *Environment Protection and Biodiversity Conservation Act* black cockatoo referral guidelines (DSEWPaC 2012b).

As part of this scope of work, the following tasks were undertaken:

- Desktop assessment of relevant background information pertaining to the site and surrounds, including database and literature searches for black cockatoos.
- Field survey to identify potential habitat for species of black cockatoo.
- An assessment of the quality of black cockatoo habitat within the site.
- Mapping of black cockatoo habitat.
- Documentation of the desktop assessment, survey methodology and results into a report.

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Former Glen Iris Golf Course

2 Background

2.1 Environmental Context

Landform and soils influence fauna habitat and species at regional and local scales. The site occurs on the Swan Coastal Plain, which is the geomorphic unit that characterises much of the Perth metropolitan area.

The Swan Coastal Plain is approximately 500 km long and 20 to 30 km wide and is roughly bound by the Indian Ocean to the west and the Darling Scarp to the east. Broadly the Swan Coastal Plain consists of two sedimentary belts of different origin. Its eastern side has formed from the deposition of alluvial material washed down from the Darling Scarp, while its western side is comprised of three dune systems that run roughly parallel to the Indian Ocean coastline (Seddon 2004). These dune systems, referred to as Quindalup, Spearwood and Bassendean associations, represent a succession of coastal deposition that has occurred since the late Quaternary period (approximately two million years ago) (Kendrick *et al.* 1991) and, as a result, they contain soils at different stages of leaching and formation.

Soil mapping by Gozzard (2011) places the site in the Bassendean dunes which are 'old, low hills of quartz sand with numerous interdunal swamps and lakes'.

Vegetation mapping by Heddle *et al.* (1980) indicates the site lies within the 'Bassendean complex - central and south' which is described as supporting 'woodland of *Eucalyptus marginata - Allocasuarina fraseriana - Banksia* spp. to low woodland of *Melaleuca* spp. and sedgelands on the moister sites' (Beard 1990).

2.2 Threatened fauna

Certain fauna taxa that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth level, fauna taxa may be listed as 'threatened' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Any action likely to have a significant impact on a taxon listed under the EPBC Act requires Ministerial approval.

In Western Australia fauna species may also be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act). It is an offence to 'take' or 'disturb' threatened fauna without Ministerial approval.

Threatened fauna species listed under the EPBC Act and/or BC Act are assigned a conservation status according to attributes such as population size and geographic distribution. Further information on threatened species and their categories is provided in Appendix A.

2.3 Black cockatoos

Three threatened species of black cockatoo occur in the south-west of WA (referred to herein collectively as 'black cockatoos'):

- *Calyptorhynchus latirostris* (Carnaby's cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Calyptorhynchus baudinii* (Baudin's cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo) which is listed as 'vulnerable' under the EPBC Act and the BC Act.

Black cockatoo habitat is conventionally separated into breeding, roosting and foraging categories:

- Black cockatoos nest in hollows that form in trees which are usually more than ~200 years old. 'Breeding habitat' comprises 'habitat trees' which are trees of a species known to support black cockatoo breeding and which either have a suitably large enough nest hollow or have a large enough diameter at breast height (DBH) to indicate that a suitable nest hollow could develop in time (DSEWPaC 2012a). A minimum DBH for a habitat tree is defined as ≥50 centimetres (cm) for most tree species used by black cockatoos and ≥30 cm for *Eucalyptus wandoo* (wandoo) and *Eucalyptus salmonophloia* (salmon gum) (DSEWPaC 2012a). Breeding habitat is also generally expected to be located within 7 km of food and water resources (Saunders 1990).
- During the day and most often overnight black cockatoos congregate in a tree or group of trees to rest. 'Roosting habitat' consists of groups or individual tall trees used for roosting. Roosts generally comprise the tallest trees in an area and can include native and non-native trees (DSEWPaC 2012a). They are often located within 6 km of water and food resources, with additional foraging ranges within 12 km (Shah 2006; DSEWPaC 2012a; Le Roux 2017). The use of a particular roost may vary depending on availability of food and water resources.
- Black cockatoos feed on the fruit and seeds of a range of native and non-native plants species. 'Foraging habitat' is vegetation that contains plant species known to be foraged on by black cockatoos.

Each black cockatoo species has a defined breeding season, with Baudin's cockatoo breeding from August/September to February/March and Carnaby's cockatoo breeding from July/August to January/February (DSEWPaC 2012a). Forest red-tailed black cockatoo breeds in October/November but may breed in March/April if there is good autumn rainfall (DSEWPaC 2012a). There is also evidence that forest red-tail black cockatoos breed throughout the year, with peaks in April – June and August – October (Johnstone *et al.* 2013).

2.4 Previous surveys

No previous black cockatoo surveys are known to have been undertaken within the site.

Emerge have previously completed a Level 1 fauna assessment within the site (Emerge Associates 2020a).

3 Methods

3.1 Desktop assessment

A search was conducted for records of black cockatoos and potential black cockatoo habitat mapping occurring within 10 km of the site using a range of publicly available regional studies and datasets. Detailed information on each dataset considered as part of the desktop review is provided in Appendix A.

3.2 Field survey

A zoologist and an ecologist from Emerge visited the site on 11 March and 12 November 2020 during the day to conduct the field survey.

Transects were traversed across the site and potential black cockatoo breeding, night roosting and foraging habitat was recorded. If observed, the presence of black cockatoos within or near the site was noted. Active searches for secondary evidence of breeding, roosting and foraging activity such as chew marks, branch clippings, droppings, moulted feathers and chewed fruit were conducted.

3.2.1 Breeding habitat

A 'habitat tree' was defined as a native eucalypt that is typically known to support black cockatoo breeding such as marri, jarrah, blackbutt, tuart, wandoo, salmon gum or to a lesser extent flooded gum, with a DBH ≥50 cm or DBH ≥30 cm for wandoo or salmon gum. As any tree that has a suitable hollow may provide breeding habitat for black cockatoos, other tree species were also considered to be habitat trees if they contained a suitable hollow.

To be suitable for use as breeding habitat by black cockatoos it was considered a hollow must:

- have an entrance opening of at least 10 cm but preferably 20-30 cm (Saunders *et al.* 1982; Groom 2010; Johnstone *et al.* 2013).
- be located at least 3 m from the ground (Saunders 1979b; Johnstone and Storr 1998; Groom 2010; Saunders 2014).
- be located in a trunk or branch that is generally large enough to contain a hollow that has a floor diameter of at least 40 cm and depth of 50-200 cm such that it could house an adult black cockatoo and nestlings (Saunders 1979a; Johnstone and Storr 1998; Saunders 2014; DPaW 2015).
- have vertical or near vertical orientation (Johnstone and Kirkby 2008; Johnstone *et al.* 2013).

Occasionally, native eucalypts were encountered that met DBH requirements but did not contain a trunk/branch of a sufficient size to support a hollow suitable for use by black cockatoos. For example, the tree may have been less than 3 m tall or had a trunk that forked between 1.3 m and 3 m in height and after the fork no limbs had a diameter such that they could contain a suitable hollow. These trees were not recorded as habitat trees as the likelihood they would ever form a suitable hollow was low.

Habitat trees were individually identified, and the attributes outlined in Table 1 were recorded for each tree.

Table 1: Attributes recorded for each habitat tree in the site

Attribute	Description
Tag	Unique identifier on a metal tag was nailed to tree
Image	Trees were individually photographed
GPS location	The location was recorded using a handheld GPS unit
Tree species	Species and common name were identified
Diameter at breast height (DBH) (cm)	DBH was measured at breast height (1.3 metres) using a diameter tape
Hollows potentially suitable for breeding by a black cockatoo	Number of hollows potentially suitable for breeding by a black cockatoo recorded (assessed from ground level only)

Hollows that appeared potentially suitable for use by a black cockatoo from the ground were further inspected using a drone and/or a pole-mounted camera. During the hollow inspection the internal dimensions of the hollow were confirmed, if possible, and an assessment was made for signs of use such as chew marks around the hollow entrance, nesting material, feathers or the presence of birds within the hollow.

All recorded habitat trees were assigned to a category listed in Table 2.

Table 2: Habitat tree categories

Category	Specifications
Nest	The tree contains a hollow used by black cockatoos for breeding as confirmed by records of black cockatoos, their eggs or fledglings or other evidence of recent nesting activity by black cockatoos
Potential nest	The tree contains one or more hollows that are suitable for use by black cockatoos as breeding habitat as confirmed by internal hollow inspection^ and evidence of use by an unidentified bird such as feathers, chew marks or nest material has been recorded within a hollow
Suitable hollow(s)	The tree contains one or more hollows that are suitable for use by black cockatoos as breeding habitat as confirmed by internal hollow inspection^
Potentially suitable hollow(s)	The tree contains or is suspected to contain one or more hollows that have the potential to be suitable for use by black cockatoos when either viewed from the ground or following an internal hollow inspection that was inconclusive^
No suitable hollow(s)	The tree does not contain hollow(s) that have the potential to be suitable for use by black cockatoos when viewed from the ground or contains hollows that were determined to be unsuitable for use by black cockatoos by internal inspection^

^Hollow determined to be suitable for use as breeding habitat by black cockatoos as listed above in Section 3.2.1.

3.2.2 Roosting habitat

The site was assessed for the presence of active or historical roosts and its potential to provide roosting habitat for black cockatoos.

During the field survey the site was searched for secondary evidence of roosting activity, such as branch clippings, droppings or moulted feathers. No dusk roost survey was undertaken as no signs indicative of roosting were recorded (refer Section 4.5). Groups of tall native and non-native trees, if present, were assumed to provide potential roosting habitat.

3.2.3 Foraging habitat

Foraging habitat was identified by comparing the vegetation within the site to literature on plant species known to provide food consumed by black cockatoos (Davies 1966; Saunders 1980; Johnstone and Storr 1998; Johnstone and Kirkby 1999; Groom 2011; Johnstone *et al.* 2011; DSEWPaC 2012a).

Foraging habitat was classified as providing a 'high', 'moderate' or 'low' value resource based on the proportion of 'primary' or 'secondary' food plants. Primary food plants were defined as those with historical and contemporary records of regular consumption by a black cockatoo species. Secondary food plants were defined as plants that black cockatoo species have been recorded consuming occasionally or that, based on their limited extent or agricultural origin, should not be considered a sustaining resource. Each patch of foraging habitat was assigned a percentage cover of primary and secondary food plants based on the preferences of each black cockatoo species. As it is not always possible to separate out food plants from non-food plants, mapped foraging habitat may also include vegetation comprising non-food plants. Classification of foraging habitat was completed such that the proportion of non-food plants was minimised as far as practicable. A list of plant species classified as primary or secondary food plants is provided as Appendix B.

Evidence of black cockatoo foraging, such as chewed fruits, was searched for within the site and allocated to a species where possible. The locations of black cockatoo foraging evidence within the site were recorded using a hand-held GPS unit.

3.3 Data analysis, presentation and mapping

Habitat trees were classified according to the scheme outlined in Table 2 and mapped on aerial imagery. A complete summary of the recorded attributes of habitat trees was compiled in a tabular format.

Foraging habitat was described according to the dominant flora species or vegetation type present and mapped on aerial photography with the boundaries interpreted from aerial photography and notes taken in the field. The value of each patch of foraging habitat was mapped for each species of black cockatoo likely to occur in the site. The proportions of high, moderate and low value foraging habitat mapped within the site are reported in Section 4.6.

3.3.1 Overall black cockatoo habitat quality

As part of environmental impact assessment and offset calculation, the Department of Agriculture, Water and the Environment (DAWE) requires that a score out of ten is provided for the overall quality of back cockatoo habitat (DAWE 2020). DAWE does not provide a methodology for scoring 'overall black cockatoo habitat quality' but instead specifies that an assessment of quality should be undertaken by an experienced technical expert (DSEWPaC 2012b).

Emerge have developed a method to provide a systematic assessment of overall black cockatoo habitat quality. The method assesses and scores the condition, context and stocking rate of breeding, roosting and foraging habitat separately and then provides an overall quality score out of ten based on the highest score determined for these categories of habitat. The assessment methodology is detailed in Appendix C.

3.4 Nomenclature and sources of information

Taxonomy and nomenclature of scientific and common names for fauna species follow the *Western Australian Museum* (WAM) *Checklist of the Terrestrial Vertebrate Fauna of Western Australia* (WAM 2020). Where common names were not provided by the Western Australian Museum (2019); (WAM 2020), these have been derived from other sources. Literature listed in Appendix A represent the main publications used to identify fauna species and habitats within the site.

3.5 Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in the EPA's document *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment* (EPA 2020) is provided in Table 3.

Table 3: Evaluation of survey methodology against standard constraints outlined in the EPA's Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020)

Constraint	Degree of limitation	Details
Level of survey	No limitation	A targeted black cockatoo habitat survey was undertaken. The level of survey and survey effort are considered adequate to assess the black cockatoo habitat values within the site.
Scope	No limitation	The survey focused on black cockatoo habitat within the site.
Proportion of fauna identified, recorded and/or collected.	No limitation	The survey focused on identifying habitat for species of black cockatoo rather. One of the two species of black cockatoo known to occur in the vicinity of the site was recorded during the survey. Habitat was reviewed across the entire site. All habitat trees and all potentially suitable hollows were assessed. The extent of foraging habitat was resolved such that the proportion of non-food plants within mapped habitat was less than 25%.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data.	No limitation	Adequate information was available from database searches and previous surveys to place habitat in context.
The proportion of the task achieved and further work which might be needed.	No limitation	The targeted black cockatoo assessment was achieved in its entirety.
Experience level of personnel	No limitation	The field survey was led by and the report authored by a qualified zoologist with over three years' experience. Technical review was undertaken by an ecologist with over ten years' experience in in environmental science in Western Australia.

Table 3: Evaluation of survey methodology against standard constraints outlined in the EPA's Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020) (continued)

Constraint	Degree of limitation	Details
Suitability of timing, weather and season	No limitation	Survey timing is not of great importance for a black cockatoo habitat assessment (with exception of detecting active nests). Nevertheless, the survey was undertaken within the main breeding season for all three species of black cockatoo (refer to Section 2.3).
Completeness	No limitation	The desktop assessment, field survey and targeted black cockatoo habitat assessment was completed comprehensively.
Spatial coverage and access	No limitation	Site coverage was comprehensive (track logged).
	No limitation	All parts of the site could be accessed as required.
Survey intensity	No limitation	The intensity of the survey was adequate given the size of the site.
Influence of disturbance	No limitation	The western portion of the site is modified due to historical disturbance associated with quarrying activities. However, no recent disturbance was noted that may have affected outcomes of the survey.
Adequacy of resources	No limitation	All resources required to perform the survey were available. The guidance currently available from Commonwealth and State agencies on the assessment of black cockatoo habitat is limited and relies heavily on technical experts preparing their own methodology. In response this assessment applies an internally developed methodology that is considered to provide a systematic and balanced characterisation of black cockatoo habitat.

4 Results

4.1 Desktop assessment

The results of the desktop assessment are summarised in Table 4, Table 5 and Table 6, and shown in Figure 2. Detailed information on each dataset considered as part of the desktop review is provided in Appendix A.

Table 4: Summary of black cockatoo background review

Category		Site context	Source
Species distribution		• Site is not within the modelled distribution of Baudin's cockatoo. • Site is within the modelled distribution of Carnaby's cockatoo but not within its breeding range. • Site is within the modelled distribution of forest red-tailed black cockatoo and within its known breeding range.	(DoEE 2016a, c, b)
Breeding sites		• No nesting records occur within the site. • Breeding of forest red-tailed black cockatoo has been recorded within 6 km of the site in Bibra Lake and Murdoch, with the most recent breeding in spring 2020.	BirdLife Australia database search (2021)
Carnaby's cockatoo breeding areas (12 km radius surrounding breeding sites)		• No confirmed or possible breeding areas intersect the site.	(Glossop *et al.* 2011)
Important bird areas for Carnaby's cockatoo		• None within the site. • None within 12 km of the site	(DPaW 2013)
Roost site		• None within the site. • 42 roost sites within 12 km of the site (see Table 5 and Table 6): o 18 associated with white-tailed^ black cockatoos only o 11 associated with forest red-tailed black cockatoos only o 13 associated with white^ and red-tailed black cockatoos	BirdLife Australia database search (2021), Peck *et al.* (2019)
Foraging habitat	White-tailed black cockatoo^	• No native foraging habitat mapped within the site. • Multiple parcels of potential native foraging habitat are mapped within the wider local area of the site. Extensive areas of potential native foraging habitat are mapped on the Darling Scarp approximately 16 km east of the site.	(Emerge Associates 2020b)
	White-tailed black cockatoo^	• No pine plantations are mapped within 12 km of the site	(Forest Products Commission 2020)
	Forest red-tailed black cockatoo	• No native foraging habitat mapped within the site. • Multiple parcels of potential native foraging habitat are mapped within the wider local area of the site. Extensive areas of potential native foraging habitat are mapped on the Darling Scarp approximately 16 km east of the site.	(Emerge Associates 2020c)

^Carnaby's and/or Baudin's cockatoo

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Table 5: White-tailed black cockatoos recorded in roosts within 12 km of the site (Birdlife Australia (2021); (Peck et al. 2019)

Roost ID	Year and number of individuals									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ARMCHAR001	NS	NS	NS	NS	NS	NS	NS	0	3	0
ARMFORR001	NS	NS	NS	0	0	18	0	0	NS	0
ARMHARR001	NS	0	0	NS	0	1	3	0	0	0
CANFERR001	NS	NS	NS	5	0	0	0	0	0	NS
CANWILR001	0	0	0	0	68	0	0	0	0	0
COCBANR001	NS	NS	NS	NS	NS	45	NS	0	20	0
COCBANR002	NS	NS	NS	NS	53	NS	0	0	0	0
COCBANR003	NS	NS	NS	NS	NS	NS	NS	6	16	0
COCCOOR005	NS	NS	NS	NS	NS	NS	NS	38	0	0
COCHAMR001	0	169	215	0	168	68	101	0	0	0
COCHAMR002	NS	NS	NS	NS	NS	263	194	0	369	506
COCMUNR003	NS	NS	NS	NS	NS	NS	0	0	0	3
COCSPER001	0	2	NS	323	NS	0	0	40	0	NS
COCSPER002	NS	5	0	NS	NS	0	24	0	NS	NS
GOSCNVR001	0	19	NS	NS	0	0	0	0	NS	80
GOSCNVR002	NS	NS	26	52	0	0	151	0	0	0
GOSSOUR002	NS	NS	NS	NS	NS	NS	50	0	0	0
KWIWANR001	63	0	0	1	0	0	0	0	0	NS
KWIWANR002	NS	NS	NS	0	0	0	0	5	0	0
KWIWANR004	NS	NS	NS	NS	NS	NS	NS	73	0	0
MELBATR001	8	0	0	0	0	0	0	0	0	0
MELKARR002	0	0	0	NS	0	55	0	0	0	0
MELLEER001	0	0	12	0	70	0	0	0	15	2
MELMURR001	700	60	142	127	234	24	78	0	227	249
MELWINR001	NS	56	81	70	41	0	21	0	0	12
MELWINR003	117	130	NS	NS	NS	0	7	54	64	108

Table 5: White-tailed black cockatoos recorded in roosts within 12 km of the site (Birdlife Australia (2021); (Peck et al. 2019) (continued)

Roost ID	Year and number of individuals									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
MELWINR004	0	0	0	0	2	0	0	0	0	NS
SEROAKR004	45	3	0	0	50	0	26	2	33	NS
SEROAKR007	NS	NS	NS	NS	NS	NS	NS	2	0	NS
SOUCOMR001	408	645	558	301	402	460	242	289	470	563
SOUSALR001	12	0	0	0	5	0	0	0	2	0

NS = not surveyed

Table 6: Forest red-tailed black cockatoos recorded in roosts within 12 km of the site (Birdlife Australia (2021); (Peck et al. 2019)

Roost ID	Year and number of individuals					
	2014	2015	2016	2017	2018	2019
ARMCHAR001	NS	NS	NS	11	16	0
CANRIVR001	NS	NS	6	11	7	16
CANROSR001	NS	NS	0	0	14	2
CANWILR001	4	7	7	5	16	82
COCBANR001	NS	0	NS	6	17	0
COCBANR002	3	NS	32	24	109	15
COCCOCR001	NS	NS	NS	NS	15	102
COCCOOR001	NS	13	0	0	8	0
COCCOOR003	NS	NS	57	6	71	33
COCMUNR001	92	NS	73	0	365	259
COCMUNR003	NS	NS	38	0	108	0
COCSPER003	NS	NS	NS	35	12	0
FREWHIR001	0	NS	0	38	29	28
GOSCNVR001	2	0	0	0	NS	0
GOSCNVR002	0	4	0	0	0	0
GOSGOSR004	19	NS	31	32	79	0

Table 6: Forest red-tailed black cockatoos recorded in roosts within 12 km of the site (Birdlife Australia (2021); (Peck et al. 2019) (continued)

Roost ID	Year and number of individuals					
	2014	2015	2016	2017	2018	2019
GOSSOUR002	NS	NS	0	36	208	15
MELLEER001	0	0	11	25	5	0
MELMURR001	199	33	125	209	441	214
MELWINR003	NS	0	0	0	1	0
MOSMOSR001	0	0	0	0	0	3
SOUCOMR001	0	0	0	0	0	1
SOUSALR001	2	0	0	0	8	0
VICWATR002	NS	NS	0	45	85	51

NS = not surveyed

4.2 General site conditions

The site is gently undulating and comprises sandy white-grey soils. Seven artificial lakes occur within the site that were sustained by irrigation at the time of the first survey day. During the second survey, only the southernmost lake contained water.

The site has been highly modified for use as a golf course and is dominated by non-native vegetation and unvegetated areas, with native vegetation present as individuals or small scattered patches. The artificial lakes are surrounded by either turf, riparian vegetation or planted trees and shrubs.

4.3 Species inventory

Approximately 20 Carnaby's cockatoo individuals were observed perching and foraging within trees in the central portion of the site during the day on 11 March 2020.

4.4 Breeding habitat

A total of 11 black cockatoo habitat trees were recorded within the site as shown in Figure 3.

All of the habitat trees were *Eucalyptus marginata* (jarrah). Two habitat trees were initially assessed to potentially contain suitable hollows based on the initial inspection from ground level. An internal hollow inspection determined that these hollows were not suitable for use by black cockatoos for breeding.

A summary of the habitat trees recorded within the site is provided in Table 7 and an inventory in Appendix D.

Table 7: Habitat trees recorded within the site

Category	No. trees	No. suitable hollows
Confirmed nest	0	-
Potential nest	0	-
Suitable hollow(s)	0	-
Potentially suitable hollow(s)	0	-
No suitable hollow(s)	11	0
Total	11	0

4.5 Roosting habitat

No roosts or secondary evidence of roosting were observed within the site during the survey. Native and non-native trees within the site have the potential to provide roosting habitat for black cockatoos.

4.6 Foraging habitat

A total of 4.76 ha of foraging habitat was mapped within the site for Carnaby's cockatoo and 4.88 ha for forest red-tailed black cockatoo as detailed in Table 9 and shown in Figure 4 and Figure 5. The foraging habitat occurs as scattered native trees and generally linear patches of native and non-native trees. The extent of foraging habitat by value category is detailed in Table 9.

Table 8: Foraging habitat quality

Foraging value	Black cockatoo species and foraging habitat area (ha)^	
	Carnaby's	Forest red-tailed
High	0.96 (20%)	0.59 (12%)
Moderate	0.67 (14%)	0.39 (8%)
Low	3.13 (66%)	3.90 (80%)
Total	4.76	4.88

^As the site is located outside of the range of Baudin's cockatoo foraging value for this species was not reported.

Primary food plants include *Banksia attenuata* (candlestick banksia), *Banksia menziesii* (firewood banksia) and **Tipuana tipu* (tipuana) whose fruits are consumed by Carnaby's cockatoo, jarrah and marri whose fruits are consumed by both Carnaby's cockatoo and forest red-tailed black cockatoo and **Melia azedarach* (Cape lilac) whose fruits are consumed by forest red-tailed black cockatoo. Secondary food plants include a range of species including *Allocasuarina fraseriana* (sheoak), *Casuarina obesa* (swamp sheoak), *Xanthorrhoea preissii* (grass tree), but predominantly comprise non-native eucalypt trees (**Eucalyptus* spp.).

A summary of dominant food plants within foraging habitat within the site is provided in Table 8.

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Table 9: Dominant primary and secondary black cockatoo foraging plants recorded within the site

Common name	Black cockatoo species and foraging habitat category	
	Carnaby's	Forest red-tailed
Candlestick banksia	Primary	Non-food
*Cape lilac	Secondary	Primary
**Eucalyptus* spp.	Secondary	Secondary
Firewood banksia	Primary	Non-food
Grass tree	Secondary	Non-food
Jarrah	Primary	Primary
Marri	Primary	Primary
Sheoak	Non-food	Secondary
Swan River blackbutt	Primary	Primary
*Swamp sheoak	Secondary	Non-food
*Tipuana	Primary	Non-food

*Denotes non-native species.

4.7 Overall quality

Overall habitat quality for Carnaby's cockatoo within the site scored three out of ten (low quality). The overall habitat quality for forest red-tailed black cockatoo scored five out of ten (moderate quality).

The outcome of the overall black cockatoo habitat quality assessment is provided in Table 10 and summarised in Table 11. The full results of the quality assessment are provided in Appendix E.

Table 10: Overall habitat quality assessment scores

Habitat category	Black cockatoo species and score	
	Carnaby's	Forest red-tailed
Breeding	N/A#	3
Roosting	1	1
Foraging	3	5
Overall Score	3	5

#No breeding habitat score was assigned as the site is located outside of the species breeding range. No habitat score was assigned for Baudin's cockatoo as the site is located outside of the species distribution range.

Table 11: Summary of attributes contributing to black cockatoo habitat quality scores

Habitat category	Quality component category	Black cockatoo species and attributes	
		Carnaby's	Forest red-tailed
Breeding	Site condition	N/A – site is located outside of its breeding range	The site supports habitat trees without suitable hollows.
	Site context		Three confirmed forest red-tailed black cockatoo nests occur within 6 km of the site and 2,236 ha of potential forest red-tailed foraging habitat is mapped within 6 km of the site.
	Species stocking rate		N/A – no evidence of breeding was recorded within the site.
Roosting	Site condition	The site supports potential roosting habitat.	The site supports potential roosting habitat.
	Site context	The site is located more than 1 km from a large white-tailed black cockatoo roost and more than 500 m from a small white-tailed black cockatoo roost.	The site is located more than 1 km from a large roost and more than 500 m from a small roost.
	Species stocking rate	N/A - no evidence of roosting was recorded within the site.	N/A - no evidence of roosting was recorded within the site.
Foraging	Site condition	The site supports foraging habitat that comprises 66% low value, 14% moderate value and 20% high value.	The site supports foraging habitat that comprises 80% low value, 8% moderate value and 12% high value.
	Site context	The site is located more than 6 km from a white-tailed black cockatoo nest.	Confirmed forest red-tailed black cockatoo nest sites occur within 6 km of the site, indicating the foraging habitat within the site may be used by the birds utilising the breeding sites.
	Species stocking rate	Limited evidence of Carnaby's cockatoo foraging was recorded. Nevertheless, it is likely that the species would forage in the site.	No evidence of foraging by forest red-tailed black cockatoos was recorded. Nevertheless, it is likely that the species would forage in the site.

5 Discussion

Carnaby's cockatoo was observed foraging in trees within the site. A record for Carnaby's cockatoo was not surprising as this species is routinely sighted across the Swan Coastal Plain and foraging habitat occurs within the site and local area.

No record of forest red-tailed black cockatoo was made during the two site visits. It is likely that forest red-tailed black cockatoo would also occur in the site as this species is similarly common within its range. Chance observation of highly mobile species like black cockatoos could require frequent surveillance. Given foraging evidence or other signs of presence may not persist in the environment for particular long periods, or necessarily be noted by surveyors on a given day, the lack of records for forest red-tailed black cockatoo should not be taken of indication that the species would not occur.

5.1 Breeding habitat

As the 11 habitat trees recorded in the site do not contain hollows suitable for use by black cockatoos for breeding, the site does not currently provide breeding habitat for any of the three species of black cockatoo. The habitat trees and other large trees within the site have the potential to form suitable hollows in the future. However, it will likely take many tens of years for hollows to form that are large enough to be suitable for use by black cockatoos for breeding.

As the site is located outside of the expected breeding distribution of Carnaby's cockatoo and Baudin's cockatoo, the potential for the future formation of breeding habitat is most relevant to forest red-tailed black cockatoo.

5.2 Roosting habitat

No signs of roosting were observed during the field survey and the BirdLife Australia dataset does not include any roost records in the site. Therefore, there is no reason to suspect that roosting currently occurs in the site. Nevertheless, the site contains tall trees and a water source that, in combination, comprise roosting habitat which could be used by black cockatoos.

5.3 Foraging habitat

The foraging habitat within the site was predominantly classified as providing low value to Carnaby's cockatoo and forest tailed black cockatoo. This is due to the high cover of secondary food plants, in particularly non-native eucalypts. While there are records of the consumption of non-native eucalypts by Carnaby's cockatoo and forest tailed black cockatoo (Groom 2011; DoEE 2017), these plants are arguably not as important food sources compared to primary food plants.

White-tailed black cockatoo (likely Carnaby's cockatoo) roosts occur within 6 km of the site and forest red-tailed black cockatoo roosts and nest sites occur within 6 km of the site. The foraging habitat within the site may be used by birds utilising the roosts and nesting in the local area. However, extensive areas of native and non-native vegetation that are dominated by primary food

plants for Carnaby's cockatoo and forest red-tailed black cockatoo occur immediately adjacent to the site and in the wider area and would provide a larger and higher value foraging resource.

5.4 Overall quality

Developing an objective scoring system for relative and to some extent subjective concept like quality can be challenging. An ecological concept like habitat may have multiple attributes, which may be independent, interdependent or contrasting with other attributes and which vary in relevance in response to the changing species requirements or environmental conditions. Consequently, overall 'quality' must be assessed holistically to be properly understood.

The three conventional categories of black cockatoo habitat are intrinsically linked in that breeding and roosting activity is directly related to the availability of foraging and watering resources surrounding nests or roosts (Saunders 1990; Shah 2006; Le Roux 2017). Black cockatoos can also move over large distances within their range to access breeding and foraging habitat and will not necessarily return to the same locations within a year or across years (Saunders 1980; Johnstone and Kirkby 2008; Johnstone *et al.* 2017; Peck *et al.* 2019). Therefore, evaluating the overall quality of black cockatoo habitat requires acknowledgement of the interrelationships between the three habitat categories and the potential for use more than one category of habitat to be relevant to a site.

The method used in the assessment of overall quality selects the highest score of the three habitat categories to represent overall habitat quality (refer Appendix C). Adopting the highest score from a habitat category within a site avoids over or under estimating habitat quality because the most important value always drives, or is reflected in, the overall score.

Foraging habitat was the highest scoring category of habitat within the site for both Carnaby's cockatoo and forest red-tailed black cockatoos as the site does not currently provide breeding habitat and while roost habitat is present, roosting is not suspected to occur.

The foraging habitat within the site was further dominated by lower value secondary food plants. As there were no significant contextual factors to increase quality for Carnaby's cockatoo, a score of three (low quality) was applied. However, forest red-tailed black cockatoo nests are recorded within 6 km of the site. A nearby nest is considered to increase the quality of foraging habitat (from an impact assessment perspective) as it indicates foraging resource is within range of a nest such that it could contribute to support breeding activity. Accordingly, the overall quality of forest red-tailed black cockatoo foraging was scored five out of ten (moderate quality).

6 Conclusions

The site occurs within the modelled distribution of Carnaby's cockatoo and forest red-tailed black cockatoo, but outside of the modelled distribution of Baudin's cockatoo. The site is also within the breeding range of forest red-tailed black cockatoo. Therefore, the habitat in the site is most relevant to Carnaby's cockatoo and forest red-tailed black cockatoo.

Carnaby's cockatoo were recorded in the site. Both Carnaby's cockatoo and forest red-tailed black cockatoo are likely to occur within the site.

Forest red-tailed black cockatoo nests have been recorded within 6 km of the site at Bibra Lake and Murdoch, with the most recent breeding record occurring in spring 2020 (BirdLife Australia 2021). The site contains 11 habitat trees of which none contain hollows suitable for use by black cockatoos for breeding. Therefore, the site does not currently provide breeding habitat for forest red-tailed black cockatoo black cockatoo.

White-tailed black cockatoo (likely Carnaby's cockatoo) and forest red-tailed black cockatoo roosts have been recorded at 42 locations within 12 km of the site (BirdLife Australia 2021). No roosts or evidence of roosting by any species of black cockatoo was recorded within the site. Tall native and non-native trees within the site represent suitable roosting habitat.

Extensive areas of native and non-native vegetation that provide foraging habitat for Carnaby's cockatoo and forest red-tailed black cockatoo occurs immediately adjacent to the site and in the wider area.

A total of 4.76 ha of foraging habitat for Carnaby's cockatoo was mapped within the site of which 0.96 ha (20%) provides a high value resource, 0.67 ha (14%) provides a moderate value resource and 3.13 ha (66%) provides a low value resource.

A total of 4.88 ha of foraging habitat for forest red-tailed black cockatoo was mapped in the site of which 0.59 ha (12%) provides a high value resource, 0.39 ha (8%) provides a moderate value resource and 3.90 ha (80%) provides a low value resource.

Overall habitat quality was scored at three out of ten (low) for Carnaby's cockatoo with foraging habitat being the highest scoring component.

Overall black cockatoo habitat quality was scored at five out of ten (moderate) for forest red-tailed black cockatoo foraging habitat being the highest scoring component.

Prepared for ECP Acquisitions 6 Pty Ltd Doc No.: EP20-009(13)--009B TAA| Version: B
Targeted Black Cockatoo Assessment
Former Glen Iris Golf Course

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Figures

Figure 1: Site Location

Figure 2: Black Cockatoo Habitat Context

Figure 3: Black Cockatoo Habitat Trees

Figure 4: Carnaby's Cockatoo Foraging Habitat

Figure 5: Forest Red-tailed Black Cockatoo Foraging Habitat

Figure 1: Site Location

Project: Targeted Black Cockatoo Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(13)--F14
Drawn: GAR
Date: 03/03/2021
Checked: MS
Approved: RAW
Date: 18/03/2021

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Scale: 1:10,000@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used

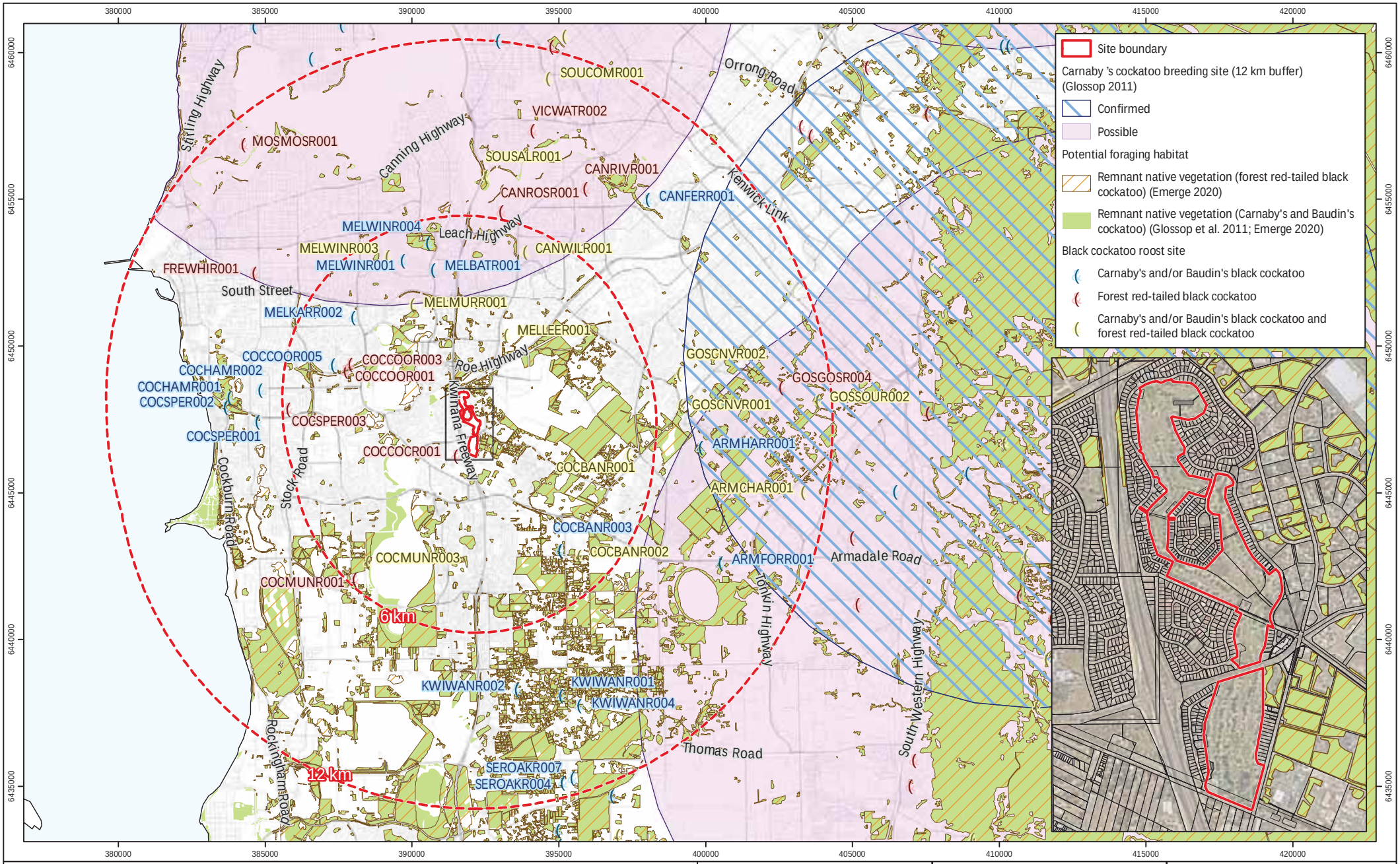

Figure 2: Black Cockatoo Habitat Context

Project: Targeted Black Cockatoo Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(13)--F15
Drawn: GAR
Date: 03/03/2021
Checked: MS
Approved: RAW
Date: 18/03/2021

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Kilometers
Scale: 1:170,000@A4
GDA 1994 MGA Zone 50

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Figure 3: Black Cockatoo Habitat Trees

Project: Targeted Black Cockatoo Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(13)--F16
Drawn: GAR
Date: 03/03/2021
Checked: MS
Approved: RAW
Date: 18/03/2021

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GDA 1994 MGA Zone 50

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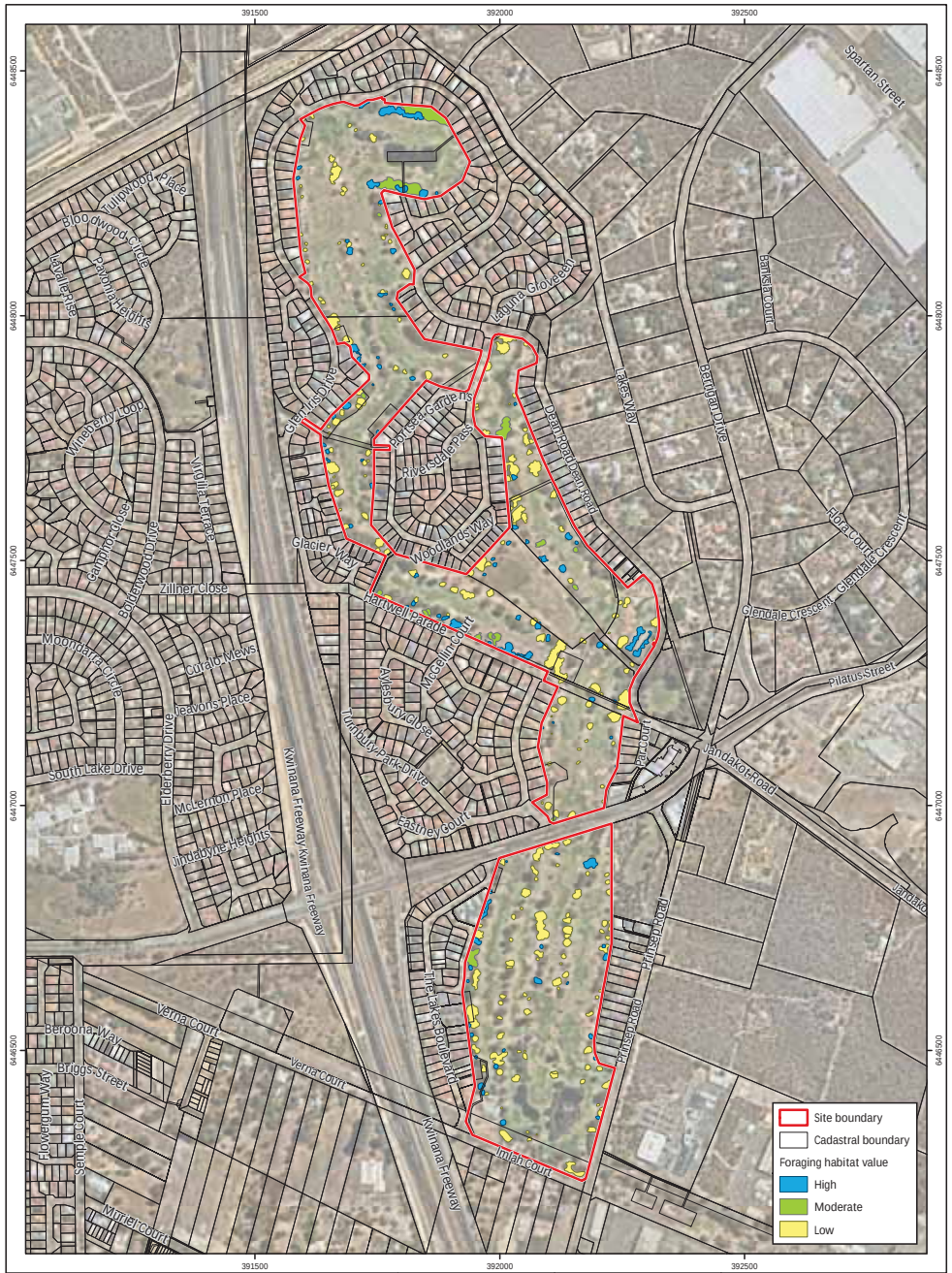

Figure 4: Carnaby's Cockatoo Foraging Habitat

Project: Targeted Black Cockatoo Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(13)--F17a
Drawn: RAW
Date: 21/06/2021
Checked: RAW
Approved: TAA
Date: 21/06/2021

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Metres
Scale: 1:10,000@A4
GDA 1994 MGA Zone 50

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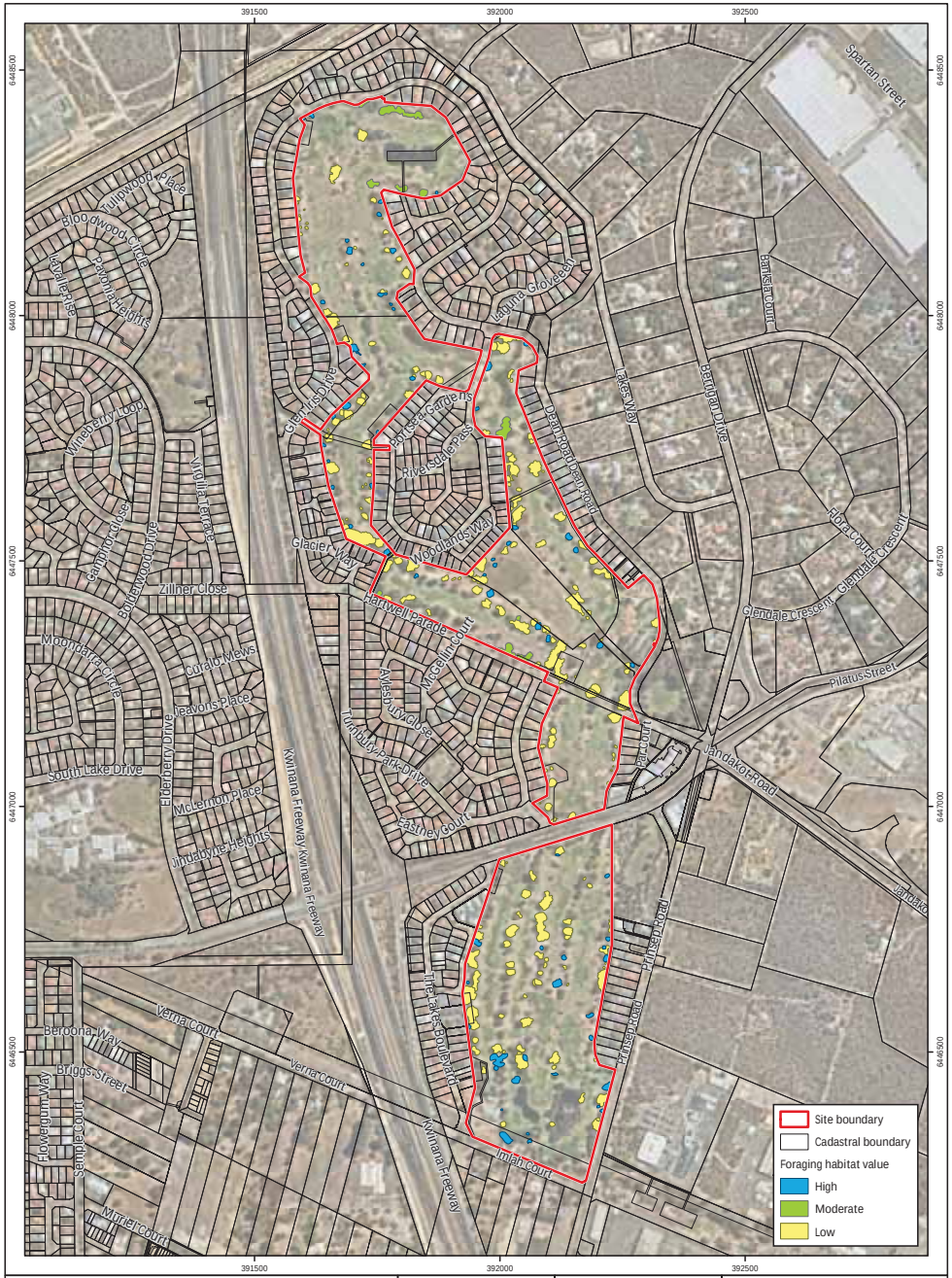

Figure 5: Forest Red-tailed Black Cockatoo Foraging Habitat

Project: Targeted Black Cockatoo Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(13)--F18a
Drawn: RAW
Date: 21/06/2021
Checked: RAW
Approved: TAA
Date: 21/06/2021

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Metres
Scale: 1:10,000@A4
GDA 1994 MGA Zone 50

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Appendix A

Additional Information

Conservation Significant Fauna

Threatened and priority fauna

Fauna species considered rare or under threat warrant special protection under Commonwealth and/or State legislation. At the Commonwealth level, fauna species can be listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as 'threatened', 'migratory' or 'marine' as described in Table 1.

Migratory species comprise birds recognised under international treaties including:

- *Japan Australia Migratory Bird Agreement 1981* (JAMBA)
- *China Australia Migratory Bird Agreement 1998* (CAMBA)
- *Republic of Korea-Australia Migratory Bird Agreement 2007* (ROKAMBA)
- *Bonn Convention 1979* (The Convention on the Conservation of Migratory Species of Wild Animals).

Fauna species listed as threatened and migratory are protected in Australia as 'matters of national environmental significance' (MNES) under the EPBC Act.

Table 1: Definitions of conservation significant fauna species pursuant to the EPBC Act

Conservation Code	Category
X	Threatened Fauna –Extinct There is no reasonable doubt that the last member of the species has died.
EW#	Threatened Fauna –Extinct in the Wild Taxa which are known only to survive in cultivation, captivity or as a naturalised population outside its past range, or taxa which have not been recorded in its known and/or expected habitat despite appropriate exhaustive surveys.
CR#	Threatened Fauna – Critically Endangered Taxa which are considered to be facing an extremely high risk of extinction in the wild.
EN#	Threatened Fauna – Endangered Taxa which are considered to be facing a very high risk of extinction in the wild.
VU#	Threatened Fauna – Vulnerable Taxa which are considered to be facing a high risk of extinction in the wild.
Migratory#	Migratory Fauna All migratory species that are: (i) native species; and (ii) from time to time included in the appendices to the Bonn Convention; and (b) all migratory species from time to time included in annexes established under JAMBA, CAMBA and ROKAMBA; and All native species from time to time identified in a list established under, or an instrument made under, an international agreement approved by the Minister.
Ma	Marine Fauna Species in the list established under s248 of the EPBC Act

#matters of national environmental significance (MNES) under the EPBC Act

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Additional Background Information

In Western Australia, fauna taxa may be classed as 'threatened', 'extinct', or 'specially protected' under the *Biodiversity Conservation Act 2016* (BC Act), which is enforced by Department of Biodiversity Conservation and Attractions (DBCA) (DBCA 2019a). The definitions of these categories are provided in Table 2.

Table 2: Definitions of specially protected fauna schedules under the BC Act (DBCA 2019a)

Category	Conservation Code	Definition
Threatened	CR	Critically endangered Threatened species considered to be facing an extremely high risk of extinction in the wild in the immediate future.
	EN	Endangered Threatened species considered to be facing a very high risk of extinction in the wild in the near future.
	VU	Vulnerable Threatened species considered to be facing a high risk of extinction in the wild in the medium-term future.
Extinct	EX	Extinct Species where there is no reasonable doubt that the last member of the species has died.
	EW	Extinct in the wild Species that is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form. Note that no species are currently listed as EW.
Specially protected	MI	Migratory species Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth Includes birds that subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds.
	CD	Species of special conservation interest (conservation dependent fauna) Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
	OS	Other specially protected species Fauna otherwise in need of special protection to ensure their conservation.

Fauna species that may be threatened or near threatened but lack sufficient information to be legislatively listed may be added to the DBCA's *Priority Fauna List* (DBCA 2018). Species listed under priorities 1-3 comprise possible threatened species that do not meet survey criteria or are otherwise data deficient. Species listed under priority 4 are those that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons (DBCA 2019a).

Priority fauna species are considered during State approval processes. Priority fauna categories and definitions are listed in Table 3 (DBCA 2019a).

Table 3: Definitions of priority fauna categories on DBCA's Priority Fauna List (DBCA 2019a)

Conservation Code	Category
P1	Priority 1 – Poorly known Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	Priority 2 – Poorly known Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	Priority 3 – Poorly known Species that are known from several locations and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	(a) Priority 4 – Rare species Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Priority 4 – Near Threatened Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Priority 4 – Other Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

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Additional Background Information

Black cockatoos

Three threatened species of black cockatoo occur on the Swan Coastal Plain (referred to herein collectively as 'black cockatoos'):

- *Calyptorhynchus latirostris* (Carnaby's cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Calyptorhynchus baudinii* (Baudin's cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo) which is listed as 'vulnerable' under the EPBC Act and the BC Act.

There are a range of regional studies and spatial datasets available which provide information on black cockatoo records and potential habitat mapping. These are detailed below.

Species distribution and breeding range

Broad-scale maps are available for the modelled distribution of Baudin's cockatoo, Carnaby's cockatoo and forest red-tailed black cockatoo (DSEWPaC 2011; DoEE 2016a, b).

The modelled distribution maps also include 'known breeding areas' and 'predicted breeding range' for Baudin's cockatoo and 'breeding range' and 'non-breeding range' for Carnaby's cockatoo.

No breeding range modelling is available for forest red-tailed black cockatoo but the species is known to breed mainly in the jarrah forest region (DBCA 2017) and in small populations on the Swan Coastal Plain within the Baldivis, Stake Hill, Lake McLarty and Capel area and increasingly in the Perth metropolitan area (DAWE 2020).

Breeding habitat

Department of Environment and Conservation (DEC, now Department of Biodiversity, Conservation and Attractions (DBCA)) and fauna experts, have identified and mapped Carnaby's cockatoo habitat on the Swan Coastal Plain and Jarrah Forest regions (Glossop *et al.* 2011). This dataset includes mapping of Carnaby's cockatoo breeding sites based on point records of breeding from a range of sources. Breeding sites were classified as 'confirmed' where eggs or chicks were recorded and 'possible' where observations relating to Carnaby's cockatoo breeding that did not include actual records of eggs or chicks (e.g. chewed hollows or records of breeding or nesting behaviour by an expert observer).

A 12 km buffer applies to each site to 'reflect the flexible use of these areas by cockatoos and to indicate the important zone for access to potential feeding habitat' (Glossop *et al.* 2011). Glossop *et al.* (2011) state that the areas mapped in the dataset are not a comprehensive record of Carnaby's cockatoo breeding and that many nesting sites are not known.

While this dataset only applies to Carnaby's cockatoo, the information it contains is also applicable for Baudin's cockatoo and forest red-tailed black cockatoo as they have similar breeding habitat requirements. That is, breeding sites that are suitable for Carnaby's cockatoo may also be suitable for

Baudin's cockatoo and forest red-tailed black cockatoo, if located within their distribution/breeding ranges.

BirdLife Australia also maintain a database of confirmed black cockatoo breeding sites which is accessible via a paid search system. BirdLife Australia have advised that their database is comprised of data collected during surveys by staff and volunteers of which most (>99%) surveys are of Carnaby's cockatoo. They have also advised that the dataset is not comprehensive and that an absence of known nests does not necessarily indicate a lack of breeding activity.

The Carnaby's cockatoo recovery plan also identifies 13 'important bird areas' for Carnaby's cockatoo, which are identified as 'sites of global bird conservation importance' (DPaW 2013). These 'important bird areas' comprise sites supporting at least 20 breeding pairs or 1% of the population regularly utilising an area in the non-breeding part of the range.

Confirmed roost sites

BirdLife Australia undertakes annual monitoring of black cockatoo overnight roost sites as part of the annual 'Great Cocky Count' community-based survey. Information gathered from these monitoring events provides roost locations and recorded black cockatoo numbers (Peck *et al.* 2019).

Native foraging habitat

Glossop et al. (2011) also mapped 'areas requiring investigation as Carnaby's cockatoo feeding habitat' for the Swan Coastal Plain and Jarrah Forest regions, based on regional vegetation mapping that may contain plant species known to be foraged upon by Carnaby's cockatoo. Note that this dataset does not include observations or point records of Carnaby's cockatoo feeding. This dataset represents areas of vegetation that may potentially provide foraging habitat for Carnaby's cockatoo.

Given this dataset was created in 2011 and in order to account for clearing of native vegetation that has occurred since this time, Emerge have updated this dataset using the current native vegetation extent as provided by DPIRD (2019a) to only show potential foraging habitat that currently exists (Emerge Associates 2020a).

Pine plantations also provide an important food source for Carnaby's cockatoo, but were not included in the Glossop et al. (2011) dataset. Mapping of pine plantations is available from the Forest Products Commission (Forest Products Commission 2020).

The Glossop et al. (2011) dataset is broadly applicable to other black cockatoos as many plant species that are foraged upon by Carnaby's cockatoo are also consumed by Baudins' cockatoo (e.g. fruit of *Banksia* spp., *Corymbia calophylla* (marri) and *Eucalyptus marginata* (jarrah)) and forest red-tailed black cockatoo (e.g. jarrah and marri fruit). However, using the Glossop et al. (2011) potential foraging habitat dataset for forest red-tailed cockatoos likely overestimates available foraging habitat as it includes multiple plant species that are not consumed by this species (e.g. *Banksia* spp.), and to a lesser extent the foraging value is also over-estimated for Baudin's cockatoo.

Emerge Associates (2020b) have used a similar methodology to Glossop et al. (2011) to define potential foraging habitat for forest-red tailed cockatoos. Specifically, DBCA (2019b) regional vegetation complex mapping has been used to determine which areas of remnant vegetation

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support plant species known to be foraged upon by forest red-tailed cockatoos, including *Allocasuarina fraseriana* (sheoak), *Corymbia calophylla* (marri), *Eucalyptus gomphocephala* (tuart) and *Eucalyptus marginata* (jarrah). Where these vegetation complexes intersect remnant vegetation mapped by DPIRD (2019b) they were considered to represent potential foraging habitat for forest red-tailed cockatoos.

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Appendix B

Black Cockatoo Foraging Plants

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Acacia baileyana	Cootamundra wattle	Secondary			Groom 2011
Acacia pentadenia	Karri wattle	Secondary			Groom 2011
Acacia saligna	Orange wattle	Secondary			Groom 2011
Agonis flexuosa	Peppermint tree	Secondary			Groom 2011
Allocasuarina fraseriana	Sheoak		Secondary	Secondary	Johnstone & Storr 1998; Johnstone et al. 2010; Johnstone 2017; DoEE 2017
Allocasuarina spp.		Secondary		Secondary	Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Anigozanthos flavidus	Tall kangaroo paw		Secondary		Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017
Araucaria heterophylla	Norfolk island pine	Secondary			Groom 2011; DoEE 2017
Banksia ashbyi	Ashby's banksia	Primary	Secondary		Saunders 1980; Groom 2011; DoEE 2017
Banksia attenuata	Slender banksia	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia baxteri	Baxter's banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia carlinoides	Pink dryandra	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia coccinea	Scarlet banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia dallanneyi	Couch honeypot dryandra	Primary	Secondary		Groom 2011; DoEE 2017
Banksia ericifolia	Heath-leaved banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia fraseri		Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia gardneri	Prostrate banksia	Primary	Secondary		Groom 2011; DoEE 2017
Banksia grandis	Bull banksia	Primary	Secondary		Saunders 1980; Johnstone & Storr 1998; Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia hookeriana	Hooker's banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia ilicifolia	Holly banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; Johnstone & Storr 1998; DoEE 2017
Banksia kippistiana		Primary	Secondary		Groom 2011; DoEE 2017
Banksia leptophylla		Primary	Secondary		Groom 2011; DoEE 2017
Banksia lindleyana	Porcupine banksia	Primary	Secondary		Johnstone et al. 2010; DoEE 2017

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Banksia littoralis	Swamp banksia	Primary	Secondary		Saunders 1980; Groom 2011Johnstone & Storr 1998; Johnstone et al. 2010; DoEE 2017
Banksia menziesii	Firewood banksia	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia mucronulata	Swordfish dryandra	Primary	Secondary		Groom 2011; DoEE 2017
Banksia nivea	Honeypot dryandra	Primary	Secondary		Saunders 1980; Groom 2011; DoEE 2017
Banksia nobilis	Golden dryandra	Primary	Secondary		Saunders 1980; Groom 2011; DoEE 2017
Banksia praemorsa	Cut-leaf banksia	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia prionotes	Acorn banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia prolata		Primary	Secondary		Johnstone et al. 2010; DoEE 2017
Banksia quercifolia	Oak-leaved banksia	Primary	Secondary		Johnstone & Storr 1998; Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia sessilis	Parrot bush	Primary	Secondary		Saunders 1980; Johnstone & Storr 1998; Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia speciosa	Showy banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia spp.		Primary	Secondary		Saunders 1979; DSEWPaC 2012; DoEE 2017
Banksia squarrosa	Pingle	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
Banksia tricuspis	Pine banksia	Primary	Secondary		Groom 2011; DoEE 2017
Banksia undata	Urchin dryandra	Primary	Secondary		Groom 2011; DoEE 2017
Banksia verticillata	Granite banksia	Primary	Secondary		Saunders 1980; Groom 2011; DoEE 2017
Brassica campestris	Canola	Secondary			Groom 2011; DoEE 2017
Callistemon spp.		Secondary	Secondary		Johnstone et al. 2010; DoEE 2017
Callistemon viminalis	Captain cook bottlebrush	Secondary			Groom 2011
Callitris sp.		Secondary			Johnstone et al. 2010; Groom 2011
Carya illnoinensis	Pecan	Primary	Secondary		Johnstone et al. 2010; Groom 2011; Groom 2014; DoEE 2017
Casuarina cunninghamiana	River sheoak	Secondary			Groom 2011
Citrullus lanatus	Pie or afghan melon	Secondary			Johnstone et al. 2010; Groom 2011

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Corymbia calophylla	Marri	Primary	Primary	Primary	Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017; Johnstone 2017; Saunders 1979; Johnstone & Kirkby 2008
Corymbia citriodora	Lemon scented gum	Secondary	Secondary	Secondary	Johnstone et al. 2010; DSEWPaC 2012; Groom 2011; Johnstone 2017
Corymbia ficifolia	Red flowering gum	Secondary			Groom 2011
Corymbia haematoxylon	Mountain marri	Secondary		Secondary	Groom 2011; DoEE 2012; DoEE 2017
Corymbia maculata	Spotted gum	-	-	-	-
Darwinia citriodora	Lemon-scented darwinia	Secondary	Secondary		Groom 2011; Johnstone et al. 2010
Diospryros sp.	Sweet persimmon	Secondary	Secondary		Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Eremophila glabra	Tarbush	Secondary			Groom 2011
Erodium aureum		Secondary			Groom 2011
Erodium botrys	Long storksbill	Secondary	Secondary		Groom 2011; Johnstone & Storr 1998; Johnstone et al. 2010
Erodium spp.		Secondary	Secondary		Johnstone et al. 2010; DoEE 2017
Eucalyptus accedens	Powderbark	-	-	-	-
Eucalyptus caesia	Silver princess	Secondary		Secondary	Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017; Johnstone 2017
Eucalyptus camaldulensis	River red gum			Secondary	DoEE 2012; DoEE 2017
Eucalyptus decipiens	Red heart/moit			Secondary	Johnstone 2017
Eucalyptus diversicolor	Karri			Primary	Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017; Johnstone & Storr 1998
Eucalyptus erythrocorys	Illyarrie	Secondary		Secondary	DSEWPaC 2012; DoEE 2017; Johnstone 2017, Johnstone et al. 2010
Eucalyptus globulus	Tasmanian blue gum	-	-	-	-
Eucalyptus gomphocephala	Tuart	Secondary		Secondary	Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Eucalyptus grandis	Flooded gum, rose gum			Secondary	DoEE 2012; DoEE 2017

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Eucalyptus lehmannii	Bushy yate			Secondary	Johnstone 2017
Eucalyptus leucoxylon	Yellow gum	Secondary			Groom 2014
Eucalyptus longicornis	Red morrell	-	-	-	-
Eucalyptus loxophleba	York gum	Secondary			Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Eucalyptus marginata	Jarrah	Primary	Secondary	Primary	Saunders 1980; Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017; Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone 2017
Eucalyptus megacarpa	Bullich	-	-	-	-
Eucalyptus occidentalis	Swamp yate	-	-	-	-
Eucalyptus patens	Blackbutt	Primary		Primary	Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017; Johnstone 2017; Groom 2011
Eucalyptus pleurocarpa	Tallerack	Secondary			Groom 2011
Eucalyptus preissiana	Bell-fruited mallee	Secondary			Groom 2011
Eucalyptus robusta	Swamp mahogany	Secondary			Johnstone et al. 2010; Groom 2011
Eucalyptus rudis	Flooded gum	-	-	-	-
Eucalyptus salmonophloia	Salmon gum	Primary			Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DSEWPaC 2012; DoEE 2017
Eucalyptus salubris	Gimlet	-	-	-	-
Eucalyptus staeri	Albany blackbutt			Secondary	Johnstone & Storr 1998
Eucalyptus todtiana	Coastal blackbutt	Secondary			Saunders 1980; Johnstone et al. 2010; Groom 2011; Johnstone & Kirkby 2008
Eucalyptus wandoo	Wandoo	Primary	Secondary	Primary	Saunders 1980; Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Ficus sp.	Fig	Secondary			Groom 2011
Grevillea armigera	Prickly toothbrushes	Primary			Groom 2011
Grevillea bipinnatifida	Fuschia grevillea	Primary			Groom 2011

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Grevillea hookeriana	Red toothbrushes	Primary			Groom 2011
Grevillea hookeriana subsp. apic	Black toothbrushes	Primary			Groom 2011
Grevillea paniculata	Kerosene bush	Primary			Groom 2011
Grevillea paradoxa	Bottlebrush grevillea	Primary			Groom 2011
Grevillea petrophiloides	Pink poker	Primary			Groom 2011
Grevillea robusta	Silky oak	Primary			Johnstone et al. 2010; Groom 2011
Grevillea spp.		Primary			Saunders 1979; Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017
Grevillea wilsonii	Native fuchsia		Secondary		Johnstone et al. 2010
Hakea auriculata		Primary			Saunders 1980; Groom 2011
Hakea candolleana		Primary			Groom 2011
Hakea circumalata	Coastal hakea	Primary			Groom 2011
Hakea commutata		Primary			Groom 2011
Hakea conchifolia	Shell-leaved hakea	Primary			Groom 2011
Hakea costata	Ribbed hakea	Primary			Groom 2011
Hakea cristata	Snail hakea	Primary	Secondary		Groom 2011; Johnstone et al. 2010
Hakea cucullata	Snail hakea	Primary			Groom 2011
Hakea cyclocarpa	Ramshorn	Primary			Saunders 1980; Groom 2011
Hakea eneabba		Primary			Groom 2011
Hakea erinacea	Hedgehog hakea	Primary	Secondary		Johnstone et al. 2010; Groom 2011
Hakea falcata	Sickle hakea	Primary			Groom 2011
Hakea flabellifolia	Fan-leaved hakea	Primary			Groom 2011
Hakea gilbertii		Primary			Saunders 1980; Groom 2011
Hakea incrassata	Golfball or marble hakea	Primary			Johnstone et al. 2010; Groom 2011
Hakea lasiantha	Woolly flowered hakea	Primary			Johnstone et al. 2010; Groom 2011
Hakea lasianthoides		Primary	Secondary		Johnstone et al. 2010; Groom 2011
Hakea laurina	Pin-cushion hakea	Primary			Johnstone et al. 2010; Groom 2011
Hakea lissocarpha	Honeybush	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011
Hakea marginata			Secondary		Johnstone et al. 2010

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Hakea megalosperma	Lesueur hakea	Primary			Groom 2011
Hakea multilineata	Grass leaf hakea	Primary			Groom 2011
Hakea neospathulata		Primary			Groom 2011
Hakea obliqua	Needles and corks	Primary			Saunders 1980; Groom 2011
Hakea oleifolia	Dungyn	Primary			Groom 2011
Hakea pandanicarpa subsp. crassifolia	Thick-leaved hakea	Primary			Groom 2011
Hakea petiolaris	Sea urchin hakea	Primary			Groom 2011
Hakea polyanthema		Primary			Groom 2011
Hakea preissii	Needle tree	Primary			Groom 2011
Hakea prostrata	Harsh hakea	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011
Hakea psilorrhyncha		Primary			Groom 2011
Hakea ruscifolia	Candle hakea	Primary	Secondary		Saunders 1980; Groom 2011; Johnstone et al. 2010
Hakea scoparia	Kangaroo bush	Primary			Groom 2011
Hakea smilacifolia		Primary			Groom 2011
Hakea spp.		Primary	Secondary		Saunders 1979; DSEWPaC 2012; DoEE 2017
Hakea stenocarpa	Narrow-fruited hakea	Primary	Secondary		Johnstone et al. 2010; Groom 2011
Hakea sulcata	Furrowed hakea	Primary			Groom 2011
Hakea trifurcata	Two-leaved hakea	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011
Hakea undulata	Wavy-leaved hakea	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011
Hakea varia	Variable-leaved hakea	Primary	Secondary		Saunders 1980; Groom 2011
Harpephyllum caffrum	Kaffir plum			Secondary	Johnstone 2017
Helianthus annuus	Sunflower	Secondary			Johnstone et al. 2010; Groom 2011
Hibiscus sp.	Hibiscus	Secondary			Groom 2011
Isopogon scabriusculus		Secondary			Groom 2011
Jacaranda mimosifolia	Jacaranda	Secondary	Secondary		Johnstone et al. 2010; Groom 2011

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Jacksonia furcellata	Grey stinkwood	Secondary			Groom 2011
Kingia australis	Kingia		Secondary		Johnstone et al. 2010
Lambertia inermis	Chittick	Secondary			Johnstone & Storr 1998; Groom 2011
Lambertia multiflora	Many-flowered honeysuckle	Secondary			Saunders 1980; Groom 2011
Liquidamber styraciflua	Liquid amber	Primary		Secondary	Johnstone et al. 2010; Groom 2011; Groom 2014; Personal observation
Lupinus sp.	Lupin	Secondary			Saunders 1980; Groom 2011
Macadamia integrifolia	Macadamia	Primary	Secondary		Johnstone et al. 2010; Grooms 2011; Groom 2014
Malus domestica	Apple	Secondary	Secondary		Johnstone et al. 2010; Johnstone & Storr 1998; DSEWPaC 2012; DoEE 2017; Groom 2011
Melaleuca leuropoma		Secondary			Saunders 1980; Groom 2011
Melia azedarach	Cape lilac or white cedar	Secondary		Primary	Johnstone et al. 2010; Groom 2011
Mesomeleana spp.		Secondary			Johnstone et al. 2010; Groom 2011
Olea europea	Olive			Secondary	Johnstone 2017
Persoonia longifolia	Snottygobble			Secondary	Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017
Pinus canariensis	Canary island pine	Primary			Johnstone et al. 2010; Groom 2011
Pinus caribea	Caribbean pine	Primary			Johnstone et al. 2010; Groom 2011
Pinus pinaster	Pinaster or maritime pine	Primary			Groom 2011
Pinus radiata	Radiata pine	Primary	Secondary		Johnstone et al. 2010; Groom 2011
Pinus spp.		Primary	Secondary		Johnstone & Storr 1998; Saunders 1979; Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017
Protea 'Pink Ice'		Secondary			Groom 2011
Protea repens		Secondary			Groom 2011
Protea spp.		Secondary			Johnstone et al. 2010

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Prunus amygdalus	Almond tree	Secondary			Johnstone & Storr 1998; Johnstone et al. 2010; Groom 2011; DoEE 2017
Pyrus communis	European pear		Secondary		Johnstone & Storr 1998; Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017
Quercus spp.	Oak		Secondary		Johnstone et al. 2010
Raphanus raphanistrum	Wild radish	Secondary			Groom 2011; DoEE 2017
Reedia spathacea			Secondary		Johnstone et al. 2010
Rumex hypogaeus	Doublegee	Secondary			Saunders 1980
Stenocarpus sinuatus		Secondary			Johnstone et al. 2010
Syzygium smithii	Lilly pilly	Secondary			Groom 2014
Tipuana tipu	Tipu or rosewood tree	Primary			Groom 2011, Groom 2014
Xanthorrhoea preissii	Grass tree	Secondary	Secondary		Groom 2011; Johnstone et al. 2010
Xylomelum occidentale	Woody pear	Secondary			Groom 2014

CBC=Carnaby's cockatoo, BBC=Baudin's cockatoo and FRTBC=Forest red-tailed black cockatoo

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Appendix C

Black Cockatoo Habitat Quality Assessment (Emerge 2021)

Introduction

As part of environmental impact assessment and offset calculation, the Department of Agriculture, Water and the Environment (DAWE) requires that a score out of ten is provided for the overall quality of back cockatoo habitat within a site (DAWE 2020). DAWE does not provide a methodology for scoring habitat quality, specifying instead that an assessment of quality should be undertaken by an experienced technical expert (DSEWPaC 2012).

Emerge Associates (Emerge) have developed this method to provide a systematic assessment of overall black cockatoo habitat quality. Black cockatoo habitat is conventionally separated into breeding, roosting and foraging categories. Our method assesses and scores the quality of breeding, roosting and foraging habitat separately and then provides an overall quality score (out of ten) based on the highest score determined for the respective habitat categories.

Methodology

The International Organization for Standardization defines 'quality' as the "*degree to which a set of inherent characteristics fulfils requirements*" (ISO 9000 2020). Developing an objective scoring system for quality is therefore challenging, as quality is both relative and, to some extent, subjective. An ecological value like habitat may also have a wide range of characteristics, with varying relevance to the requirements of a species and that may be independent, interdependent or contrasting with other characteristics, such that habitat quality must be assessed holistically to be properly understood.

The three categories of black cockatoo habitat are intrinsically linked in that breeding and roosting activity is directly related to the availability of foraging and watering resources surrounding nests or roosts (Saunders 1990; Shah 2006; Le Roux 2017). Black cockatoos can also move over large distances within their range to access breeding and foraging habitat and will not necessarily return to the same locations within a year or across years (Saunders 1980; Johnstone and Kirkby 2008; Johnstone *et al.* 2017; Peck *et al.* 2019). Therefore, evaluating the overall quality of black cockatoo habitat requires acknowledgement of the relationships between the different habitat categories and the potential for use of all habitats within a site, given the condition of each habitat, the sites' location and the history of use of habitat within a site by black cockatoos.

While breeding, roosting and foraging habitat are interrelated, we suggest that the different habitat categories should not be scored cumulatively as this can overestimate quality. That is, if a site contains multiple categories of habitat it does not necessarily contain greater quality habitat. For example, a site that contains a roost is not necessarily of higher overall quality if it also contains breeding habitat.

Alternatively, averaging the scores from all three habitat categories can act to underestimate habitat, since certain types of habitat are recorded less frequently than others and therefore their absence would act to devalue quality. For example, the likelihood of recording a roost is generally low compared to recording foraging or breeding habitat but a site that lacks a roost is not necessarily of lower overall quality.

EMERGE_BC_Quality_Appendix (V007)
Black Cockatoo Habitat Quality Assessment

Hence, our scoring system selects the highest habitat category score to represent overall habitat quality. Adopting the highest score from any habitat category within a site avoids over or under estimating habitat quality because the most important value always drives, or is reflected in, the overall score.

To provide a score for each habitat category, the following three 'quality components' are considered as recommended by DAWE (DAWE 2020):

- Site condition which is the "*condition of a site in relation to the ecological requirements of a threatened species or ecological community. This includes considerations such as vegetation condition and structure, the diversity of habitat species present, and the number of relevant habitat features".*
- Site context which is the "*relative importance of a site in terms of its position in the landscape, taking into account the connectivity needs of a threatened species or ecological community. This includes considerations such as movement patterns of the species, the proximity of the site in relation to other areas of suitable habitat, and the role of the site in relation to the overall population or extent of a species or community*".
- Species stocking rate which is the "*usage and/or density of a species at a particular site…It includes considerations such as survey data for a site in regards to a particular species population or, in the case of a threatened ecological community this may be a number of different populations. It also includes consideration of the role of the site population in regards to the overall species population viability or community extent*".

A habitat quality assessment should aim to combine current information on the status of black cockatoos and habitat characteristics within a site with the best available information regarding the status of black cockatoo populations and black cockatoo habitat within areas surrounding a site. Black cockatoo habitat assessments for a given site don't typically allow scope for physical survey of areas surrounding a site and so the ability to obtain new information is usually limited to that which can be obtained within a site. Therefore, we considered that, when assessing the above components, site condition is best defined from a current survey, site context is best defined from literature and relevant databases (Glossop *et al.* 2011; DPaW 2013; DoEE 2016a, c, b; Peck *et al.* 2019) and information on species stocking rate is best obtained from a combination of current survey, previous survey or databases (Glossop *et al.* 2011; DPaW 2013; DoEE 2016a, c, b; Peck *et al.* 2019).

Method

The *Habitat Scoring Tool* provided as Plate 1 is an *Excel* spreadsheet document that is used to determine a quality score for each habitat category component by answering queries about habitat within and surrounding the site. The *Habitat Scoring Tool* shows the attributes measured within each habitat category and quality component. An overall score from one to ten is assigned for each species, with 1-3 being low, 4-6 being moderate, 7 being moderate – high and 8-10 being high.

The highest score of 10 is reserved for habitat that has an active nest(s) as it provides the best confirmation that the site and/or surrounding area provides sufficient resources and is therefore worthy of a higher quality score. Foraging habitat scores a maximum total of eight as it is an essential

requirement for black cockatoos, particularly to support breeding. Roosting habitat scores a maximum total of seven as it is more transient than the other habitat components.

A quality score is calculated for each habitat category by summing maximum scores for each query. Because maximum scores are selected, multiple answers may be provided for any query where appropriate without exaggerating the quality score. For key confirmed habitat such as roosts or nests, the scoring tool ensures that relevant, higher scores are achieved irrespective of whether all preceding queries have been answered positively (for example a roost always scores 8 irrespective of whether other quality criteria have been met).

The highest score from any of the three habitat categories is then adopted as the overall score for black cockatoo habitat quality within the site.

Black Cockatoo Habitat Quality Assessment - Scoring Tool (Baudin's cockatoo)
<insert site name>

		Query		Answer	Weighting	Site score	Sum
Breeding habitat	Site condition	1.1	The site contains habitat trees with either:				
			no suitable hollow(s)	y	1.0	1.0	1.0
			suitable hollow(s)	n	4.0	0.0	
			suitable hollow(s) that have signs of use by black cockatoos	n	5.0	0.0	
	Site context	1.2	The site contains habitat trees and is located within 6 km of a black cockatoo nest(s) (active, historical or potential)	y	1.0	1.0	1.0
		1.3	The site contains habitat trees and is located within 6 km of either:				
			>2,000 ha of native vegetation that provides foraging habitat	y	1.0	1.0	
			>10,000 ha of native vegetation that provides foraging habitat	n	2.0	0.0	
	Species stocking rate	1.4	The site contains habitat tree(s) that support(s) an active nest(s)	n	Maximum score (10)	0.0	0.0
						Score out of a maximum of 10	3
Roosting habitat	Site condition	2.1	The site contains trees suitable for roosting and a water source or a water source exists nearby	y	1.0	1.0	1.0
	Site context	2.2	The site is located within 1 km of a large roost (≥150 individuals) or 500 m of a small roost (< 150 individuals)(used within last 5 years)	n	3.0	0.0	0.0
	Species stocking rate	2.3	The site contains a roost (used within last 5 years)	n	7.0	0.0	0.0
						Score out of a maximum of 7	1
Foraging habitat	Site condition	3.1	Within the site the proportion of foraging habitat that is:				
			low value	90%	1.0	0.9	1.4
			moderate value	1%	3.0	0.0	
			high value	10%	5.0	0.5	
	Site context	3.2	The site is located within 6 km of a nest(s) (active, historical or potential)	y	2.0	2.0	2.0
	Species stocking rate	3.4	The site is likely to support foraging by the species	y	1.0	1.0	1.0
						Score out of a maximum of 8	4

SUMMARY		
Habitat category	**Score**	**Habitat quality**
Breeding	3	Low
Roosting	1	Low
Foraging	4	Moderate
Overall habitat quality score	**4**	Moderate

Note:
1. Within the breeding category, a score of 10 applies if an active nest(s) occurs within the site, regardless of the answer to other queries in this category
2. Within the roosting category, a score of 7 applies if a roost occurs within the site, regardless of the answer to other queries in this category.
3. The overall habitat quality score consists of the highest score from each habitat category.

Plate 1: Black Cockatoo Habitat Scoring Tool (Baudin's cockatoo example)

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General references

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Appendix D

Black Cockatoo Habitat Tree Data

Tag No.	Easting	Northing	DBH (cm)	Species	Category	Notes
1	391990	6446466	75	Eucalyptus marginata	No suitable hollow(s)	
2	392097	6447344	67	Eucalyptus marginata	No suitable hollow(s)	
3	392099	6447344	61	Eucalyptus marginata	No suitable hollow(s)	
4	391830	6447470	68	Eucalyptus marginata	No suitable hollow(s)	
5	392080	6447370	89	Eucalyptus marginata	No suitable hollow(s)	
6	392079	6447368	86	Eucalyptus marginata	No suitable hollow(s)	
7	391737	6448274	105	Eucalyptus marginata	No suitable hollow(s)	Internal hollow inspection undertaken but hollow(s) not suitable for black cockatoos
8	391836	6448409	81	Eucalyptus marginata	No suitable hollow(s)	
9	391835	6448406	58	Eucalyptus marginata	No suitable hollow(s)	
10	391831	6448405	87	Eucalyptus marginata	No suitable hollow(s)	Internal hollow inspection undertaken but hollow(s) not suitable for black cockatoos
11	391705	6447935	93	Eucalyptus marginata	No suitable hollow(s)	

Appendix E

Overall Habitat Quality Assessment

Black Cockatoo Habitat Quality Assessment - Scoring Tool (Carnaby's cockatoo)
Former Glen Iris Golf Course

		Query		Answer	Weighting	Site score	Sum
Breeding habitat	Site condition	1.1	The site contains habitat trees with either:				
			no suitable hollow(s)	N/A	1.0	0.0	0.0
			suitable hollow(s)	N/A	4.0	0.0	
			suitable hollow(s) that have signs of use by black cockatoos	N/A	5.0	0.0	
	Site context	1.2	The site contains habitat trees and is located within 6 km of a black cockatoo nest(s) (active, historical or potential)	N/A	1.0	0.0	0.0
		1.3	The site contains habitat trees and is located within 6 km of either:				
			>2,000 ha of native vegetation that provides foraging habitat	N/A	1.0	0.0	
			>10,000 ha of native vegetation that provides foraging habitat	N/A	2.0	0.0	
	Species stocking rate	1.4	The site contains habitat tree(s) that support(s) an active nest(s)	N/A	Maximum score (10)	0.0	0.0
						Score out of a maximum of 10	0
Roosting habitat	Site condition	2.1	The site contains trees suitable for roosting and a water source or a water source exists nearby	y	1.0	1.0	1.0
	Site context	2.2	The site is located within 1 km of a large roost (≥150 individuals) or 500 m of a small roost (< 150 individuals)(used within last 5 years)	n	3.0	0.0	0.0
	Species stocking rate	2.3	The site contains a roost (used within last 5 years)	n	7.0	0.0	0.0
						Score out of a maximum of 7	1
Foraging habitat	Site condition	3.1	Within the site the proportion of foraging habitat that is:				
			low value	66%	1.0	0.7	2.1
			moderate value	14%	3.0	0.4	
			high value	20%	5.0	1.0	
	Site context	3.2	The site is located within 6 km of a nest(s) (active, historical or potential)	n	2.0	0.0	0.0
	Species stocking rate	3.4	The site is likely to support foraging by the species	y	1.0	1.0	1.0
						Score out of a maximum of 8	3

SUMMARY		
Habitat category	Score	Habitat quality
Breeding	N/A	N/A
Roosting	1	Low
Foraging	3	Moderate
Overall habitat quality score	3	Moderate

Note:
1. Within the breeding category, a score of 10 applies if an active nest(s) occurs within the site, regardless of the answer to other queries in this category
2. Within the roosting category, a score of 7 applies if a roost occurs within the site, regardless of the answer to other queries in this category.
3. The overall habitat quality score consists of the highest score from each habitat category.

Black Cockatoo Habitat Quality Assessment - Scoring Tool (forest red-tailed black cockatoo)
Former Glen Iris Golf Course

		Query		Answer	Weighting	Site score	Sum
Breeding habitat	Site condition	1.1	The site contains habitat trees with either:				
			no suitable hollow(s)	y	1.0	1.0	1.0
			suitable hollow(s)	n	4.0	0.0	
			suitable hollow(s) that have signs of use by black cockatoos	n	5.0	0.0	
	Site context	1.2	The site contains habitat trees and is located within 6 km of a black cockatoo nest(s) (active, historical or potential)	y	1.0	1.0	2.0
		1.3	The site contains habitat trees and is located within 6 km of either:				
			>2,000 ha of native vegetation that provides foraging habitat	y	1.0	1.0	
			>10,000 ha of native vegetation that provides foraging habitat	n	2.0	0.0	
	Species stocking rate	1.4	The site contains habitat tree(s) that support(s) an active nest(s)	n	Maximum score (10)	0.0	0.0
						Score out of a maximum of 10	3
Roosting habitat	Site condition	2.1	The site contains trees suitable for roosting and a water source or a water source exists nearby	y	1.0	1.0	1.0
	Site context	2.2	The site is located within 1 km of a large roost (≥150 individuals) or 500 m of a small roost (< 150 individuals)(used within last 5 years)	n	3.0	0.0	0.0
	Species stocking rate	2.3	The site contains a roost (used within last 5 years)	n	7.0	0.0	0.0
						Score out of a maximum of 7	1
Foraging habitat	Site condition	3.1	Within the site the proportion of foraging habitat that is:				
			low value	80%	1.0	0.8	1.6
			moderate value	8%	3.0	0.2	
			high value	12%	5.0	0.6	
	Site context	3.2	The site is located within 6 km of a nest(s) (active, historical or potential)	y	2.0	2.0	2.0
	Species stocking rate	3.4	The site is likely to support foraging by the species	y	1.0	1.0	1.0
						Score out of a maximum of 8	5

SUMMARY		
Habitat category	Score	Habitat quality
Breeding	3	Low
Roosting	1	Low
Foraging	5	Moderate
Overall habitat quality score	5	Moderate

Note:
1. Within the breeding category, a score of 10 applies if an active nest(s) occurs within the site, regardless of the answer to other queries in this category
2. Within the roosting category, a score of 7 applies if a roost occurs within the site, regardless of the answer to other queries in this category.
3. The overall habitat quality score consists of the highest score from each habitat category.

Appendix F

Arboricultural Assessment

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Document Reference: EP20-009(12)--011B TAA

Emerge contact: Tom Atkinson

17 September 2021

ECP Acquisitions 6 Pty Ltd
Attention: Jarrod Rendell
C/- Acumen Development Solutions
18 Lyall Street
SOUTH PERTH WA 6151

Delivered by email to: jarrod@acumends.com.au

Dear Jarrod

ARBORICULTURAL ASSESSMENT – FORMER GLEN IRIS GOLF COURSE

1 INTRODUCTION

Acumen Development Solutions, on behalf of ECP Acquisitions 6 Pty Ltd, engaged Emerge Associates (Emerge) to conduct an arboricultural assessment within the former Glen Iris Golf Course, which comprises Lots 6 and 7 Glen Iris Drive, Lots 3, 509 and 512 Dean Road and Lot 139 Imlah Court, Jandakot (referred to herein as the 'site').

A separate assessment was previously undertaken to map black cockatoo habitat trees[1] (Emerge Associates 2021). The purpose of this arboricultural assessment was to provide information on attributes of all large trees within the site to inform tree retention.

The location of the site is shown in Figure 1.

2 METHODS

2.1 Field survey

The field survey was completed by subcontracted qualified arborist from Arborite[2].

The survey was completed by the arborist over multiple dates in January and February 2021. During the survey the site was traversed on foot. The arborist recorded the attributes outlined in Table 1 for all trees with a trunk diameter at breast height (DBH) of 30 centimetres (cm) or greater , including habitat trees previously assessed by Emerge Associates (2021). In some instances, a single location was recorded for groups of similar juvenile or semi-mature trees (with DBH ≥30 cm).

[1] Native eucalypts with a trunk 'diameter at breast height' (DBH) of ≥50 centimetres (cm).
[2] David Cuddihy, Graduate Certificate Arboriculture (Australian Qualifications Framework (AQF) Level 8)

Table 1: Attributes assessed for each tree

Attribute	Notes
Unique id	Aluminium tag number
Spatial location	XY coordinates using GPS receiver ± 5m^
Image	Oblique digital photograph (12 megapixel or greater)
Species name	Using WA herbarium nomenclature
Common name	Using WA herbarium nomenclature
Height	1-5 m, 1-10 m, 10-15 m, 15-20 m, 20-25 m, 25 +m
Canopy spread (width)	1-5 m, 1-10 m, 10-15 m, 15-20 m
Trunk diameter	Diameter at breast height (DBH) (cm)
Health	Excellent, good, average, poor, dead
Age	Juvenile, semi-mature, mature
Useful life expectancy	25+ years, 15-25 years, 5-15 years, <5 years
Retention value	Low, medium, high
Notes	Safety concerns, tree defects, pruning requirements, further ecologist/arborist assessment recommended etc.

2.2 Health

Tree health was determined by the arborist according to scheme outlined in Table 2.

Table 2: Tree health rating descriptions

Tree Health Rating	Description
Excellent	Tree with >90% of original canopy present. Less than 5% epicormic growth and deadwood. No history of failures or pruning wounds. Well-formed canopy.
Good	Tree with 75-90% of original canopy present. Epicormic growth less than 10% of remaining canopy. Some dead branchlets, minor limb failures and pruning wounds. Minor canopy imbalance.
Average	Tree with 50– 75% of original canopy present Some epicormic growth. Some major dead stems and major deadwood up to 30%. History of larger limb failure and canopy imbalance.
Poor	Major canopy die-back with major stems deceased. Structurally unsound, history of large limb failure. Hazardous tree.
Dead	Tree dead or transient. Less than 5 years useful life expectancy.

2.3 Useful life expectancy

Useful life expectancy (ULE) is an estimate of the number of years a tree is expected to remain alive. ULE is a method of assessing the relative importance of individual trees and the amenity value that can be realised for the remaining duration of the trees' lifespan. In conjunction with landscape significance, ULE helps making informed decisions on the retention value of trees on site.

ULE was determined by the arborist who considered the age of the tree, the average life span of the species and any local environmental modifying factors that may influence life span.

2.4 Retention value

There is always a compromise between retaining trees on a development site and the economic imperatives of land development. Establishing priorities for the retention of trees is an important part of the planning process if amenity is to be sustained in the long term.

Retention value was classified 'high', 'medium', 'low' and 'very low' by the arborist. Arborite's method for classifying retention value contrasts ULE with landscape significance, as outlined in Table 3. Landscape significance of trees was determined by the arborist using the criteria outlined in Table 4.

Table 3: Tree retention matrix

Useful life expectancy (ULE)	Landscape significance						
	1	2	3	4	5	6	7
Long - Greater than 25 years	High						
Medium - 15 to 25 years			Medium				
Short - 5 to 15 years				Low			
Transient - Less than 5 years					Very low		
Dead or potentially hazardous							

Table 4: Criteria for rating landscape significance of trees

Significance rating	Criteria
1 - Significant	• The subject tree is listed as a heritage Item with a local, state or national level of significance. • The subject tree forms part of the curtilage of a Heritage Item and has a known or documented association with that item. • The subject tree is a commemorative planting having been planted by an important historical person (s) or to commemorate an important historical event. • The subject tree is scheduled as a threatened species. • The tree is a locally indigenous species, representative of the original vegetation of the area and is known as an important food, shelter or nesting tree for endangered or threatened fauna species. • The subject tree is a remnant tree, being a tree in existence prior to development of the area. • The subject tree has a very large live crown size exceeding 300 m² with normal to dense foliage cover, is located in a visually prominent in the landscape, exhibits very good form and habit typical of the species and makes a significant contribution to the amenity and visual character of the area by creating a sense of place or creating a sense of identity. • The tree is visually prominent in view from surrounding areas, being a landmark or visible from a considerable distance.
2 - Very high	• The tree has a strong historical association with a heritage item. (building/structure/artifact/garden etc) within or adjacent the property and/or exemplifies a particular era or style of landscape design associated with the original development of the site. • The subject tree is listed on a local Significant Tree Register. • The tree is a locally-indigenous species and representative of the original vegetation of the area and the tree is located within a defined biodiversity corridor or has known wildlife habitat value. • The subject tree has a very large live crown size exceeding 200 m²; a crown density exceeding 70% Crown Cover (normal-dense), is a very good representative of the species in terms of its form and branching habit or is aesthetically distinctive and makes a positive contribution to the visual character and the amenity of the area.
3- High	• The tree has a suspected historical association with a heritage item or landscape supported by anecdotal or visual evidence. • The tree is a locally-indigenous species and representative of the original vegetation of the area. • The subject tree has a large live crown size exceeding 100 m². • The tree is a good representative of the species in terms of its form and branching habit with minor deviations from normal (e.g. crown distortion/suppression) with a crown density of at least 70% Crown Cover (normal). • The subject tree is visible from the street and surrounding properties and makes a positive contribution to the visual character and the amenity of the area.
4 - Moderate	• The subject tree has a medium live crown size exceeding 40 m². • The tree is a fair representative of the species, exhibiting moderate deviations from typical form (distortion/suppression etc) with a crown density of more than 50% Crown Cover (thinning to normal). • The tree makes a fair contribution to the visual character and amenity of the area.

Table 4: Criteria for rating landscape significance of trees (continued)

Significance rating	Criteria
4 - Moderate	• The tree is visible from surrounding properties, but is not visually prominent – view may be partially obscured by other vegetation or built forms. • The tree has no known or suspected historical association.
5- Low	• The subject tree has a small live crown size of less than 40 m² and can be replaced within the short term with new tree planting. • The tree is a poor representative of the species, showing significant deviations from the typical form and branching habit with a crown density of less than 50% Crown Cover (sparse). • The subject tree is not visible from surrounding properties (visibility obscured) and makes a negligible contribution or has a negative impact on the amenity and visual character of the area.
6 - Very low	• The subject tree is listed as an environment weed in the relevant Local Government Area, being invasive, or a nuisance species. • The subject tree is scheduled as exempt (not protected) under the provisions of the local Council's due to its species, nuisance or position relative to buildings or other structures.
7 - Insignificant	• The tree is a declared pest or environmental weed.

2.5 Spatial location

Following the survey, the spatial location of high and medium retention value trees was updated using data supplied by project surveyors MNG.

3 RESULTS

A total of 1,215 trees were recorded within the site, comprising 80 species and 26 unidentified trees. (including one 'unknown' category which was not assigned species). Nine species are native to the local area and 72 species are non-native[3]. The unidentified trees are also non-native. The locations of native and non-native trees within the site are shown in Figure 2.

A summary of the ten most common species in the site is provided in Table 5.

Table 5: Ten most common tree species in the site

Species name	Common name	No. individuals
**Eucalyptus camaldulensis*	River red-gum	158
**Corymbia maculata*	Spotted gum	106
**Eucalyptus grandis*	Rose gum	102
**Eucalyptus leucoxylon*	Yellow gum	72
**Eucalyptus* sp.	Gum	59
**Eucalyptus cladocalyx*	Sugar gum	56
**Eucalyptus citriodora*	Lemon-scented gum	42
Banksia attenuata	Slender banksia	41
**Acacia* sp.	Wattle	36
**Ficus microcarpa*	Chinese banyan	36

Ninety-seven (97) trees were classified as having 'high' retention value, 375 were classified as having 'medium' retention value and the remaining 743 trees were classified as having 'low' retention value. The

[3] Non-native species denoted by an asterisk ('*') in text and raw data.

retention value of each tree is shown in Figure 3. Note only three of the retention value categories outlined in Section 2.4 were applied (that is no trees were classified as having a very low retention value).

The data recorded for each tree is provided as Attachment 1.

Summary and closing

We trust that this letter provides sufficient details on the trees within the site. Should you have any questions regarding the content of this letter, please do not hesitate to contact the undersigned.

Yours sincerely
Emerge Associates

Tom Atkinson
PRINCIPAL ENVIRONMENTAL CONSULTANT

cc: nil

Encl: Figure 1: Site Location
Figure 2: Tree Species
Figure 3: Retention Value
Attachment 1: Tree Inventory Data and Photos

References

Emerge Associates 2021, *Targeted Black Cockatoo Assessment - Former Glen Iris Golf Course*, EP20-009(13)--009A MS, Version A.

Figures

Figure 1: Site Location

Figure 2: Tree Species

Figure 3: Retention Value

Figure 1: Site Location

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F21
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 100 200 300
Metres
Scale: 1:10,000@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
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Figure 2a: Trees

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F24
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
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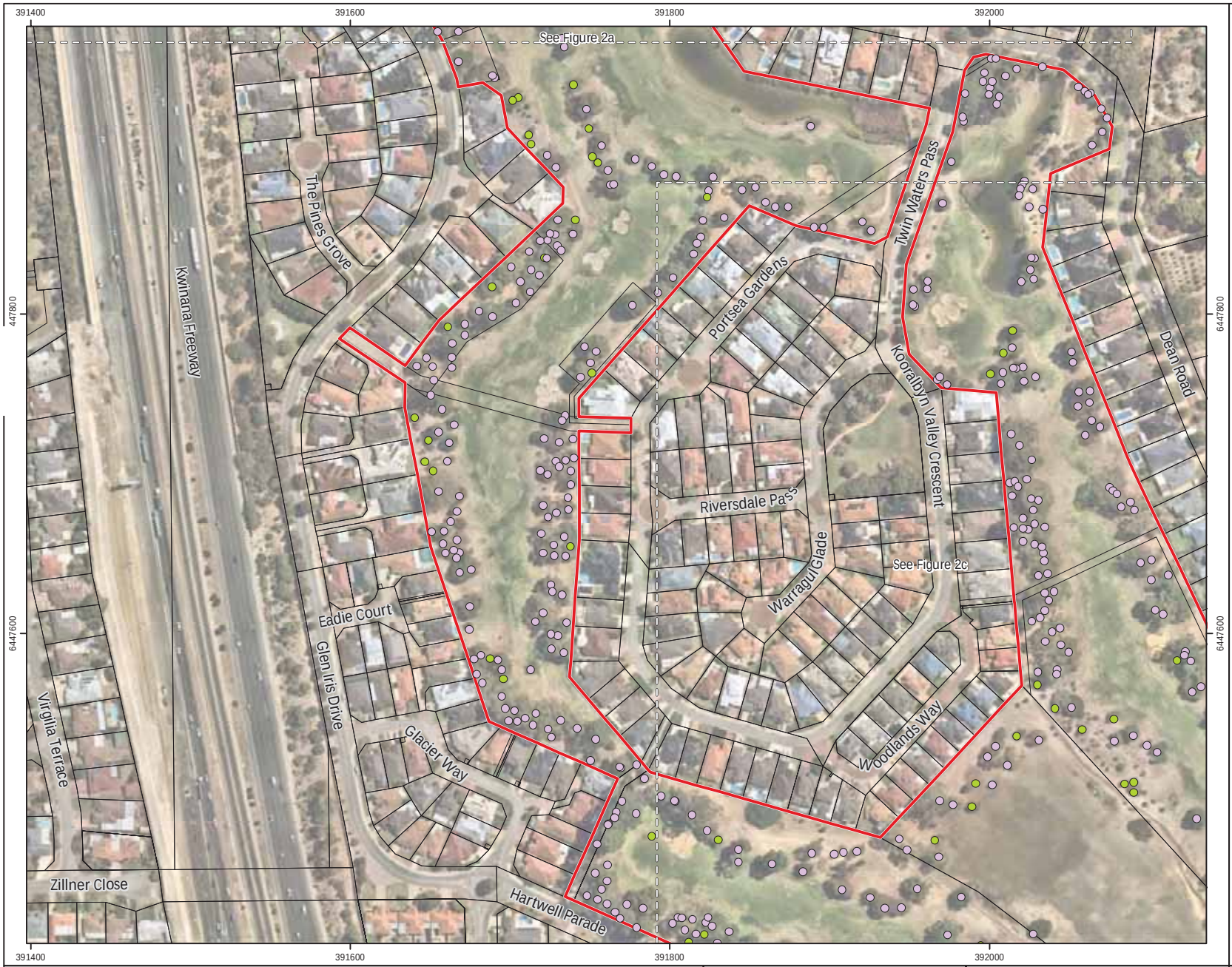

Site boundary
Cadastral boundary
Native tree
Non-native tree

Figure 2b: Trees

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F24
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

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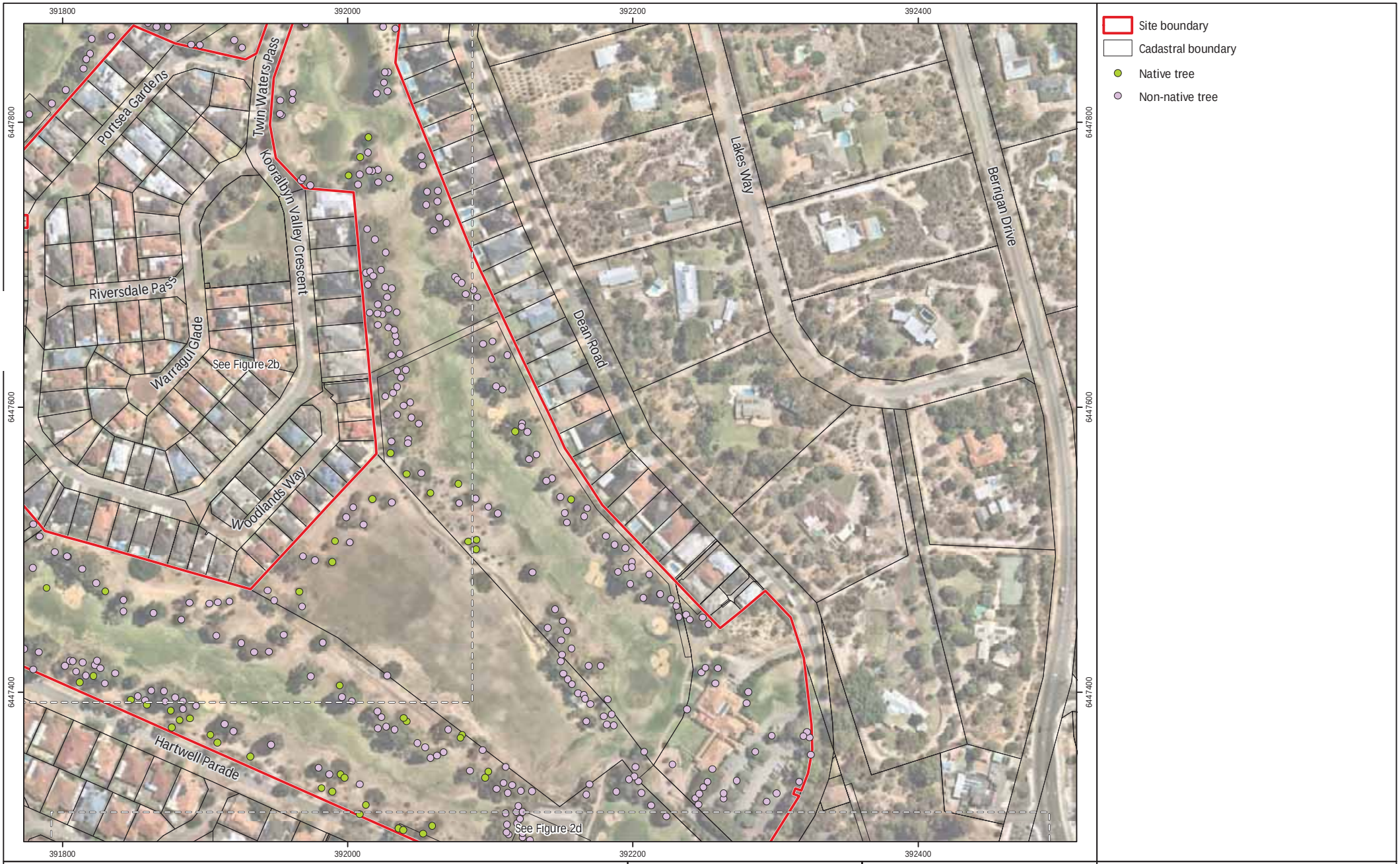

Figure 2c: Trees

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F24
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

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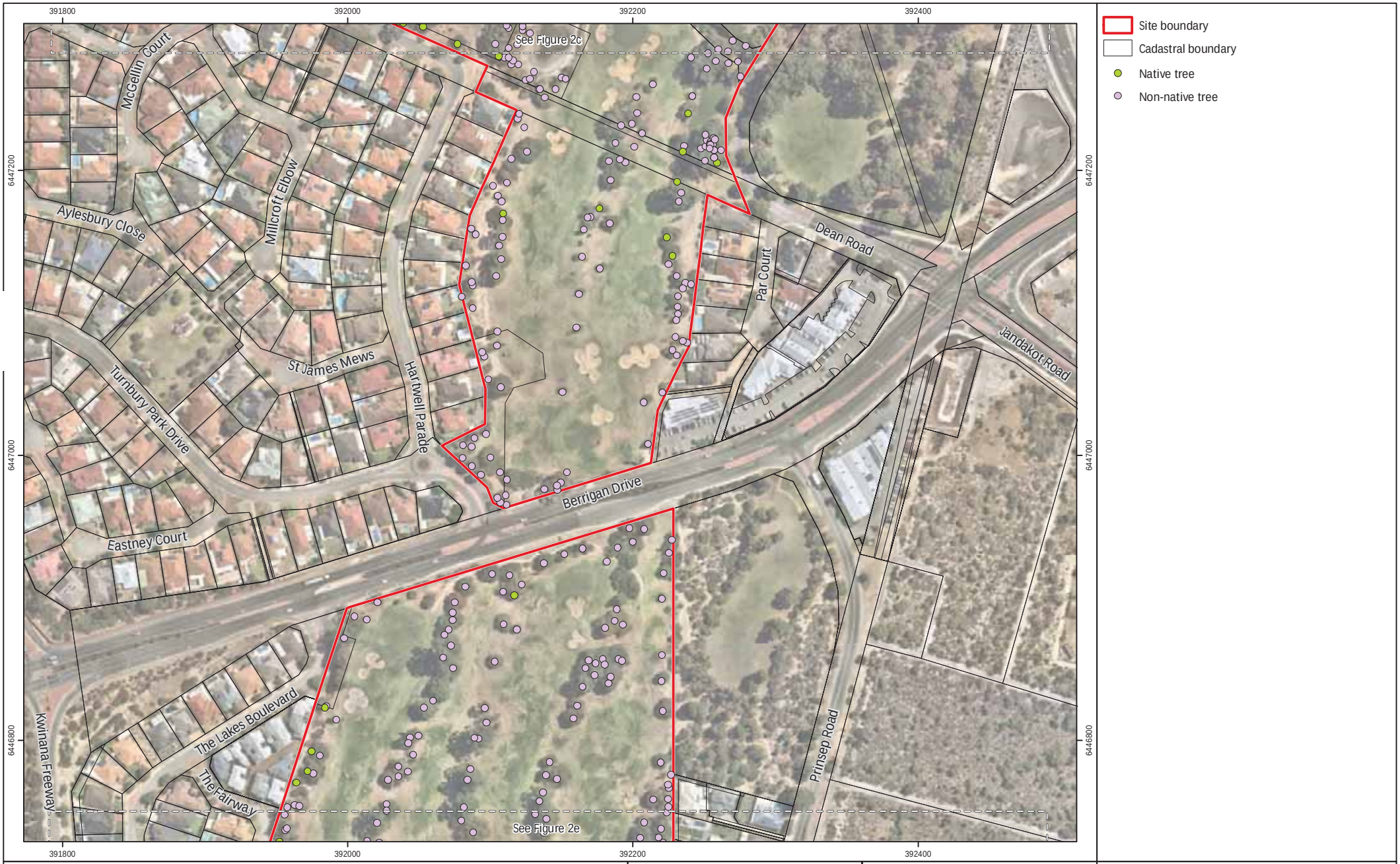

Figure 2d: Trees

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F24
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

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Figure 2e: Trees

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F24
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

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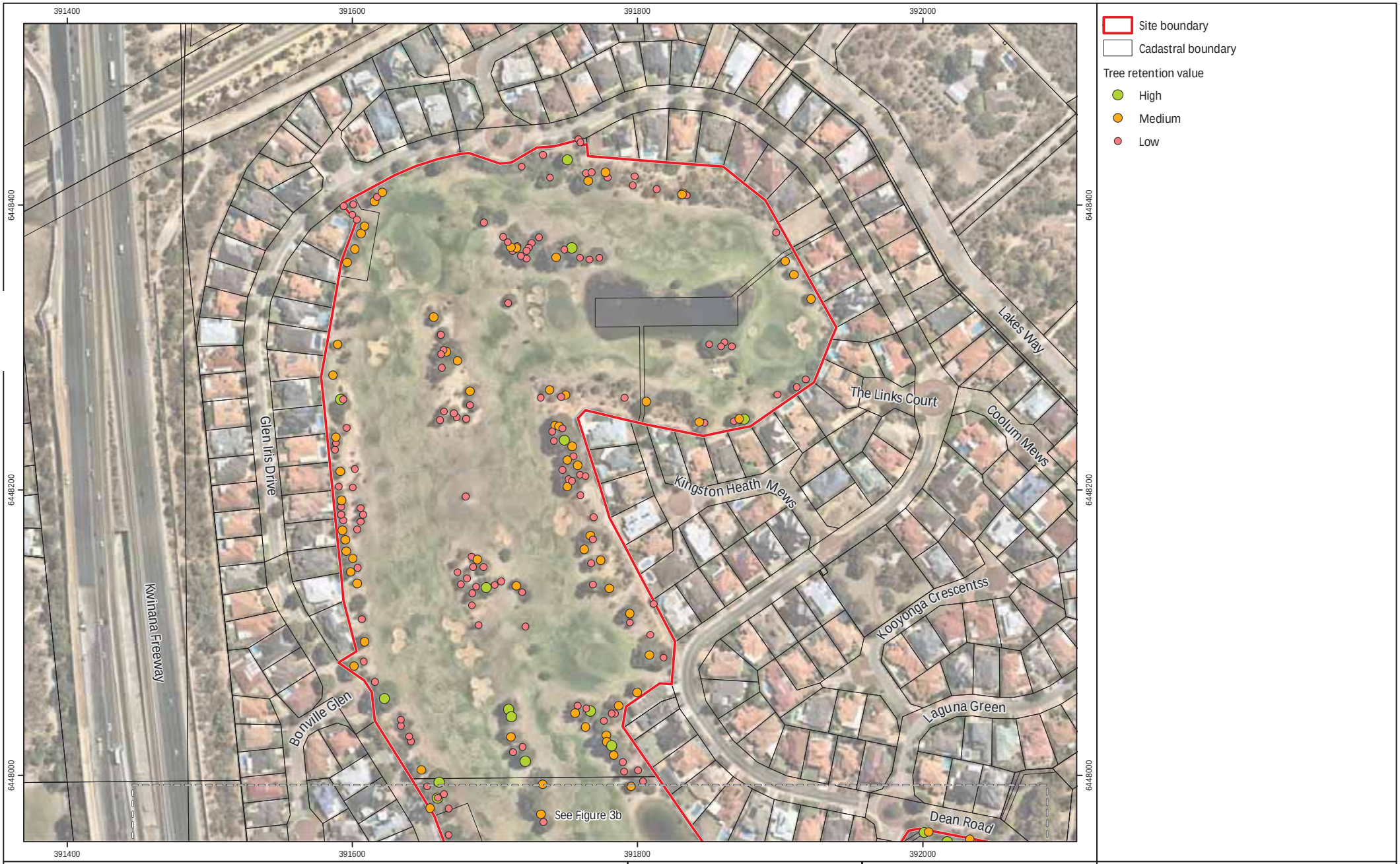

Figure 3a: Tree Retention Value

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F23
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

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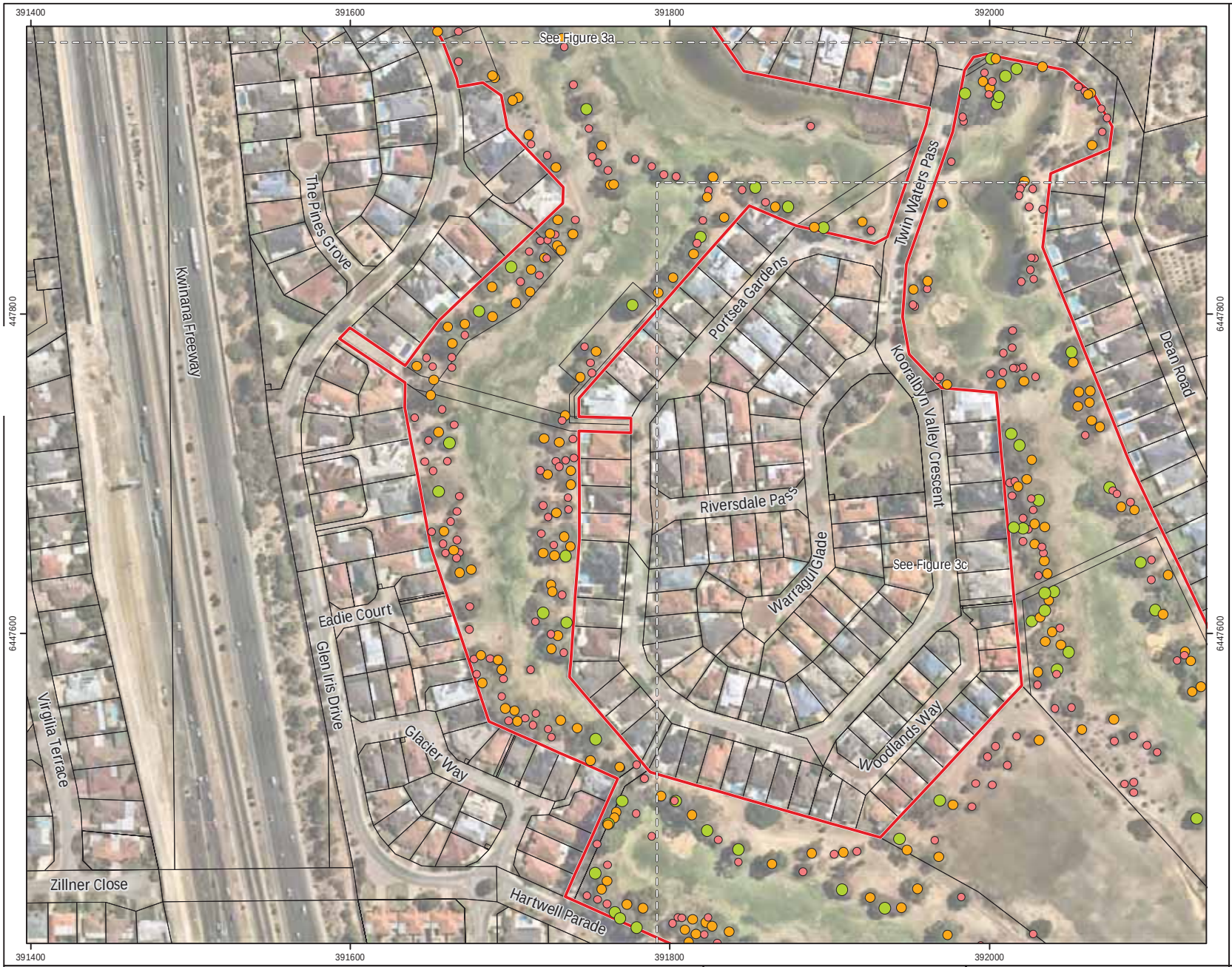

Site boundary

Cadastral boundary

Tree retention value

- High
- Medium
- Low

Figure 3b: Tree Retention Value

Project: Arboricultural Assessment
Former Glen Iris Golf Course

Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F23
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 50 100 150
Metres

Scale: 1:3,500@A4

GDA 1994 MGA Zone 50

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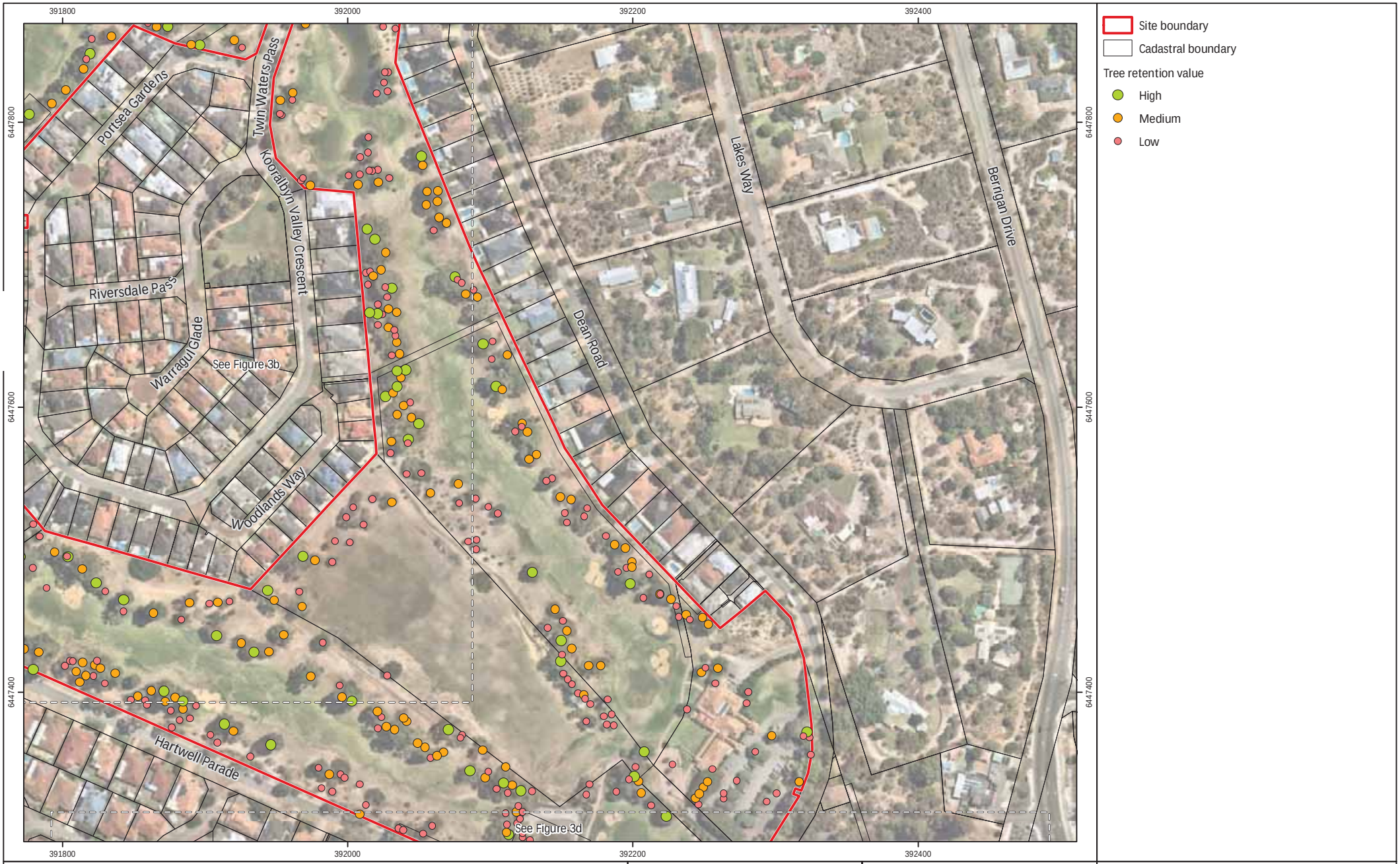

Figure 3c: Tree Retention Value

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F23
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

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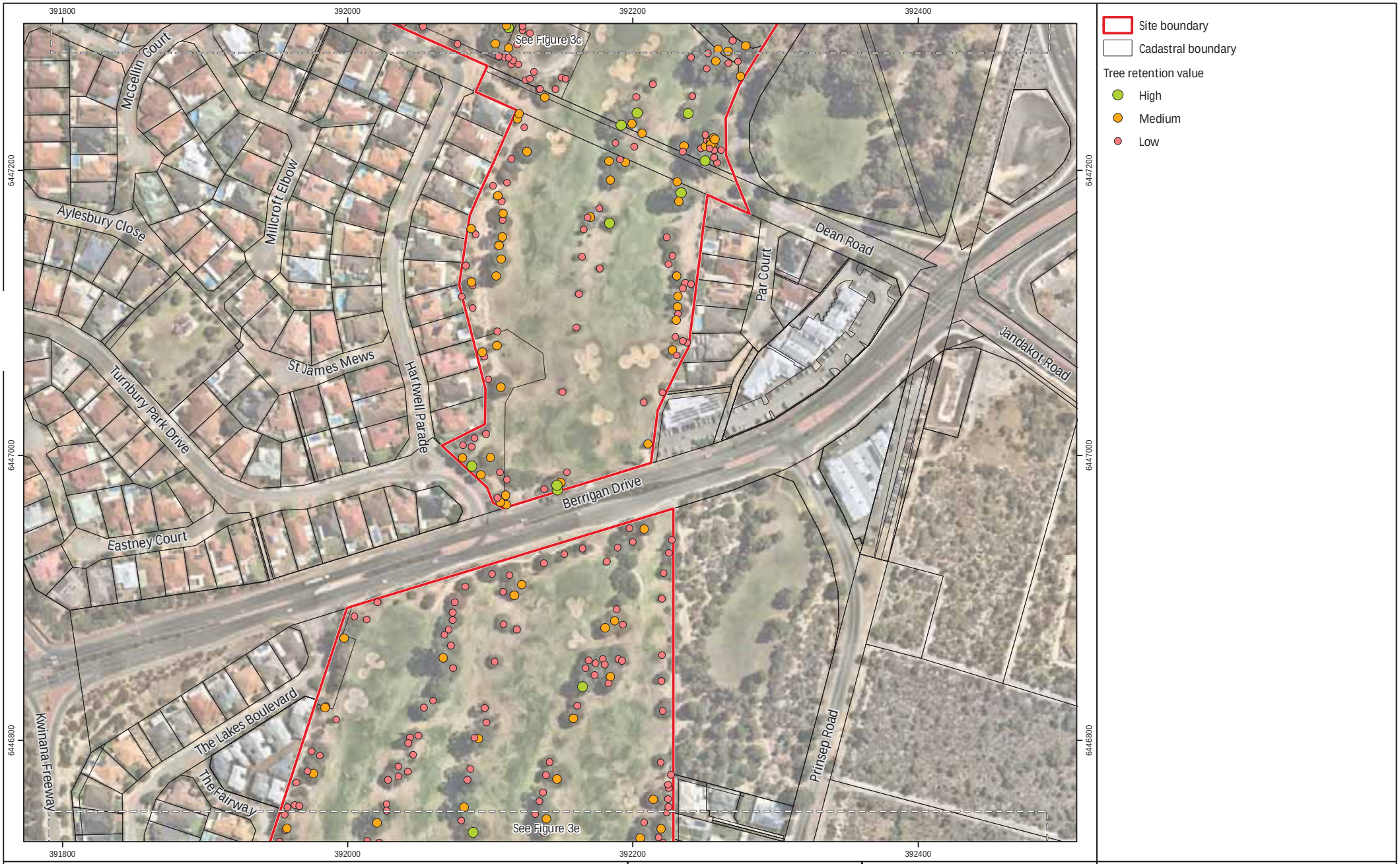

Figure 3d: Tree Retention Value

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F23
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

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Figure 3e: Tree Retention Value

Project: Arboricultural Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(12)--F23
Drawn: GAR
Date: 07/04/2021
Checked: RAW
Approved: ALB
Date: 03/06/2021

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

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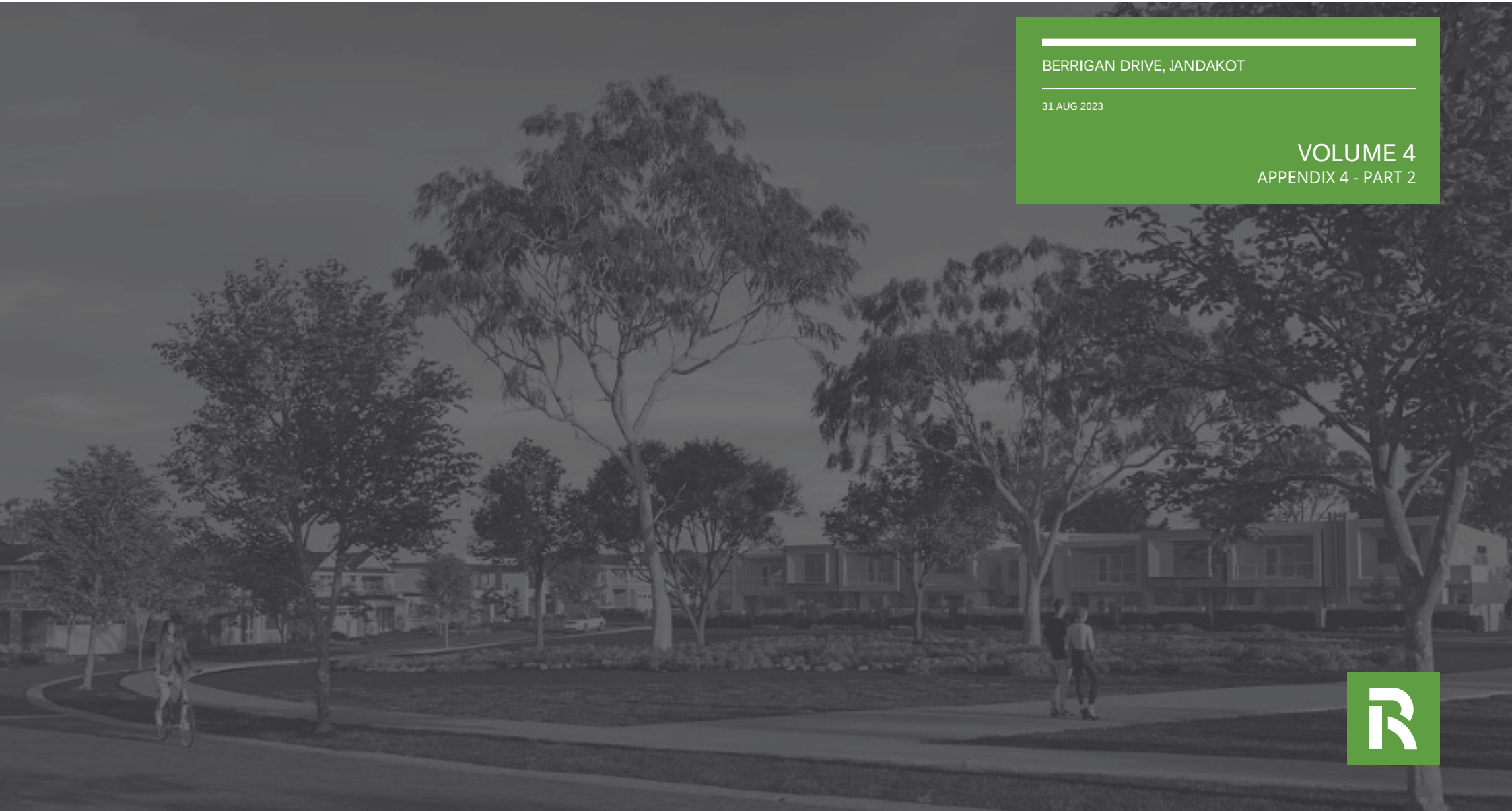
GLEN IRIS ESTATE

STRUCTURE PLAN



BERRIGAN DRIVE, JANDAKOT

31 AUG 2023

VOLUME 4
APPENDIX 4 - PART 2

Attachment A

Tree Inventory Data and Photos

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
1	*Eucalyptus marginata*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.75	Yes
2	*Eucalyptus marginata*	1	10-15	5-10	Poor	Mature	15-25	Medium	0.67	Yes
3	*Eucalyptus marginata*	1	5-10	5-10	Poor	Mature	15-25	Low	0.61	Yes
4	*Eucalyptus marginata*	1	5-10	5-10	Poor	Mature	5-15	Low	0.68	Yes
5	*Eucalyptus marginata*	1	5-10	5-10	Poor	Mature	5-15	Low	0.89	Yes
6	*Eucalyptus marginata*	1	5-10	5-10	Poor	Mature	5-15	Low	0.86	Yes
7	*Eucalyptus marginata*	1	10-15	5-10	Poor	Mature	5-15	Medium	1.05	Yes
8	*Eucalyptus marginata*	1	10-15	5-10	Average	Mature	15-25	Medium	0.81	Yes
9	*Eucalyptus marginata*	1	5-10	5-10	Average	Mature	15-25	Low	0.58	Yes
10	*Eucalyptus marginata*	1	10-15	5-10	Average	Mature	15-25	Medium	0.87	Yes
11	*Eucalyptus marginata*	1	5-10	5-10	Excellent	Mature	25+	Medium	0.93	Yes
N/A	*Melaleuca sp.*	1	5-10	10-15	Good	Mature	25+	High	0.2	No
12	*Melaleuca rhaphiophylla*	1	1-5	1-5	Poor	Mature	0-5	Low	0.6	No
13	*Eucalyptus grandis*	1	20-25	15-20	Good	Mature	25+	High	1	No
14	*Eucalyptus camaldulensis*	1	15-20	5-10	Good	Semi-mature	15-25	Medium	0.4	No
15	*Eucalyptus camaldulensis*	1	5-10	10-15	Average	Semi-mature	15-25	Low	0.3	No
16	*Eucalyptus camaldulensis*	1	15-20	10-15	Average	Semi-mature	15-25	Low	0.55	No
17	*Corymbia maculata*	1	5-10	1-5	Good	Juvenile	25+	Low	0.15	No
18	*Corymbia maculata*	1	15-20	10-15	Average	Semi-mature	15-25	Medium	0.55	No
22	*Eucalyptus robusta*	1	5-10	1-5	Poor	Juvenile	5-15	Low	0.2	No
23	*Eucalyptus grandis*	1	20-25	10-15	Average	Semi-mature	15-25	Medium	0.5	No
24	*Eucalyptus grandis*	1	10-15	1-5	Poor	Juvenile	5-15	Low	0.2	No
25	*Eucalyptus robusta*	1	5-10	1-5	Average	Juvenile	15-25	Low	0.25	No
26	*Eucalyptus grandis*	1	15-20	1-5	Average	Juvenile	15-25	Low	0.25	No
27	*Eucalyptus grandis*	1	15-20	5-10	Average	Semi-mature	25+	Medium	0.45	No
28	*Eucalyptus grandis*	1	5-10	1-5	Average	Juvenile	25+	Low	0.25	No
29	*Eucalyptus grandis*	1	5-10		Average	Juvenile	25+	Low	0.25	No
30	*Eucalyptus grandis*	1	20-25	15-20	Average	Mature	15-25	Medium	0.75	No
31	*Eucalyptus grandis*	1	20-25	10-15	Average	Mature	15-25	Medium	0.6	No
32	*Eucalyptus camaldulensis*	1	5-10	5-10	Average	Juvenile	25+	Low	0.4	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
33	*Eucalyptus camaldulensis*	1	5-10	1-5	Average	Juvenile	25+	Low	0.3	No
34	*Eucalyptus grandis*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.3	No
38	*Erythrina sykseii*	1	10-15	10-15	Average	Mature	15-25	Medium	0.75	No
39	*Platanus x acerifolia*	1	10-15	5-10	Average	Mature	15-25	Low	0.5	No
40	*Melaleuca quinquenervia*	15	10-15	5-10	Average	Semi-mature	15-25	Low	0.4	No
41	*Melaleuca quinquenervia*	1	10-15	10-15	Good	Mature	25+	Medium	0.75	No
42	*Melaleuca quinquenervia*	1	5-10	5-10	Average	Semi-mature	25+	Low	0.55	No
43	*Melia azaderach*	1	10-15	5-10	Average	Semi-mature	25+	Low	0.45	No
44	*Erythrina sykseii*	1	10-15	10-15	Average	Mature	15-25	Medium	0.7	No
58	*Morus alba*	1	1-5	1-5	Average	Mature	15-25	Low	0.25	No
59	*Ficus microcarpa*	1	10-15	10-15	Good	Semi-mature	25+	Medium	0.5	No
60	*Ficus microcarpa*	1	10-15	10-15	Good	Semi-mature	25+	Medium	0.5	No
61	*Ficus microcarpa*	1	10-15	10-15	Good	Semi-mature	25+	Medium	0.55	No
62	*Ficus microcarpa*	1	10-15	10-15	Good	Semi-mature	25+	Medium	0.75	No
63	*Robinia pseudoacacia 'umbraculifera'*	6	1-5	1-5	Poor	Semi-mature		Low	0.2	No
64	*Tipuana tipu*	2	5-10	5-10	Poor	Semi-mature	0-5	Low	0.25	No
65	*Ulmus parvifolia*	1	5-10	1-5	Dead	Juvenile	0-5	Low	0.25	No
66	*Tipuana tipu*	5	5-10	5-10	Poor	Juvenile	0-5	Low	0.25	No
67	*Tipuana tipu*	1	5-10	5-10	Poor	Semi-mature	0-5	Low	0.35	No
68	*Pheonix canariensis*	1	5-10	1-5	Average	Mature	15-25	Medium	0.6	No
69	*Schefflera actinophylla*	1	5-10	5-10	Average	Mature	5-15	Low	0.6	No
70	*Eucalyptus citriodora*	1	15-20	10-15	Average	Mature	5-15	High	0.75	No
71	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Mature	5-15	Low	0.55	No
72	*Hibiscus tiliaceus*	1	10-15	10-15	Average	Mature	15-25	Low	0.65	No
73	*Eucalyptus citriodora*	1	15-20	10-15	Average	Semi-mature	15-25	Medium	0.55	No
74	*Lagunaria patersonia*	1	5-10	1-5	Poor	Juvenile	0-5	Low	0.2	No
75	*Tipuana tipu*	4	5-10	5-10	Average	Juvenile	5-15	Low	0.3	No
76	*Robinia pseudoacacia 'umbraculifera'*	5	1-5	1-5	Average	Semi-mature	5-15	Low	0.2	No
77	*Robinia pseudoacacia 'umbraculifera'*	8	5-10	5-10	Average	Semi-mature	5-15	Low	0.3	No
78	*Ficus microcarpa*	1	5-10	5-10	Good	Semi-mature	25+	Medium	0.5	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
79	*Ficus microcarpa*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.45	No
80	*Ficus microcarpa*	1	5-10	5-10	Average	Semi-mature	25+	Medium	0.35	No
81	*Schinus molle*	1	1-5	1-5	Average	Semi-mature	5-15	Low	0.25	No
82	*Ficus microcarpa*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.4	No
83	*Ficus microcarpa*	3	1-5	1-5	Poor	Juvenile	0-5	Low	0.2	No
84	*Allocasuarina sp.*	8	15-20	5-10	Good	Mature	25+	Medium	0.65	No
85	*Pheonix canariensis*	1	5-10	5-10	Average	Juvenile	25+	Low	0.8	No
86	*Eucalyptus camaldulensis*	1	20-25	5-10	Average	Semi-mature	25+	Medium	0.5	No
87	*Agonis flexuosa*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.5	No
88	*Cupressus sp.*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.25	No
89	*Syagrus romanzoffiana*	1	1-5	1-5	Poor	Juvenile	5-15	Low	0.2	No
90	*Syagrus romanzoffiana*	1	5-10	1-5	Average	Semi-mature	15-25	Low	0.35	No
91	*Melaleuca rhaphiophylla*	1	5-10	10-15	Average	Mature	15-25	High	0.8	No
92	*Unknown*	1	10-15	5-10	Average	Mature	15-25	Medium	0.5	No
93	*Banksia sp.*	1	1-5	1-5	Average	Semi-mature	15-25	Low	0.3	No
94	*Melaleuca rhaphiophylla*	4	1-5	1-5	Good	Semi-mature	25+	Medium	0.4	No
95	*Eucalyptus grandis*	1	20-25	15-20	Good	Mature	25+	High	1.2	No
96	*Ficus microcarpa*	1	5-10	5-10	Good	Semi-mature	25+	Medium	0.5	No
97	*Acacia saligna*	1	5-10	1-5	Poor	Semi-mature	0-5	Low	0.4	No
98	*Schinus terebinthifolia*	1	1-5	5-10	Average	Juvenile	15-25	Low	0.3	No
99	*Acacia sp.*	1	1-5	5-10	Average	Semi-mature	15-25	Low	0.3	No
100	*Banksia attenuata*	1	1-5	5-10	Poor	Semi-mature	0-5	Low	0.45	No
101	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Semi-mature	25+	Medium	0.45	No
102	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Juvenile	25+	Low	0.45	No
103	*Acacia sp.*	1	1-5	5-10	Average	Semi-mature	15-25	Low	0.25	No
104	*Aruacaria columnaris*	1	5-10	1-5	Average	Juvenile	25+	Low	0.2	No
105	*Eucalyptus sp.*	1	10-15	5-10	Good	Juvenile	25+	Medium	0.4	No
106	*Eucalyptus camaldulensis*	1	10-15	5-10	Good	Juvenile	25+	Medium	0.3	No
107	*Eucalyptus camaldulensis*	1	10-15	1-5	Average	Juvenile	15-25	Low	0.3	No
108	*Eucalyptus camaldulensis*	1	5-10	1-5	Good	Juvenile	25+	Medium	0.2	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
109	*Eucalyptus grandis*	1	5-10	1-5	Good	Juvenile	25+	Low	0.2	No
110	*Tipuana tipu*	1	1-5	5-10	Average	Semi-mature	15-25	Low	0.3	No
111	*Eucalyptus platypus*	1	1-5	1-5	Good	Juvenile	25+	Low	0.15	No
112	*Eucalyptus camaldulensis*	1	10-15	1-5	Good	Juvenile	25+	Medium	0.25	No
113	*Eucalyptus cladocalyx*	1	5-10	1-5	Average	Juvenile	15-25	Low	0.2	No
114	*Olea europaea*	1	1-5	1-5	Good	Semi-mature	15-25	Low	0.25	No
115	*Ficus microcarpa*	1	1-5	1-5	Average	Juvenile	25+	Low	0.35	No
116	*Aruacaria heterophylla*	1	5-10	1-5	Average	Juvenile	25+	Medium	0.4	No
117	*Eucalyptus citriodora*	1	15-20	5-10	Average	Semi-mature	25+	Low	0.35	No
118	*Eucalyptus citriodora*	1	15-20	5-10	Good	Semi-mature	25+	High	0.5	No
119	*Eucalyptus citriodora*	1	15-20	5-10	Good	Semi-mature	25+	Medium	0.35	No
120	*Eucalyptus citriodora*	1	15-20	10-15	Good	Semi-mature	25+	High	0.5	No
121	*Ficus microcarpa*	1	1-5	1-5	Average	Semi-mature	15-25	Low	0.25	No
122	*Ficus microcarpa*	1	5-10	5-10	Good	Semi-mature	25+	Low	0	No
123	*Eucalyptus citriodora*	1	10-15	5-10	Average	Juvenile	25+	Medium	0.3	No
124	*Eucalyptus citriodora*	1	5-10	1-5	Good	Juvenile	25+	Medium	0.2	No
125	*Eucalyptus citriodora*	1	10-15	5-10	Good	Juvenile	25+	Medium	0.3	No
126	*Tipuana tipu*	1	1-5	1-5	Poor	Juvenile	0-5	Low	0.2	No
127	*Ulmus parvifolia*	8	1-5	5-10	Average	Juvenile	5-15	Low	0.2	No
128	*Corymbia maculata*	1	10-15	5-10	Good	Juvenile	25+	Medium	0.45	No
129	*Corymbia maculata*	1	10-15	5-10	Excellent	Semi-mature	25+	High	0.5	No
130	*Corymbia maculata*	1	5-10	5-10	Good	Semi-mature	25+	Medium	0.45	No
131	*Olea europaea*	1	1-5	1-5	Average	Semi-mature	15-25	Low	0.2	No
132	*Jacaranda mimosifolia*	1	5-10	1-5	Poor	Semi-mature	0-5	Low	0.2	No
133	*Acacia sp.*	1	5-10	5-10	Poor	Mature	0-5	Low	0.3	No
134	*Cupressus sp.*	3	1-5	1-5	Poor	Semi-mature	0-5	Low	0.35	No
135	*Eucalyptus citriodora*	1	15-20	10-15	Average	Semi-mature	15-25	Medium	0.5	No
136	*Eucalyptus grandis*	1	15-20	10-15	Average	Semi-mature	25+	Medium	0.8	No
137	*Eucalyptus sp.*	1	1-5	1-5	Average	Juvenile	15-25	Low	0.1	No
138	*Eucalyptus cladocalyx*	1	5-10	1-5	Good	Juvenile	25+	Low	0.15	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
139	*Eucalyptus camaldulensis*	1	10-15	1-5	Average	Juvenile	25+	Medium	0.3	No
140	*Eucalyptus camaldulensis*	1	10-15	5-10	Good	Juvenile	25+	Medium	0.4	No
141	*Ficus microcarpa*	1	1-5	5-10	Average	Juvenile	15-25	Low	0.3	No
142	*Eucalyptus grandis*	1	15-20	10-15	Good	Semi-mature	25+	Medium	0.5	No
143	*Cupressus sp.*	1	1-5	5-10	Average	Semi-mature	5-15	Low	0.3	No
144	*Acacia sp.*	1	1-5	1-5	Average	Semi-mature	15-25	Low	0.2	No
145	*Cupressus sp.*	1	1-5	1-5	Average	Semi-mature	5-15	Low	0.3	No
146	*Eucalyptus grandis*	1	15-20	10-15	Good	Semi-mature	25+	Medium	0.5	No
147	*Cupressus sp.*	1	1-5	1-5	Average	Semi-mature	5-15	Low	0.3	No
148	*Eucalyptus grandis*	1	15-20	10-15	Average	Semi-mature	25+	Medium	0.75	No
149	*Ficus microcarpa*	1	1-5	1-5	Good	Juvenile	25+	Medium	0.2	No
150	*Eucalyptus grandis*	1	15-20	10-15	Good	Semi-mature	25+	Medium	0.5	No
151	*Acacia sp.*	1	1-5	10-15	Average	Mature	5-15	Low	0.4	No
152	*Cupressus sp.*	1	1-5	1-5	Poor	Semi-mature	0-5	Low	0.2	No
153	*Grevillea robusta*	1	5-10	1-5	Good	Juvenile	15-25	Medium	0.2	No
154	*Banksia attenuata*	1	5-10	5-10	Average	Semi-mature	5-15	Medium	0.45	No
155	*Acacia sp.*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.25	No
156	*Aruacaria heterophylla*	1	5-10	1-5	Good	Juvenile	25+	Medium	0.25	No
157	*Cupressus sp.*	1	5-10	1-5	Poor	Semi-mature	0-5	Low	0.3	No
158	*Eucalyptus leucoxylon*	1	5-10	10-15	Average	Mature	5-15	Low	0.55	No
159	*Erythrina sykseii*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.6	No
160	*Ficus microcarpa*	1	5-10	10-15	Good	Semi-mature	25+	Medium	0.6	No
161	*Eucalyptus camaldulensis*	1	10-15	1-5	Average	Juvenile	25+	Medium	0.25	No
162	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Semi-mature	25+	Medium	0.45	No
163	*Eucalyptus platypus*	1	1-5	1-5	Good	Juvenile	25+	Low	0.15	No
164	*Ulmus parvifolia*	1	5-10	10-15	Good	Mature	15-25	Medium	0.35	No
165	*Syagrus romanzoffiana*	1	10-15	1-5	Average	Semi-mature	15-25	Low	0.3	No
166	*Eucalyptus camaldulensis*	1	5-10	10-15	Average	Semi-mature	15-25	Low	0.75	No
167	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Juvenile	15-25	Low	0.35	No
168	*Ulmus parvifolia*	4	1-5	1-5	Average	Juvenile	15-25	Low	0.2	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
169	*Eucalyptus sp.*	1	5-10	1-5	Average	Juvenile	25+	Low	0.15	No
170	*Eucalyptus camaldulensis*	1	10-15	10-15	Poor	Semi-mature	5-15	Low	0.5	No
171	*Eucalyptus camaldulensis*	1	10-15	5-10	Poor	Semi-mature	5-15	Low	0.35	No
172	*Eucalyptus camaldulensis*	1	15-20	10-15	Average	Mature	15-25	Low	0.5	No
176	*Eucalyptus camaldulensis*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.3	No
177	*Eucalyptus camaldulensis*	1	1-5	1-5	Good	Juvenile	25+	Low	0.1	No
178	*Eucalyptus camaldulensis*	3	5-10	1-5	Average	Juvenile	15-25	Low	0.2	No
179	*Fraxinus ornus*	1	1-5	1-5	Average	Juvenile		Low	0.1	No
180	*Callistemon sp.*	1	1-5	1-5	Poor	Juvenile	0-5	Low	0.1	No
181	*Eucalyptus camaldulensis*	6	5-10	1-5	Average	Juvenile	15-25	Low	0.25	No
182	*Melaleuca rhaphiophylla*	1	1-5	1-5	Average	Mature	5-15	Low	0.6	No
183	*Eucalyptus camaldulensis*	1	15-20	10-15	Average	Mature	15-25	Medium	0.6	No
184	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Mature	15-25	Low	0.65	No
185	*Eucalyptus camaldulensis*	1	15-20	5-10	Average	Mature	15-25	Low	0.55	No
186	*Eucalyptus camaldulensis*	1	5-10	10-15	Average	Juvenile	5-15	Low	0.35	No
187	*Ficus microcarpa*	1	10-15	10-15	Good	Mature	25+	Medium	0.75	No
188	*Eucalyptus camaldulensis*	1	15-20	10-15	Good	Mature	25+	High	0.75	No
189	*Platanus x acerifolia*	1	5-10	1-5	Average	Juvenile	15-25	Low	0.2	No
190	*Eucalyptus camaldulensis*	1	10-15	10-15	Good	Semi-mature	25+	Medium	0.6	No
191	*Eucalyptus camaldulensis*	1	5-10	1-5	Average	Juvenile	15-25	Low	0.2	No
192	*Eucalyptus camaldulensis*	1	5-10	1-5	Average	Juvenile	15-25	Low	0.2	No
193	*Eucalyptus camaldulensis*	1	20-25	10-15	Average	Mature	15-25	Medium	0.65	No
194	*Eucalyptus camaldulensis*	1	1-5	1-5	Poor	Semi-mature	5-15	Low	0.4	No
195	*Eucalyptus camaldulensis*	1	10-15	1-5	Average	Juvenile	25+	Low	0.3	No
196	*Ficus carica*	1	1-5	1-5	Good	Semi-mature	15-25	Low	0.2	No
197	*Eucalyptus camaldulensis*	1	10-15	1-5	Average	Juvenile	25+	Low	0.25	No
198	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Semi-mature	25+	Low	0.35	No
199	*Platanus x acerifolia*	1	15-20	10-15	Excellent	Mature	25+	High	0.6	No
200	*Syzygium smithii*	1	10-15	5-10	Excellent	Mature	25+	Low	0.4	No
201	*Eucalyptus patens*	1	5-10	5-10	Average	Mature	5-15	Medium	0.5	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
202	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Mature	5-15	Medium	0.5	No
203	*Eucalyptus globulus*	1	15-20	10-15	Good	Mature	25+	High	1.2	No
204	*Archontophoenix cunninghamiana*	1	5-10	1-5	Excellent	Semi-mature	25+	Low	0.2	No
205	*Lagerstroemia indica*	1	1-5	5-10	Good	Semi-mature	15-25	Low	0.2	No
206	*Fraxinus sp.*	1	5-10	5-10	Poor	Mature	0-5	Low	0.3	No
207	*Ulmus parvifolia*	1	1-5	1-5	Good	Juvenile	15-25	Low	0.2	No
208	*Eucalyptus citriodora*	1	20-25	10-15	Excellent	Mature	25+	High	0.7	No
209	*Eucalyptus camaldulensis*	1	15-20	15-20	Good	Mature	25+	High	1.2	No
210	*Syagrus romanzoffiana*	1	5-10	1-5	Average	Semi-mature	5-15	Low	0.3	No
211	*Eucalyptus citriodora*	1	5-10	5-10	Good	Juvenile	25+	Medium	0.4	No
212	*Jacaranda mimosifolia*	1	5-10	5-10	Good	Semi-mature	15-25	Medium	0.2	No
213	*Syagrus romanzoffiana*	1	5-10	1-5	Poor	Juvenile	5-15	Low	0.25	No
214	*Tipuana tipu*	1	5-10	5-10	Excellent	Semi-mature	25+	Low	0.4	No
215	*Ulmus parvifolia*	1	5-10	5-10	Good	Mature	25+	Medium	0.4	No
216	*Erythrina sykseii*	1	5-10	5-10	Average	Semi-mature	15-25	Low	0.6	No
217	*Ficus sp.*	1	5-10	5-10	Good	Semi-mature	25+	Medium	0.6	No
218	*Cinnamomum camphora*	1	10-15	10-15	Good	Semi-mature	25+	Medium	0.6	No
219	*Melaleuca rhaphiophylla*	1	1-5	1-5	Average	Juvenile	15-25	Low	0.2	No
220	*Agonis flexuosa*	1	10-15	10-15	Good	Mature	25+	High	0.8	No
221	*Eucalyptus sp.*	1	5-10	5-10	Good	Semi-mature	15-25	Medium	0.4	No
222	*Eucalyptus sp.*	1	5-10	5-10	Average	Semi-mature	15-25	Low	0.4	No
223	*Poplar lombardi*	1	10-15	1-5	Excellent	Semi-mature	15-25	Low	0.4	No
224	*Cinnamomum camphora*	1	1-5	1-5	Good	Juvenile	15-25	Low	0.2	No
225	*Ficus microcarpa*	1	1-5	1-5	Good	Juvenile	25+	Low	0.35	No
226	*Jacaranda mimosifolia*	1	1-5	1-5	Average	Juvenile	15-25	Low	0.2	No
227	*Araucaria heterophylla*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.3	No
228	*Cinnamomum camphora*	1	1-5	1-5	Good	Juvenile	25+	Low	0.2	No
229	*Unknown*	1	10-15	10-15	Excellent	Semi-mature	25+	High	0.5	No
230	*Syagrus romanzoffiana*	1	5-10	1-5	Average	Semi-mature	15-25	Low	0.2	No
231	*Syagrus romanzoffiana*	1	10-15	1-5	Average	Semi-mature	15-25	Low	0.2	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
232	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Semi-mature	15-25	Low	0.6	No
233	*Eucalyptus sp.*	1	5-10	1-5	Poor	Juvenile	5-15	Low	0.3	No
234	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Semi-mature	15-25	Low	0.5	No
235	*Eucalyptus cladocalyx*	1	15-20	5-10	Good	Mature	25+	Medium	0.6	No
236	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Semi-mature	25+	Medium	0.5	No
237	*Eucalyptus camaldulensis*	1	15-20	10-15	Excellent	Semi-mature	25+	High	0.5	No
238	*Eucalyptus camaldulensis*	1	5-10	5-10	Average	Juvenile	25+	Low	0.5	No
239	*Eucalyptus camaldulensis*	1	10-15	10-15	Average	Mature	15-25	Medium	0.8	No
240	*Corymbia maculata*	1	10-15	5-10	Excellent	Semi-mature	25+	High	0.4	No
241	*Eucalyptus leucoxylon*	1	5-10	10-15	Good	Mature	25+	Medium	0.7	No
242	*Eucalyptus cladocalyx*	1	15-20	10-15	Average	Mature	5-15	Low	0.9	No
243	*Liquidambar styraciflua*	1	5-10	1-5	Poor	Juvenile	0-5	Low	0.25	No
244	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Mature	25+	Medium	0.6	No
245	*Pinus radiata*	1	15-20	10-15	Excellent	Mature	25+	High	1.2	No
246	*Banksia attenuata*	1	1-5	1-5	Average	Semi-mature	5-15	Low	0.2	No
247	*Banksia attenuata*	1	1-5	1-5	Average	Juvenile	5-15	Low	0.2	No
248	*Banksia attenuata*	1	1-5	1-5	Average	Juvenile	5-15	Low	0.2	No
249	*Acacia sp.*	1	5-10	10-15	Poor	Mature	5-15	Low	0.7	No
250	*Eucalyptus cladocalyx*	1	5-10	5-10	Poor	Semi-mature	5-15	Low	0.5	No
251	*Tipuana tipu*	1	5-10	5-10	Good	Juvenile	25+	Low	0.4	No
252	*Eucalyptus grandis*	1	5-10	5-10	Poor	Semi-mature	0-5	Low	0.5	No
253	*Melaleuca rhaphiophylla*	1	5-10	5-10	Average	Semi-mature	15-25	Medium	0.4	No
254	*Banksia attenuata*	1	5-10	1-5	Average	Semi-mature	15-25	Medium	0.3	No
255	*Melaleuca rhaphiophylla*	1	5-10	5-10	Average	Mature	15-25	Low	0.6	No
256	*Acacia sp.*	1	5-10	10-15	Average	Semi-mature	5-15	Low	0.5	No
257	*Eucalyptus marginata*	1	5-10	5-10	Poor	Semi-mature	5-15	Low	0.5	No
258	*Corymbia maculata*	1	15-20	5-10	Good	Semi-mature	25+	High	0.6	No
259	*Corymbia citriodora*	1	15-20	10-15	Good	Semi-mature	25+	Medium	0.4	No
260	*Eucalyptus sp.*	1	1-5	1-5	Poor	Juvenile	5-15	Low	0.3	No
261	*Eucalyptus leucoxylon*	1	10-15	5-10	Good	Mature	25+	High	0.6	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
262	*Eucalyptus cladocalyx*	1	15-20	5-10	Average	Mature	15-25	Medium	0.8	No
263	*Eucalyptus citriodora*	1	15-20	5-10	Good	Semi-mature	25+	Medium	0.4	No
264	*Eucalyptus camaldulensis*	1	15-20	5-10	Good	Semi-mature	25+	Medium	0.4	No
265	*Eucalyptus grandis*	1	15-20	5-10	Average	Semi-mature	25+	Low	0.4	No
266	*Eucalyptus citriodora*	1	15-20	5-10	Excellent	Semi-mature	25+	High	0.4	No
267	*Eucalyptus camaldulensis*	1	20-25	10-15	Average	Mature	15-25	Medium	0.6	No
268	*Eucalyptus citriodora*	1	20-25	5-10	Excellent	Semi-mature	25+	High	0.5	No
269	*Eucalyptus cladocalyx*	1	15-20	10-15	Average	Mature	25+	Medium	0.6	No
270	*Eucalyptus citriodora*	1	20-25	15-20	Good	Mature	25+	High	1	No
271	*Eucalyptus citriodora*	1	20-25	10-15	Excellent	Semi-mature	25+	High	0.7	No
272	*Eucalyptus botryoides*	1	10-15	5-10	Good	Juvenile	25+	Medium	0.4	No
273	*Ulmus parvifolia*	1	1-5	1-5	Average	Juvenile	15-25	Low	0.1	No
274	*Eucalyptus camaldulensis*	1	15-20	15-20	Average	Mature	15-25	Medium	0.9	No
275	*Unknown*	1	5-10	5-10	Average	Semi-mature	5-15	Medium	0.5	No
276	*Eucalyptus camaldulensis*	1	10-15	10-15	Average	Semi-mature	5-15	Low	0.6	No
277	*Eucalyptus cladocalyx*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.5	No
278	*Eucalyptus cladocalyx*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.4	No
279	*Eucalyptus grandis*	1	10-15	5-10	Poor	Juvenile	5-15	Low	0.45	No
280	*Eucalyptus citriodora*	1	20-25	5-10	Good	Semi-mature	25+	High	0.5	No
281	*Eucalyptus citriodora*	1	20-25	10-15	Excellent	Mature	25+	High	0.8	No
282	*Agonis flexuosa*	1	1-5	5-10	Average	Juvenile	5-15	Low	0.3	No
283	*Grevillea robusta*	1	5-10	1-5	Good	Juvenile	15-25	Medium	0.2	No
284	*Eucalyptus sp.*	1	5-10	5-10	Good	Semi-mature	15-25	Medium	0.5	No
285	*Agonis flexuosa*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.3	No
286	*Eucalyptus grandis*	1	15-20	10-15	Good	Mature	25+	High	0.7	No
287	*Agonis flexuosa*	1	1-5	1-5	Average	Juvenile	5-15	Low	0.2	No
288	*Ficus microcarpa*	1	10-15	5-10	Good	Juvenile	15-25	Low	0.4	No
289	*Ficus microcarpa*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.4	No
290	*Eucalyptus grandis*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.2	No
291	*Eucalyptus botryoides*	1	15-20	10-15	Good	Semi-mature	25+	Medium	0.5	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
292	*Corymbia ficifolia*	1	10-15	5-10	Good	Juvenile	15-25	Medium	0.4	No
293	*Eucalyptus citriodora*	1	20-25	15-20	Good	Mature	25+	Medium	1	No
294	*Eucalyptus grandis*	1	20-25	15-20	Good	Mature	25+	High	1	No
295	*Corymbia maculata*	1	15-20	5-10	Good	Semi-mature	25+	High	0.45	No
296	*Allocasuarina sp.*	1	15-20	10-15	Good	Semi-mature	25+	Medium	0.6	No
297	*Eucalyptus botryoides*	1	15-20	10-15	Excellent	Semi-mature	25+	Medium	0.5	No
298	*Eucalyptus botryoides*	1	5-10	5-10	Poor	Semi-mature	5-15	Low	0.4	No
299	*Allocasuarina sp.*	1	10-15	1-5	Average	Semi-mature	15-25	Low	0.4	No
300	*Allocasuarina sp.*	1	5-10	1-5	Average	Juvenile	25+	Low	0.3	No
301	*Allocasuarina sp.*	1	5-10	1-5	Average	Juvenile	15-25	Low	0.2	No
302	*Allocasuarina sp.*	1	10-15	5-10	Average	Semi-mature	15-25	Low	0.4	No
303	*Eucalyptus marginata*	1	1-5	5-10	Average	Semi-mature	5-15	Low	0.4	No
304	*Allocasuarina fraseriana*	1	10-15	1-5	Average	Semi-mature	15-25	Low	0.4	No
305	*Eucalyptus patens*	1	5-10	10-15	Average	Mature	5-15	Low	0.8	No
306	*Allocasuarina fraseriana*	1	10-15	5-10	Average	Mature	15-25	Low	0.5	No
307	*Allocasuarina sp.*	1	15-20	5-10	Good	Mature	15-25	Medium	0.8	No
308	*Allocasuarina sp.*	1	5-10	1-5	Average	Semi-mature	5-15	Low	0.4	No
309	*Allocasuarina sp.*	1	5-10	1-5	Average	Semi-mature	5-15	Low	0.4	No
310	*Melaleuca quinquenervia*	1	5-10	5-10	Poor	Semi-mature	5-15	Low	0.5	No
311	*Melia azaderach*	1	5-10	5-10	Poor	Juvenile	5-15	Low	0.4	No
312	*Corymbia ficifolia*	1	1-5	1-5	Good	Juvenile	15-25	Medium	0.3	No
313	*Melaleuca quinquenervia*	1	5-10	5-10	Good	Mature	25+	Low	0.5	No
314	*Melaleuca quinquenervia*	1	5-10	5-10	Good	Mature	25+	Medium	0.5	No
315	*Melaleuca quinquenervia*	1	5-10	5-10	Good	Mature	15-25	Medium	0.5	No
316	*Melia azaderach*	1	10-15	5-10	Good	Mature	25+	Low	0.6	No
317	*Cupressus sp.*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.3	No
318	*Cupressus sp.*	1	1-5	1-5	Poor	Juvenile	5-15	Low	0.2	No
319	*Eucalyptus grandis*	1	20-25	15-20	Excellent	Mature	25+	High	0.9	No
320	*Eucalyptus citriodora*	1	15-20	5-10	Good	Semi-mature	25+	Medium	0.6	No
321	*Eucalyptus camaldulensis*	1	15-20	5-10	Average	Semi-mature	25+	Medium	0.6	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
322	*Eucalyptus grandis*	1	15-20	10-15	Excellent	Semi-mature	25+	High	0.6	No
323	*Eucalyptus grandis*	1	15-20	10-15	Excellent	Semi-mature	25+	High	0.6	No
324	*Eucalyptus citriodora*	1	10-15	1-5	Good	Juvenile	25+	Low	0.2	No
325	*Eucalyptus cladocalyx*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.3	No
326	*Eucalyptus cladocalyx*	1	1-5	5-10	Average	Juvenile	5-15	Low	0.2	No
327	*Eucalyptus citriodora*	1	15-20	15-20	Good	Mature	25+	High	0.9	No
328	*Eucalyptus citriodora*	1	15-20	5-10	Good	Semi-mature	25+	Medium	0.3	No
329	*Eucalyptus citriodora*	1	20-25	10-15	Excellent	Semi-mature	25+	High	0.5	No
330	*Eucalyptus citriodora*	1	15-20	10-15	Excellent	Semi-mature	25+	High	0.6	No
331	*Eucalyptus camaldulensis*	1	15-20	15-20	Average	Mature	15-25	Medium	0.8	No
332	*Melia azaderach*	1	5-10	5-10	Good	Juvenile	25+	Low	0.4	No
333	*Melaleuca quinquenervia*	1	5-10	1-5	Average	Juvenile	25+	Low	0.3	No
334	*Eucalyptus citriodora*	1	10-15	5-10	Excellent	Juvenile	25+	Medium	0.3	No
335	*Melaleuca quinquenervia*	1	5-10	1-5	Good	Juvenile	25+	Medium	0.3	No
336	*Melaleuca quinquenervia*	1	5-10	1-5	Good	Juvenile	25+	Low	0.2	No
337	*Melaleuca quinquenervia*	1	5-10	1-5	Excellent	Juvenile	25+	Low	0.3	No
338	*Melaleuca quinquenervia*	1	5-10	1-5	Excellent	Juvenile	25+	Low	0.3	No
339	*Melaleuca quinquenervia*	10	5-10	1-5	Good	Semi-mature	25+	Medium	0.35	No
340	*Eucalyptus camaldulensis*	1	5-10	1-5	Excellent	Juvenile	25+	Medium	0.3	No
341	*Eucalyptus camaldulensis*	1	5-10	1-5	Average	Juvenile	15-25	Low	0.3	No
342	*Eucalyptus camaldulensis*	1	5-10	1-5	Average	Juvenile	15-25	Low	0.2	No
343	*Eucalyptus platypus*	1	1-5	5-10	Good	Juvenile	25+	Low	0.2	No
344	*Eucalyptus camaldulensis*	1	5-10	1-5	Excellent	Juvenile	25+	Low	0.2	No
345	*Olea europaea*	1	1-5	1-5	Good	Semi-mature	15-25	Low	0.2	No
346	*Syagrus romanzoffiana*	4	5-10	1-5	Average	Juvenile	25+	Low	0.3	No
347	*Eucalyptus robusta*	1	10-15	5-10	Good	Juvenile	25+	Low	0.45	No
348	*Melaleuca quinquenervia*	1	5-10	1-5	Good	Juvenile	15-25	Low	0.3	No
349	*Melaleuca quinquenervia*	1	5-10	5-10	Excellent	Semi-mature	25+	Low	0.5	No
350	*Tipuana tipu*	1	5-10	1-5	Average	Juvenile	25+	Low	0.2	No
351	*Eucalyptus robusta*	4	10-15	1-5	Average	Juvenile	15-25	Low	0.3	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
352	*Eucalyptus sp.*	1	15-20	10-15	Good	Mature	25+	High	0.7	No
353	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Mature	25+	Medium	0.5	No
354	*Eucalyptus grandis*	1	15-20	10-15	Good	Mature	25+	Medium	0.8	No
355	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Mature	25+	Medium	0.5	No
356	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Mature	25+	Medium	0.6	No
357	*Eucalyptus citriodora*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.55	No
358	*Corymbia maculata*	1	10-15	5-10	Excellent	Juvenile	25+	Medium	0.4	No
359	*Corymbia maculata*	1	10-15	5-10	Excellent	Semi-mature	25+	Medium	0.4	No
360	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Semi-mature	15-25	Low	0.3	No
361	*Eucalyptus citriodora*	1	20-25	10-15	Excellent	Mature	25+	High	0.8	No
362	*Corymbia ficifolia*	1	5-10	1-5	Average	Semi-mature	5-15	Low	0.3	No
363	*Eucalyptus camaldulensis*	1	5-10	5-10	Poor	Juvenile	5-15	Low	0.2	No
364	*Eucalyptus globulus*	1	15-20	10-15	Average	Mature	15-25	Medium	0.7	No
365	*Eucalyptus camaldulensis*	1	5-10	10-15	Average	Mature	15-25	Low	0.5	No
366	*Eucalyptus cladocalyx*	1	15-20	10-15	Average	Mature	15-25	Medium	0.9	No
367	*Eucalyptus globulus*	1	15-20	10-15	Average	Mature	15-25	High	1.5	No
368	*Eucalyptus cladocalyx*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.3	No
369	*Eucalyptus cladocalyx*	1	10-15	5-10	Poor	Semi-mature	0-5	Low	0.5	No
370	*Eucalyptus robusta*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.4	No
371	*Eucalyptus nicholii*	1	15-20	10-15	Average	Mature	15-25	High	0.9	No
372	*Eucalyptus cladocalyx*	1	15-20	10-15	Average	Mature	15-25	Medium	0.6	No
373	*Eucalyptus grandis*	1	15-20	10-15	Good	Mature	25+	Medium	0.9	No
374	*Eucalyptus grandis*	1	15-20	5-10	Average	Mature	5-15	Low	1	No
375	*Eucalyptus camaldulensis*	1	10-15	10-15	Average	Mature	15-25	Medium	0.6	No
376	*Melaleuca rhaphiophylla*	1	5-10	5-10	Poor	Mature	5-15	Low	0.4	No
377	*Corymbia maculata*	1	10-15	1-5	Excellent	Semi-mature	25+	Medium	0.4	No
378	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Mature	25+	Medium	0.5	No
379	*Eucalyptus patens*	1	5-10	1-5	Average	Semi-mature	5-15	Low	0.4	No
380	*Eucalyptus patens*	1	1-5	1-5	Average	Juvenile	5-15	Low	0.3	No
381	*Corymbia maculata*	1	10-15	5-10	Excellent	Semi-mature	25+	Medium	0.4	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
382	*Eucalyptus patens*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.3	No
383	*Banksia sp.*	1	5-10	5-10	Average	Mature	5-15	Medium	0.5	No
384	*Eucalyptus grandis*	1	15-20	10-15	Average	Mature	15-25	Low	0.7	No
385	*Eucalyptus sp.*	1	5-10	10-15	Poor	Mature	5-15	Low	0.9	No
386	*Eucalyptus leucoxylon*	1	5-10	5-10	Poor	Semi-mature	5-15	Low	0.4	No
387	*Eucalyptus sp.*	1	10-15	10-15	Average	Mature	5-15	Low	0.6	No
388	*Eucalyptus camaldulensis*	1	10-15	5-10	Good	Juvenile	25+	Medium	0.3	No
389	*Eucalyptus grandis*	1	15-20	10-15	Good	Semi-mature	25+	Medium	0.5	No
390	*Corymbia maculata*	1	10-15	1-5	Good	Semi-mature	25+	Medium	0.3	No
391	*Eucalyptus botryoides*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.3	No
392	*Eucalyptus sp.*	1	10-15	10-15	Average	Mature	5-15	Low	0.5	No
393	*Eucalyptus grandis*	1	15-20	10-15	Excellent	Mature	25+	High	0.7	No
394	*Corymbia maculata*	1	10-15	5-10	Excellent	Juvenile	25+	Medium	0.3	No
395	*Eucalyptus grandis*	1	5-10	1-5	Poor	Juvenile	5-15	Low	0.2	No
396	*Acacia sp.*	1	5-10	10-15	Poor	Mature	5-15	Low	0.4	No
397	*Eucalyptus grandis*	1	10-15	5-10	Excellent	Semi-mature	25+	Medium	0.4	No
398	*Eucalyptus grandis*	1	5-10	5-10	Poor	Juvenile	5-15	Low	0.2	No
399	*Eucalyptus grandis*	1	10-15	5-10	Excellent	Juvenile	25+	Medium	0.3	No
400	*Eucalyptus sp.*	1	5-10	5-10	Good	Juvenile	25+	Low	0.2	No
401	*Eucalyptus sp.*	1	10-15	5-10	Average	Semi-mature	5-15	Low	0.4	No
402	*Eucalyptus sp.*	1	15-20	5-10	Good	Semi-mature	25+	Medium	0.4	No
403	*Eucalyptus sp.*	1	10-15	1-5	Average	Semi-mature	15-25	Low	0.4	No
404	*Eucalyptus sp.*	1	15-20	10-15	Average	Mature	25+	Medium	0.6	No
405	*Eucalyptus sp.*	1	15-20	10-15	Excellent	Mature	25+	Medium	0.6	No
406	*Eucalyptus robusta*	1	5-10	5-10	Average	Semi-mature	15-25	Low	0.5	No
407	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Semi-mature	15-25	Low	0.5	No
408	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Mature	15-25	Low	0.7	No
409	*Brachychiton populneus*	1	5-10	1-5	Good	Juvenile	15-25	Medium	0.3	No
410	*Eucalyptus camaldulensis*	1	5-10	5-10	Average	Semi-mature	25+	Medium	0.6	No
411	*Eucalyptus citriodora*	1	15-20	10-15	Excellent	Semi-mature	25+	High	0.6	No

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412	*Eucalyptus sp.*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.5	No
413	*Melia azaderach*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.3	No
414	*Eucalyptus camaldulensis*	1	10-15	10-15	Average	Mature	15-25	Medium	0.9	No
415	*Eucalyptus camaldulensis*	1	15-20	10-15	Average	Mature	15-25	Medium	0.8	No
416	*Corymbia citriodora*	1	15-20	10-15	Excellent	Semi-mature	25+	High	0.6	No
417	*Corymbia calophylla*	1	5-10	1-5	Excellent	Juvenile	25+	Low	0.2	No
418	*Corymbia citriodora*	1	25+	10-15	Excellent	Mature	25+	High	0.8	No
419	*Eucalyptus robusta*	1	5-10	5-10	Average	Semi-mature	15-25	Medium	0.7	No
420	*Corymbia calophylla*	1	1-5	1-5	Average	Juvenile	5-15	Low	0.2	No
421	*Corymbia calophylla*	1	5-10	1-5	Poor	Juvenile	5-15	Low	0.35	No
422	*Eucalyptus sp.*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.3	No
423	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Mature	5-15	Low	0.6	No
424	*Eucalyptus cladocalyx*	1	10-15	10-15	Average	Mature	5-15	Low	0.6	No
425	*Agonis flexuosa*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.4	No
426	*Corymbia calophylla*	1	1-5	1-5	Average	Juvenile	15-25	Low	0.2	No
427	*Eucalyptus camaldulensis*	1	5-10	5-10	Excellent	Juvenile	25+	Medium	0.4	No
428	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Juvenile	15-25	Low	0.3	No
429	*Eucalyptus camaldulensis*	1	15-20	10-15	Average	Semi-mature	15-25	Low	0.5	No
430	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Juvenile	15-25	Low	0.3	No
431	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Juvenile	5-15	Low	0.35	No
432	*Eucalyptus camaldulensis*	1	15-20	10-15	Good	Juvenile	25+	Medium	0.4	No
433	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Juvenile	5-15	Low	0.4	No
434	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Juvenile	5-15	Low	0.35	No
435	*Ulmus parvifolia*	1	1-5	5-10	Good	Juvenile	15-25	Low	0.2	No
436	*Eucalyptus camaldulensis*	1	15-20	10-15	Average	Mature	15-25	High	0.7	No
437	*Corymbia maculata*	1	10-15	5-10	Excellent	Semi-mature	25+	Medium	0.4	No
438	*Corymbia maculata*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.3	No
439	*Eucalyptus grandis*	1	15-20	10-15	Excellent	Semi-mature	25+	High	0.6	No
440	*Robinia sp.*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.2	No
441	*Eucalyptus robusta*	1	10-15	5-10	Good	Mature	25+	High	0.6	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
442	*Corymbia maculata*	1	10-15	5-10	Excellent	Juvenile	25+	Medium	0.2	No
443	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Semi-mature	15-25	Low	0.4	No
444	*Corymbia maculata*	1	15-20	5-10	Good	Semi-mature	25+	Medium	0.4	No
445	*Eucalyptus camaldulensis*	1	15-20	10-15	Good	Mature	25+	Medium	0.6	No
446	*Eucalyptus camaldulensis*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.5	No
447	*Eucalyptus grandis*	1	20-25	10-15	Average	Semi-mature	15-25	Medium	0.6	No
448	*Eucalyptus marginata*	1	5-10	5-10	Average	Semi-mature	15-25	Medium	0.5	No
449	*Banksia attenuata*	1	1-5	1-5	Good	Juvenile	25+	Medium	0.2	No
450	*Corymbia maculata*	1	10-15	5-10	Good	Juvenile	25+	Medium	0.4	No
451	*Eucalyptus grandis*	1	10-15	5-10	Poor	Semi-mature	0-5	Low	0.5	No
452	*Corymbia maculata*	1	15-20	5-10	Average	Semi-mature	5-15	Low	0.4	No
453	*Corymbia maculata*	1	15-20	10-15	Good	Semi-mature	15-25	Medium	0.5	No
454	*Eucalyptus grandis*	1	15-20	10-15	Excellent	Semi-mature	25+	High	0.5	No
455	*Corymbia maculata*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.4	No
456	*Allocasuarina fraseriana*	1	5-10	1-5	Average	Semi-mature	5-15	Low	0.4	No
457	*Eucalyptus grandis*	1	15-20	10-15	Good	Mature	15-25	Medium	0.6	No
458	*Eucalyptus camaldulensis*	1	10-15	10-15	Excellent	Semi-mature	25+	Medium	0.6	No
459	*Eucalyptus leucoxylon*	1	5-10	5-10	Excellent	Semi-mature	25+	Medium	0.5	No
460	*Eucalyptus leucoxylon*	1	10-15	10-15	Excellent	Mature	25+	High	0.8	No
461	*Ficus microcarpa*	1	10-15	5-10	Excellent	Juvenile	25+	Medium	0.4	No
462	*Eucalyptus leucoxylon*	1	10-15	10-15	Excellent	Mature	25+	High	0.6	No
463	*Eucalyptus camaldulensis*	1	10-15	5-10	Good	Juvenile	25+	Low	0.3	No
464	*Eucalyptus camaldulensis*	1	10-15	1-5	Good	Juvenile	25+	Medium	0.4	No
465	*Eucalyptus camaldulensis*	1	5-10	1-5	Good	Juvenile	25+	Low	0.2	No
466	*Eucalyptus camaldulensis*	1	10-15	5-10	Excellent	Semi-mature	25+	Medium	0.4	No
467	*Ficus microcarpa*	1	5-10	5-10	Good	Semi-mature	25+	Low	0.3	No
468	*Eucalyptus botryoides*	1	15-20	10-15	Average	Mature	15-25	Medium	0.75	No
469	*Eucalyptus cladocalyx*	1	10-15	10-15	Poor	Mature	5-15	Low	0.6	No
470	*Corymbia maculata*	1	15-20	5-10	Excellent	Semi-mature	25+	High	0.45	No
471	*Eucalyptus leucoxylon*	1	5-10	10-15	Excellent	Mature	25+	High	0.7	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
472	*Eucalyptus grandis*	1	20-25	10-15	Average	Mature	15-25	Medium	1	No
473	*Corymbia maculata*	1	15-20	10-15	Excellent	Semi-mature	25+	High	0.4	No
474	*Eucalyptus cladocalyx*	1	10-15	10-15	Average	Semi-mature	15-25	Low	0.45	No
475	*Eucalyptus camaldulensis*	1	10-15	10-15	Average	Mature	15-25	Medium	0.6	No
476	*Olea europaea*	1	5-10	5-10	Excellent	Semi-mature	15-25	Low	0.3	No
477	*Olea europaea*	1	5-10	5-10	Excellent	Semi-mature	15-25	Low	0.3	No
478	*Lophostemon confertus*	1	10-15	5-10	Average	Semi-mature	15-25	Low	0.4	No
479	*Eucalyptus marginata*	1	5-10	5-10	Poor	Semi-mature	0-5	Low	0.5	No
480	*Eucalyptus grandis*	1	20-25	10-15	Excellent	Mature	25+	High	0.8	No
481	*Eucalyptus grandis*	1	20-25	10-15	Good	Mature	25+	Medium	1	No
482	*Eucalyptus grandis*	1	20-25	10-15	Good	Mature	15-25	Medium	0.7	No
483	*Eucalyptus cladocalyx*	1	20-25	10-15	Excellent	Mature	25+	High	0.75	No
484	*Eucalyptus grandis*	1	20-25	10-15	Good	Mature	15-25	Medium	0.7	No
485	*Unknown*	1	5-10	1-5	Good	Juvenile	15-25	Low	0.2	No
486	*Eucalyptus spathulata*	1	5-10	5-10	Poor	Semi-mature	5-15	Low	0.4	No
487	*Araucaria columnaris*	1	10-15	5-10	Excellent	Semi-mature	25+	High	0.4	No
488	*Corymbia maculata*	1	10-15	5-10	Excellent	Semi-mature	25+	Medium	0.4	No
489	*Corymbia maculata*	1	15-20	5-10	Good	Semi-mature	25+	Medium	0.4	No
490	*Eucalyptus cladocalyx*	1	1-5	5-10	Average	Juvenile	5-15	Low	0.3	No
491	*Eucalyptus citriodora*	1	15-20	10-15	Average	Mature	5-15	Low	0.65	No
492	*Lophostemon confertus*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.4	No
493	*Eucalyptus citriodora*	1	20-25	10-15	Good	Semi-mature	25+	High	0.6	No
494	*Eucalyptus citriodora*	1	20-25	10-15	Excellent	Mature	25+	High	0.6	No
495	*Corymbia maculata*	1	15-20	10-15	Excellent	Semi-mature	25+	Medium	0.4	No
496	*Eucalyptus sp.*	1	20-25	15-20	Good	Mature	25+	Medium	0.7	No
497	*Corymbia maculata*	1	20-25	15-20	Excellent	Mature	25+	High	0.9	No
498	*Eucalyptus camaldulensis*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.4	No
499	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Juvenile	5-15	Low	0.4	No
500	*Eucalyptus sp.*	1	10-15	5-10	Average	Semi-mature	5-15	Low	0.4	No
501	*Eucalyptus camaldulensis*	1	15-20	10-15	Good	Mature	25+	Medium	0.7	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
502	*Corymbia maculata*	1	10-15	5-10	Excellent	Semi-mature	25+	Medium	0.3	No
503	*Banksia attenuata*	1	1-5	5-10	Good	Semi-mature	25+	Medium	0.3	No
504	*Corymbia maculata*	1	10-15	1-5	Good	Semi-mature	25+	Medium	0.4	No
505	*Corymbia maculata*	1	10-15	1-5	Good	Semi-mature	25+	Medium	0.3	No
506	*Eucalyptus robusta*	1	10-15	10-15	Good	Mature	25+	Medium	0.8	No
507	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Mature	15-25	Low	0.5	No
508	*Banksia attenuata*	2	1-5	1-5	Average	Semi-mature	15-25	Low	0.3	No
509	*Corymbia maculata*	1	5-10	1-5	Good	Juvenile	15-25	Low	0.4	No
510	*Angophora costada*	1	10-15	1-5	Excellent	Semi-mature	25+	Medium	0.4	No
511	*Eucalyptus gomphocephala*	1	5-10	5-10	Good	Semi-mature	25+	Medium	0.5	No
512	*Banksia attenuata*	2	5-10	5-10	Average	Semi-mature	5-15	Low	0.3	No
513	*Corymbia maculata*	1	10-15	5-10	Excellent	Semi-mature	25+	Medium	0.3	No
514	*Corymbia maculata*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.3	No
515	*Banksia attenuata*	2	5-10	5-10	Average	Mature	0-5	Low	0.5	No
516	*Corymbia maculata*	1	15-20	10-15	Excellent	Mature	25+	High	0.6	No
517	*Corymbia maculata*	1	15-20	10-15	Excellent	Semi-mature	25+	Medium	0.4	No
518	*Corymbia maculata*	1	10-15	10-15	Excellent	Semi-mature	25+	Medium	0.5	No
519	*Banksia sp.*	1	1-5	1-5	Average	Semi-mature	15-25	Low	0.3	No
520	*Banksia attenuata*	2	1-5	5-10	Average	Semi-mature	5-15	Low	0.4	No
521	*Eucalyptus marginata*	1	10-15	5-10	Average	Mature	5-15	Low	0.6	No
522	*Eucalyptus marginata*	1	5-10	5-10	Poor	Mature	5-15	Low	0.6	No
523	*Corymbia maculata*	1	10-15	5-10	Excellent	Semi-mature	25+	Medium	0.4	No
524	*Corymbia maculata*	1	15-20	10-15	Excellent	Mature	25+	High	0.5	No
525	*Jacaranda mimosifolia*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.3	No
526	*Banksia attenuata*	1	1-5	1-5	Poor	Semi-mature	0-5	Low	0.2	No
527	*Banksia attenuata*	2	1-5	5-10	Average	Semi-mature	5-15	Low	0.3	No
528	*Corymbia maculata*	1	15-20	10-15	Excellent	Mature	25+	High	0.5	No
529	*Corymbia maculata*	1	15-20	5-10	Good	Semi-mature	25+	Medium	0.5	No
530	*Banksia attenuata*	10	1-5	1-5	Poor	Semi-mature	5-15	Low	0.2	No
531	*Corymbia maculata*	1	15-20	10-15	Excellent	Mature	25+	High	0.6	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
532	*Callistemon sp.*	1	1-5	5-10	Good	Semi-mature	15-25	Low	0.2	No
533	*Banksia attenuata*	3	1-5	1-5	Average	Semi-mature	5-15	Low	0.2	No
534	*Corymbia maculata*	1	5-10	1-5	Excellent	Juvenile	25+	Medium	0.4	No
535	*Banksia sp.*	1	1-5	1-5	Average	Semi-mature	5-15	Low	0.3	No
536	*Eucalyptus marginata*	1	1-5	1-5	Average	Juvenile	5-15	Low	0.3	No
537	*Banksia attenuata*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.3	No
538	*Unknown*	1	5-10	1-5	Poor	Juvenile	0-5	Low	0.2	No
539	*Banksia sp.*	1	5-10	5-10	Good	Mature	15-25	Medium	0.4	No
540	*Banksia attenuata*	4	1-5	1-5	Average	Semi-mature	5-15	Low	0.2	No
541	*Allocasuarina fraseriana*	1	5-10	5-10	Poor	Semi-mature	0-5	Low	0.4	No
542	*Banksia attenuata*	1	1-5	5-10	Average	Semi-mature	5-15	Low	0.2	No
543	*Allocasuarina fraseriana*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.6	No
544	*Allocasuarina fraseriana*	1	5-10	5-10	Average	Mature	5-15	Low	0.8	No
545	*Allocasuarina fraseriana*	1	5-10	5-10	Average	Mature	5-15	Low	0.7	No
546	*Melia azaderach*	1	5-10	5-10	Good	Juvenile	25+	Low	0.3	No
547	*Eucalyptus citriodora*	1	10-15	5-10	Good	Juvenile	25+	Medium	0.5	No
548	*Corymbia ficifolia*	1	5-10	5-10	Excellent	Semi-mature	15-25	Medium	0.5	No
549	*Eucalyptus citriodora*	1	20-25	15-20	Excellent	Mature	25+	High	0.8	No
550	*Eucalyptus camaldulensis*	1	15-20	15-20	Good	Mature	15-25	Medium	0.85	No
551	*Eucalyptus camaldulensis*	1	15-20	10-15	Average	Mature	15-25	Medium	0.7	No
552	*Eucalyptus camaldulensis*	1	15-20	5-10	Average	Semi-mature	15-25	Low	0.5	No
553	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Juvenile	15-25	Low	0.3	No
554	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Juvenile	15-25	Low	0.4	No
555	*Eucalyptus camaldulensis*	1	15-20	10-15	Average	Mature	15-25	Low	0.7	No
556	*Eucalyptus camaldulensis*	1	15-20	10-15	Average	Semi-mature	5-15	Low	0.6	No
557	*Eucalyptus camaldulensis*	1	15-20	5-10	Average	Mature	15-25	Medium	0.5	No
558	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Mature	15-25	Low	0.5	No
559	*Eucalyptus camaldulensis*	1	15-20	10-15	Good	Mature	25+	Medium	0.6	No
560	*Eucalyptus camaldulensis*	1	15-20	10-15	Average	Mature	15-25	Medium	1.1	No
561	*Eucalyptus camaldulensis*	1	15-20	15-20	Average	Mature	5-15	Low	0.7	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
562	*Eucalyptus marginata*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.5	No
563	*Eucalyptus citriodora*	1	15-20	10-15	Good	Semi-mature	25+	Medium	0.5	No
564	*Eucalyptus grandis*	1	10-15	5-10	Average	Juvenile	15-25	Low	0.4	No
565	*Eucalyptus grandis*	1	10-15	5-10	Average	Juvenile	15-25	Low	0.4	No
566	*Corymbia maculata*	1	15-20	10-15	Good	Semi-mature	25+	Medium	0.6	No
567	*Allocasuarina fraseriana*	1	10-15	5-10	Poor	Mature	0-5	Low	0.5	No
568	*Corymbia maculata*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.4	No
569	*Corymbia maculata*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.4	No
570	*Agonis flexuosa*	1	1-5	5-10	Good	Juvenile	15-25	Low	0.2	No
571	*Schinus molle*	1	5-10	10-15	Good	Mature	15-25	Low	0.7	No
572	*Ficus microcarpa*	1	5-10	10-15	Excellent	Semi-mature	25+	Medium	0.6	No
573	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Semi-mature	25+	Medium	0.3	No
574	*Eucalyptus cladocalyx*	1	10-15	5-10	Average	Juvenile	5-15	Low	0.3	No
575	*Ulmus parvifolia*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.2	No
576	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Semi-mature	25+	Medium	0.45	No
577	*Melia azaderach*	1	5-10	1-5	Good	Juvenile	25+	Low	0.2	No
578	*Eucalyptus leucoxylon*	1	1-5	5-10	Average	Juvenile	15-25	Low	0.2	No
579	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.2	No
580	*Corymbia ficifolia*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.2	No
581	*Corymbia maculata*	1	15-20	10-15	Excellent	Semi-mature	25+	Medium	0.5	No
582	*Eucalyptus cladocalyx*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.5	No
583	*Corymbia maculata*	1	5-10	1-5	Good	Juvenile	25+	Low	0.2	No
584	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.3	No
585	*Eucalyptus citriodora*	1	20-25	15-20	Excellent	Mature	25+	High	1	No
586	*Eucalyptus marginata*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.3	No
587	*Banksia attenuata*	1	1-5	1-5	Average	Juvenile	5-15	Low	0.2	No
588	*Robinia sp.*	1	5-10	1-5	Good	Juvenile	15-25	Low	0.1	No
589	*Quercus robur*	1	10-15	10-15	Excellent	Juvenile	25+	High	0.4	No
590	*Banksia ilicifolia*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.4	No
591	*Eucalyptus robusta*	1	10-15	5-10	Good	Semi-mature	15-25	Medium	0.5	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
592	*Corymbia calophylla*	1	10-15	5-10	Good	Juvenile	15-25	Low	0.4	No
593	*Cupressus sp.*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.4	No
594	*Ulmus parvifolia*	1	5-10	10-15	Good	Juvenile	25+	Low	0.3	No
595	*Eucalyptus grandis*	1	20-25	10-15	Average	Mature	15-25	Medium	0.8	No
596	*Corymbia citriodora*	1	15-20	10-15	Good	Mature	15-25	Medium	0.6	No
597	*Angophora costada*	1	10-15	10-15	Excellent	Semi-mature	25+	Medium	0.4	No
598	*Eucalyptus camaldulensis*	1	10-15	1-5	Good	Juvenile	25+	Low	0.3	No
599	*Callistemon sp.*	1	5-10	5-10	Good	Juvenile	15-25	Low	0.2	No
600	*Eucalyptus spathulata*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.2	No
601	*Eucalyptus spathulata*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.2	No
602	*Eucalyptus grandis*	1	15-20	10-15	Good	Mature	25+	Medium	0.7	No
603	*Corymbia calophylla*	1	10-15	5-10	Good	Semi-mature	15-25	Medium	0.5	No
604	*Jacaranda mimosifolia*	1	5-10	5-10	Good	Juvenile	15-25	Low	0.2	No
605	*Corymbia maculata*	1	15-20	10-15	Excellent	Semi-mature	25+	Medium	0.5	No
606	*Corymbia citriodora*	1	15-20	5-10	Excellent	Mature	25+	High	0.6	No
607	*Eucalyptus grandis*	1	20-25	15-20	Good	Mature	25+	Medium	1	No
608	*Corymbia calophylla*	1	10-15	10-15	Good	Mature	25+	Medium	0.6	No
609	*Corymbia maculata*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.4	No
610	*Eucalyptus leucoxylon*	1	5-10	10-15	Excellent	Semi-mature	25+	Medium	0.5	No
611	*Corymbia maculata*	1	5-10	5-10	Good	Juvenile	15-25	Low	0.2	No
612	*Eucalyptus sp.*	1	15-20	10-15	Excellent	Mature	25+	High	0.7	No
613	*Eucalyptus robusta*	1	10-15	10-15	Average	Mature	5-15	Medium	1	No
614	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Semi-mature	15-25	Low	0.35	No
615	*Eucalyptus camaldulensis*	1	15-20	10-15	Average	Mature	15-25	Low	0.6	No
616	*Banksia attenuata*	1	5-10	5-10	Average	Semi-mature	15-25	Medium	0.3	No
617	*Eucalyptus camaldulensis*	1	10-15	10-15	Average	Semi-mature	5-15	Low	0.6	No
618	*Eucalyptus robusta*	1	10-15	5-10	Good	Juvenile	15-25	Low	0.4	No
619	*Eucalyptus sp.*	1	10-15	5-10	Average	Juvenile	15-25	Low	0.5	No
620	*Eucalyptus sp.*	1	15-20	10-15	Good	Mature	25+	Medium	0.65	No
621	*Corymbia maculata*	1	15-20	10-15	Excellent	Semi-mature	25+	Medium	0.4	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
622	*Eucalyptus sp.*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.4	No
623	*Eucalyptus sp.*	1	10-15	10-15	Good	Semi-mature	25+	Medium	0.5	No
624	*Eucalyptus sp.*	1	10-15	10-15	Good	Mature	25+	Medium	0.6	No
625	*Banksia ilicifolia*	1	5-10	1-5	Average	Semi-mature	5-15	Low	0.3	No
626	*Corymbia maculata*	1	15-20	10-15	Excellent	Mature	25+	Medium	0.5	No
627	*Corymbia maculata*	1	15-20	10-15	Good	Mature	15-25	Medium	0.6	No
628	*Eucalyptus sp.*	1	15-20	10-15	Excellent	Mature	25+	High	0.6	No
629	*Eucalyptus sp.*	1	15-20	10-15	Excellent	Mature	15-25	Medium	0.6	No
630	*Eucalyptus sp.*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.4	No
631	*Corymbia maculata*	1	10-15	5-10	Excellent	Juvenile	25+	Low	0.3	No
632	*Corymbia calophylla*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.4	No
633	*Corymbia maculata*	1	15-20	10-15	Good	Mature	25+	Medium	0.8	No
634	*Eucalyptus grandis*	1	15-20	10-15	Good	Mature	25+	Medium	0.75	No
635	*Eucalyptus sp.*	1	10-15	5-10	Good	Juvenile	25+	Low	0.3	No
636	*Corymbia maculata*	1	5-10	1-5	Good	Juvenile	25+	Low	0.2	No
637	*Eucalyptus leucoxylon*	1	5-10	10-15	Good	Semi-mature	25+	Medium	0.5	No
638	*Eucalyptus nicholii*	1	10-15	5-10	Average	Mature	15-25	Medium	0.6	No
639	*Eucalyptus camaldulensis*	1	10-15	1-5	Average	Juvenile	15-25	Low	0.2	No
640	*Eucalyptus citriodora*	1	10-15	5-10	Poor	Semi-mature	5-15	Low	0.4	No
641	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Juvenile	15-25	Low	0.2	No
642	*Eucalyptus cladocalyx*	1	10-15	5-10	Good	Juvenile	15-25	Low	0.3	No
643	*Eucalyptus camaldulensis*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.4	No
644	*Eucalyptus leucoxylon*	1	5-10	10-15	Good	Mature	25+	Medium	0.5	No
645	*Grevillea robusta*	1	5-10	1-5	Poor	Juvenile	0-5	Low	0.2	No
646	*Eucalyptus cladocalyx*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.3	No
647	*Eucalyptus sp.*	1	10-15	1-5	Good	Juvenile	25+	Low	0.3	No
648	*Eucalyptus camaldulensis*	1	10-15	10-15	Average	Mature	15-25	Low	0.5	No
649	*Eucalyptus camaldulensis*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.4	No
650	*Lophostemon confertus*	1	10-15	5-10	Poor	Juvenile	5-15	Low	0.4	No
651	*Eucalyptus leucoxylon*	1	1-5	5-10	Good	Juvenile	15-25	Low	0.3	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
652	*Eucalyptus cladocalyx*	1	10-15	5-10	Good	Semi-mature	25+	Low	0.45	No
653	*Corymbia maculata*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.4	No
654	*Corymbia calophylla*	1	5-10	10-15	Good	Semi-mature	25+	Medium	0.55	No
655	*Eucalyptus camaldulensis*	1	15-20	10-15	Good	Mature	25+	High	0.5	No
656	*Corymbia maculata*	1	15-20	5-10	Excellent	Semi-mature	25+	Medium	0.4	No
657	*Eucalyptus camaldulensis*	1	15-20	5-10	Good	Semi-mature	25+	Low	0.4	No
658	*Eucalyptus camaldulensis*	1	5-10	5-10	Good	Semi-mature	25+	Medium	0.3	No
659	*Brachychiton populneus*	1	5-10	1-5	Excellent	Juvenile	25+	Medium	0.2	No
660	*Eucalyptus camaldulensis*	1	10-15	10-15	Good	Mature	25+	Medium	0.5	No
661	*Eucalyptus camaldulensis*	1	10-15	10-15	Good	Semi-mature	25+	Low	0.5	No
662	*Eucalyptus cladocalyx*	1	15-20	15-20	Good	Mature	25+	High	0.7	No
663	*Eucalyptus camaldulensis*	1	15-20	5-10	Average	Semi-mature	15-25	Low	0.3	No
664	*Eucalyptus sp.*	1	15-20	10-15	Good	Mature	25+	High	0.7	No
665	*Corymbia maculata*	1	15-20	10-15	Excellent	Semi-mature	25+	Medium	0.45	No
666	*Araucaria columnaris*	1	5-10	1-5	Good	Juvenile	25+	Low	0.2	No
667	*Eucalyptus citriodora*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.4	No
668	*Lophostemon confertus*	1	10-15	10-15	Excellent	Mature	25+	Low	0.6	No
669	*Robinia sp.*	1	5-10	1-5	Poor	Semi-mature	0-5	Low	0.2	No
670	*Eucalyptus sp.*	1	10-15	5-10	Average	Mature	25+	Medium	1	No
671	*Eucalyptus patens*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.5	No
672	*Banksia attenuata*	1	5-10	1-5	Average	Semi-mature	5-15	Low	0.35	No
673	*Banksia attenuata*	1	5-10	5-10	Good	Semi-mature	15-25	Medium	0.3	No
674	*Eucalyptus marginata*	1	10-15	10-15	Good	Mature	25+	Medium	0.7	No
675	*Corymbia citriodora*	1	15-20	10-15	Good	Mature	25+	Medium	0.6	No
676	*Corymbia citriodora*	1	15-20	10-15	Good	Mature	25+	Medium	0.7	No
677	*Erythrina sykseii*	1	5-10	5-10	Good	Mature	25+	Low	0.6	No
678	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Mature	15-25	Low	0.55	No
679	*Corymbia citriodora*	1	20-25	10-15	Excellent	Mature	25+	High	0.9	No
680	*Corymbia citriodora*	1	15-20	10-15	Good	Semi-mature	25+	Medium	0.4	No
681	*Corymbia citriodora*	1	10-15	5-10	Average	Semi-mature	5-15	Low	0.4	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
682	*Corymbia citriodora*	1	15-20	5-10	Average	Semi-mature	15-25	Low	0.45	No
683	*Corymbia citriodora*	1	10-15	1-5	Average	Semi-mature	5-15	Low	0.4	No
684	*Corymbia citriodora*	1	15-20	10-15	Excellent	Mature	25+	High	0.6	No
685	*Eucalyptus camaldulensis*	1	15-20	10-15	Average	Mature	25+	Medium	0.6	No
686	*Corymbia maculata*	1	10-15	10-15	Excellent	Mature	25+	High	0.6	No
687	*Eucalyptus nicholii*	1	10-15	10-15	Excellent	Mature	25+	High	0.7	No
688	*Eucalyptus nicholii*	1	5-10	10-15	Average	Mature	25+	Medium	0.6	No
689	*Corymbia maculata*	1	10-15	5-10	Good	Semi-mature	15-25	Low	0.3	No
690	*Corymbia maculata*	1	15-20	5-10	Poor	Semi-mature	5-15	Low	0.4	No
691	*Eucalyptus nicholii*	1	10-15	10-15	Excellent	Mature	25+	High	0.8	No
692	*Eucalyptus nicholii*	1	10-15	10-15	Good	Mature	25+	Medium	0.6	No
694	*Eucalyptus nicholii*	1	5-10	5-10	Good	Semi-mature	25+	Medium	0.4	No
695	*Corymbia maculata*	1	10-15	5-10	Average	Semi-mature	15-25	Low	0.4	No
696	*Allocasuarina fraseriana*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.5	No
697	*Eucalyptus nicholii*	1	15-20	10-15	Good	Mature	15-25	High	1.3	No
698	*Banksia attenuata*	1	5-10	1-5	Average	Semi-mature	5-15	Low	0.3	No
699	*Eucalyptus nicholii*	1	10-15	5-10	Good	Mature	25+	Medium	0.7	No
700	*Banksia ilicifolia*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.3	No
701	*Banksia attenuata*	2	5-10	1-5	Average	Semi-mature	5-15	Low	0.3	No
702	*Leptospermum laevigatum*	1	5-10	5-10	Average	Mature	5-15	Low	0.3	No
703	*Eucalyptus nicholii*	1	15-20	5-10	Good	Mature	25+	Medium	0.7	No
704	*Eucalyptus sp.*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.5	No
705	*Cupressus sp.*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.4	No
706	*Callistemon sp.*	1	5-10	5-10	Average	Mature	5-15	Low	0.4	No
707	*Cupressus sp.*	1	5-10	5-10	Average	Mature	5-15	Low	0.6	No
708	*Callistemon sp.*	1	1-5	5-10	Average	Mature	5-15	Low	0.4	No
709	*Eucalyptus sideroxylon*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.3	No
710	*Melia azaderach*	1	1-5	1-5	Average	Juvenile	5-15	Low	0.2	No
711	*Eucalyptus leucoxylon*	1	1-5	5-10	Average	Semi-mature	5-15	Low	0.4	No
712	*Unknown*	1	5-10	5-10	Poor	Mature	0-5	Low	0.7	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
713	*Eucalyptus grandis*	1	15-20	15-20	Excellent	Mature	25+	High	0.8	No
714	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.2	No
715	*Corymbia maculata*	1	10-15	5-10	Excellent	Semi-mature	25+	Medium	0.4	No
716	*Unknown*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.3	No
717	*Corymbia maculata*	1	10-15	5-10	Excellent	Semi-mature	25+	Medium	0.4	No
718	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.2	No
719	*Eucalyptus leucoxylon*	1	5-10	5-10	Excellent	Semi-mature	25+	Medium	0.2	No
720	*Corymbia maculata*	1	10-15	5-10	Excellent	Semi-mature	25+	Medium	0.4	No
721	*Eucalyptus leucoxylon*	1	1-5	5-10	Average	Semi-mature	5-15	Low	0.35	No
722	*Eucalyptus sideroxylon*	1	5-10	5-10	Good	Semi-mature	25+	Medium	0.4	No
723	*Eucalyptus nicholii*	1	5-10	5-10	Excellent	Semi-mature	25+	Medium	0.5	No
724	*Eucalyptus citriodora*	1	10-15	5-10	Excellent	Juvenile	25+	Medium	0.2	No
725	*Corymbia maculata*	1	10-15	5-10	Excellent	Semi-mature	25+	Medium	0.4	No
726	*Eucalyptus camaldulensis*	1	5-10	1-5	Good	Juvenile	25+	Low	0.2	No
727	*Eucalyptus cladocalyx*	1	5-10	1-5	Excellent	Juvenile	25+	Low	0.2	No
728	*Corymbia maculata*	1	10-15	5-10	Good	Semi-mature	25+	Low	0.3	No
729	*Unknown*	1	5-10	5-10	Poor	Mature	0-5	Low	0.5	No
730	*Eucalyptus camaldulensis*	1	10-15	1-5	Good	Juvenile	25+	Low	0.2	No
731	*Eucalyptus cladocalyx*	1	5-10	5-10	Good	Juvenile	25+	Low	0.2	No
732	*Eucalyptus camaldulensis*	1	5-10	1-5	Good	Juvenile	25+	Low	0.2	No
733	*Eucalyptus camaldulensis*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.4	No
734	*Eucalyptus camaldulensis*	2	10-15	5-10	Good	Juvenile	25+	Low	0.2	No
735	*Eucalyptus sideroxylon*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.4	No
736	*Eucalyptus camaldulensis*	1	5-10	1-5	Good	Juvenile	25+	Low	0.2	No
737	*Corymbia maculata*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.3	No
738	*Eucalyptus camaldulensis*	1	10-15	1-5	Good	Juvenile	25+	Low	0.2	No
739	*Eucalyptus cladocalyx*	1	5-10	5-10	Good	Juvenile	25+	Low	0.2	No
740	*Eucalyptus camaldulensis*	1	15-20	10-15	Good	Mature	25+	Medium	0.5	No
741	*Eucalyptus leucoxylon*	1	1-5	5-10	Average	Semi-mature	5-15	Low	0.2	No
742	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Semi-mature	15-25	Low	0.2	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
743	*Banksia attenuata*	1	5-10	5-10	Good	Mature	15-25	Medium	0.3	No
744	*Banksia attenuata*	15	5-10	5-10	Good	Mature	15-25	Medium	0.3	No
745	*Ficus microcarpa*	7	5-10	5-10	Good	Semi-mature	15-25	Medium	0.3	No
746	*Corymbia maculata*	1	10-15	5-10	Good	Mature	25+	Medium	0.4	No
747	*Eucalyptus sideroxylon*	1	5-10	5-10	Good	Semi-mature	25+	Medium	0.4	No
748	*Melaleuca quinquenervia*	1	5-10	5-10	Good	Semi-mature	25+	Medium	0.5	No
749	*Unknown*	2	5-10	5-10	Poor	Semi-mature	0-5	Low	0.3	No
750	*Fraxinus ornus*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.2	No
751	*Syzygium smithii*	2	5-10	5-10	Good	Juvenile	15-25	Low	0.2	No
752	*Melia azaderach*	1	10-15	10-15	Good	Mature	25+	Low	0.7	No
753	*Corymbia maculata*	1	15-20	5-10	Good	Semi-mature	25+	Medium	0.5	No
754	*Melia azaderach*	1	5-10	5-10	Good	Semi-mature	25+	Low	0.4	No
755	*Eucalyptus sideroxylon*	1	10-15	5-10	Good	Semi-mature	15-25	Medium	0.4	No
756	*Eucalyptus leucoxylon*	1	5-10	10-15	Good	Mature	25+	Medium	0.5	No
757	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.3	No
758	*Eucalyptus grandis*	1	15-20	10-15	Excellent	Semi-mature	25+	Medium	0.4	No
759	*Eucalyptus sp.*	1	5-10	5-10	Good	Juvenile	15-25	Low	0.3	No
760	*Eucalyptus botryoides*	1	5-10	5-10	Good	Juvenile	15-25	Low	0.2	No
761	*Eucalyptus sideroxylon*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.4	No
762	*Eucalyptus grandis*	1	15-20	10-15	Good	Juvenile	25+	Low	0.3	No
763	*Eucalyptus sideroxylon*	1	5-10	5-10	Good	Semi-mature	25+	Medium	0.4	No
764	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Mature	5-15	Low	0.3	No
765	*Callistemon sp.*	1	1-5	5-10	Average	Semi-mature	5-15	Low	0.3	No
766	*Eucalyptus cladocalyx*	1	5-10	5-10	Good	Juvenile	15-25	Low	0.2	No
767	*Schinus molle*	1	1-5	5-10	Average	Semi-mature	5-15	Low	0.2	No
768	*Eucalyptus cladocalyx*	1	5-10	5-10	Good	Juvenile	15-25	Low	0.3	No
769	*Eucalyptus cladocalyx*	1	5-10	5-10	Good	Juvenile	15-25	Low	0.3	No
770	*Eucalyptus camaldulensis*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.2	No
771	*Eucalyptus leucoxylon*	1	1-5	5-10	Average	Semi-mature	5-15	Low	0.3	No
772	*Corymbia calophylla*	1	5-10	5-10	Average	Juvenile	15-25	Medium	0.3	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
773	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Semi-mature	15-25	Low	0.4	No
774	*Corymbia maculata*	1	5-10	1-5	Good	Juvenile	15-25	Low	0.2	No
775	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.25	No
776	*Acacia sp.*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.2	No
777	*Schinus molle*	1	1-5	5-10	Good	Juvenile	15-25	Low	0.2	No
778	*Eucalyptus sideroxylon*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.3	No
779	*Acacia sp.*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.3	No
780	*Eucalyptus sideroxylon*	1	10-15	5-10	Average	Semi-mature	5-15	Low	0.3	No
781	*Corymbia calophylla*	1	15-20	10-15	Good	Semi-mature	25+	High	0.6	No
782	*Eucalyptus sideroxylon*	1	10-15	5-10	Average	Juvenile	15-25	Low	0.3	No
783	*Eucalyptus camaldulensis*	1	10-15	1-5	Good	Juvenile	15-25	Low	0.25	No
784	*Eucalyptus cladocalyx*	1	5-10	5-10	Excellent	Juvenile	25+	Medium	0.2	No
785	*Fraxinus sp.*	3	1-5	1-5	Poor	Semi-mature	0-5	Low	0.1	No
786	*Melia azaderach*	4	5-10	1-5	Poor	Juvenile	0-5	Low	0.2	No
787	*Eucalyptus camaldulensis*	1	5-10	1-5	Good	Juvenile	5-15	Low	0.2	No
788	*Allocasuarina fraseriana*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.2	No
789	*Acacia sp.*	1	10-15	10-15	Average	Mature	5-15	Low	0.6	No
790	*Corymbia maculata*	1	15-20	10-15	Excellent	Mature	25+	High	0.5	No
791	*Banksia attenuata*	3	5-10	1-5	Average	Semi-mature	5-15	Low	0.2	No
792	*Eucalyptus sp.*	1	5-10	1-5	Poor	Semi-mature	5-15	Low	0.3	No
793	*Banksia attenuata*	3	5-10	1-5	Average	Mature	5-15	Low	0.3	No
794	*Eucalyptus grandis*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.5	No
795	*Banksia attenuata*	1	1-5	1-5	Poor	Semi-mature	5-15	Low	0.2	No
796	*Corymbia calophylla*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.3	No
797	*Banksia attenuata*	1	5-10	5-10	Average	Mature	5-15	Low	0.3	No
798	*Eucalyptus marginata*	8	5-10	5-10	Average	Juvenile	15-25	Medium	0.3	No
799	*Banksia attenuata*	8	1-5	1-5	Average	Semi-mature	5-15	Low	0.2	No
800	*Corymbia ficifolia*	1	1-5	1-5	Average	Juvenile	5-15	Low	0.2	No
801	*Corymbia ficifolia*	1	1-5	1-5	Average	Juvenile	5-15	Low	0.2	No
802	*Eucalyptus sp.*	2	1-5	5-10	Good	Juvenile	15-25	Low	0.3	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
803	*Eucalyptus sp.*	1	5-10	5-10	Excellent	Semi-mature	25+	Medium	0.4	No
804	*Eucalyptus sp.*	1	5-10	5-10	Excellent	Semi-mature	25+	Medium	0.4	No
805	*Eucalyptus sp.*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.4	No
806	*Schinus molle*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.4	No
807	*Schinus molle*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.3	No
808	*Unknown*	1	5-10	1-5	Poor	Juvenile	5-15	Low	0.2	No
809	*Unknown*	1	10-15	1-5	Average	Semi-mature	15-25	Low	0.3	No
810	*Erythrina sykseii*	1	10-15	10-15	Good	Mature	15-25	Low	0.6	No
811	*Unknown*	1	10-15	1-5	Good	Semi-mature	15-25	Low	0.2	No
812	*Erythrina sykseii*	1	10-15	10-15	Average	Mature	15-25	Low	0.7	No
813	*Melaleuca quinquenervia*	1	10-15	10-15	Excellent	Mature	25+	High	0.9	No
814	*Lophostemon confertus*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.2	No
815	*Lophostemon confertus*	1	10-15	5-10	Good	Semi-mature	15-25	Low	0.4	No
816	*Eucalyptus marginata*	1	10-15	10-15	Average	Semi-mature	15-25	Medium	0.75	No
817	*Eucalyptus marginata*	1	5-10	5-10	Average	Semi-mature	15-25	Medium	0.5	No
818	*Ficus microcarpa*	1	10-15	10-15	Excellent	Semi-mature	25+	Medium	0.6	No
819	*Banksia attenuata*	10	5-10	1-5	Poor	Semi-mature	5-15	Low	0.2	No
820	*Corymbia ficifolia*	1	5-10	5-10	Good	Semi-mature	15-25	Medium	0.4	No
821	*Banksia attenuata*	2	1-5	1-5	Poor	Semi-mature	5-15	Low	0.2	No
822	*Eucalyptus marginata*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.2	No
823	*Melaleuca preissiana*	1	5-10	10-15	Average	Mature	5-15	Low	0.4	No
824	*Schinus molle*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.5	No
825	*Corymbia maculata*	1	10-15	1-5	Average	Juvenile	5-15	Low	0.3	No
826	*Eucalyptus sp.*	1	15-20	10-15	Excellent	Mature	25+	High	0.7	No
827	*Corymbia maculata*	1	10-15	5-10	Average	Juvenile	5-15	Low	0.3	No
828	*Eucalyptus grandis*	1	15-20	10-15	Good	Mature	25+	Medium	0.7	No
829	*Acacia sp.*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.4	No
830	*Eucalyptus grandis*	1	10-15	1-5	Excellent	Juvenile	25+	Low	0.2	No
831	*Acacia sp.*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.3	No
832	*Acacia sp.*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.2	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
833	*Eucalyptus grandis*	1	10-15	5-10	Good	Juvenile	25+	Low	0.2	No
834	*Acacia sp.*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.3	No
835	*Eucalyptus grandis*	1	10-15	1-5	Excellent	Juvenile	25+	Low	0.2	No
836	*Eucalyptus grandis*	1	10-15	5-10	Good	Juvenile	25+	Low	0.3	No
837	*Eucalyptus grandis*	1	15-20	10-15	Good	Semi-mature	25+	Medium	0.4	No
838	*Eucalyptus grandis*	1	15-20	10-15	Good	Semi-mature	25+	Medium	0.4	No
839	*Acacia sp.*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.2	No
840	*Corymbia ficifolia*	1	1-5	5-10	Average	Semi-mature	5-15	Low	0.3	No
841	*Jacaranda mimosifolia*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.3	No
842	*Cupressus sp.*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.5	No
843	*Eucalyptus sp.*	1	15-20	5-10	Good	Mature	25+	Medium	0.5	No
844	*Eucalyptus sp.*	1	15-20	5-10	Good	Mature	25+	Medium	0.5	No
845	*Eucalyptus sp.*	1	10-15	1-5	Average	Juvenile	15-25	Low	0.3	No
846	*Eucalyptus sp.*	1	10-15	1-5	Average	Juvenile	5-15	Low	0.3	No
847	*Eucalyptus sp.*	1	15-20	15-20	Excellent	Mature	25+	High	0.7	No
848	*Eucalyptus grandis*	1	15-20	10-15	Good	Semi-mature	25+	Low	0.3	No
849	*Corymbia calophylla*	1	10-15	10-15	Good	Semi-mature	15-25	Medium	0.4	No
850	*Jacaranda mimosifolia*	1	10-15	1-5	Average	Juvenile	5-15	Low	0.2	No
851	*Eucalyptus sp.*	1	10-15	10-15	Good	Mature	25+	Medium	0.7	No
852	*Eucalyptus sp.*	1	10-15	5-10	Good	Semi-mature	15-25	Medium	0.4	No
853	*Eucalyptus sp.*	1	10-15	5-10	Good	Semi-mature	15-25	Low	0.5	No
854	*Eucalyptus sp.*	1	10-15	10-15	Good	Semi-mature	25+	Medium	0.5	No
855	*Callistemon sp.*	1	1-5	5-10	Average	Semi-mature	5-15	Low	0.2	No
856	*Corymbia calophylla*	1	5-10	5-10	Poor	Semi-mature	0-5	Low	0.3	No
857	*Eucalyptus sp.*	1	5-10	1-5	Average	Juvenile	15-25	Low	0.3	No
858	*Angophora costada*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.4	No
859	*Eucalyptus camaldulensis*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.2	No
860	*Corymbia ficifolia*	1	1-5	1-5	Poor	Juvenile	0-5	Low	0.2	No
861	*Eucalyptus grandis*	1	10-15	5-10	Excellent	Juvenile	25+	Medium	0.4	No
862	*Corymbia ficifolia*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.2	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
863	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Mature	25+	Medium	0.5	No
864	*Eucalyptus nicholii*	1	10-15	5-10	Poor	Mature	5-15	Low	0.6	No
865	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Semi-mature	15-25	Medium	0.3	No
866	*Eucalyptus grandis*	1	15-20	10-15	Average	Semi-mature	15-25	Low	0.5	No
867	*Corymbia calophylla*	1	10-15	10-15	Excellent	Semi-mature	15-25	Medium	0.5	No
868	*Eucalyptus grandis*	1	10-15	10-15	Good	Semi-mature	25+	Medium	0.5	No
869	*Cupressus sp.*	2	5-10	1-5	Poor	Juvenile	5-15	Low	0.2	No
870	*Corymbia maculata*	1	5-10	1-5	Good	Juvenile	25+	Low	0.2	No
871	*Eucalyptus camaldulensis*	1	10-15	1-5	Average	Juvenile	15-25	Low	0.3	No
872	*Corymbia citriodora*	1	10-15	10-15	Good	Semi-mature	15-25	Medium	0.5	No
873	*Eucalyptus nicholii*	1	10-15	10-15	Average	Mature	5-15	Low	0.8	No
874	*Eucalyptus nicholii*	1	10-15	10-15	Average	Mature	15-25	Medium	0.7	No
875	*Eucalyptus nicholii*	1	10-15	10-15	Good	Mature	15-25	Medium	0.6	No
876	*Eucalyptus nicholii*	1	10-15	10-15	Average	Mature	5-15	Low	0.6	No
877	*Acacia sp.*	1	5-10	1-5	Average	Semi-mature	5-15	Low	0.3	No
878	*Erythrina sykseii*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.4	No
879	*Corymbia calophylla*	1	10-15	5-10	Excellent	Semi-mature	25+	High	0.4	No
880	*Jacaranda mimosifolia*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.3	No
881	*Quercus robur*	1	5-10	1-5	Excellent	Juvenile	25+	Medium	0.1	No
882	*Corymbia calophylla*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.5	No
883	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.2	No
884	*Corymbia maculata*	1	15-20	5-10	Good	Semi-mature	25+	Medium	0.4	No
885	*Corymbia calophylla*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.5	No
886	*Corymbia maculata*	1	15-20	10-15	Excellent	Mature	25+	High	0.7	No
887	*Corymbia calophylla*	1	5-10	5-10	Good	Semi-mature	25+	Medium	0.3	No
888	*Eucalyptus cladocalyx*	1	10-15	1-5	Good	Juvenile	25+	Low	0.2	No
889	*Eucalyptus cladocalyx*	1	10-15	5-10	Average	Juvenile	5-15	Low	0.3	No
890	*Corymbia maculata*	1	10-15	5-10	Good	Semi-mature	15-25	Low	0.3	No
891	*Unknown*	1	5-10	10-15	Average	Semi-mature	15-25	Low	0.4	No
892	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Mature	15-25	Medium	0.4	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
893	*Ficus microcarpa*	1	5-10	5-10	Good	Juvenile	5-15	Low	0.2	No
894	*Eucalyptus utilis*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.3	No
895	*Eucalyptus sideroxylon*	1	5-10	5-10	Excellent	Semi-mature	25+	Medium	0.3	No
896	*Corymbia maculata*	1	10-15	10-15	Excellent	Mature	25+	High	0.6	No
897	*Eucalyptus sideroxylon*	1	10-15	5-10	Good	Mature	15-25	Medium	0.5	No
898	*Eucalyptus grandis*	1	15-20	10-15	Good	Mature	25+	High	0.6	No
899	*Eucalyptus sideroxylon*	1	10-15	10-15	Good	Mature	25+	Medium	0.5	No
900	*Corymbia maculata*	1	10-15	1-5	Good	Juvenile	15-25	Low	0.1	No
901	*Corymbia citriodora*	1	15-20	10-15	Excellent	Mature	25+	High	0.5	No
902	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Mature	5-15	Low	0.6	No
903	*Eucalyptus camaldulensis*	1	15-20	10-15	Average	Mature	15-25	Medium	0.7	No
904	*Eucalyptus camaldulensis*	1	5-10	1-5	Excellent	Juvenile	15-25	Low	0.1	No
905	*Eucalyptus marginata*	1	5-10	5-10	Good	Semi-mature	25+	Medium	0.4	No
906	*Corymbia maculata*	1	10-15	10-15	Excellent	Semi-mature	25+	Medium	0.4	No
907	*Eucalyptus globulus*	1	10-15	10-15	Average	Mature	5-15	Low	0.9	No
908	*Corymbia maculata*	1	15-20	10-15	Excellent	Mature	25+	High	0.6	No
909	*Eucalyptus grandis*	1	15-20	10-15	Good	Semi-mature	15-25	Low	0.4	No
910	*Eucalyptus grandis*	1	15-20	10-15	Good	Semi-mature	15-25	Medium	0.5	No
911	*Eucalyptus sp.*	1	15-20	10-15	Excellent	Mature	25+	Medium	0.5	No
912	*Ulmus parvifolia*	1	5-10	10-15	Average	Mature	15-25	Low	0.5	No
913	*Platanus acerifolia*	1	10-15	10-15	Excellent	Mature	25+	Medium	0.5	No
914	*Acacia sp.*	8	5-10	10-15	Poor	Semi-mature	0-5	Low	0.3	No
915	*Schinus terebinthifolia*	1	5-10	5-10	Poor	Juvenile	5-15	Low	0.2	No
916	*Melia azaderach*	1	5-10	5-10	Good	Semi-mature	25+	Low	0.4	No
917	*Melia azaderach*	3	5-10	5-10	Average	Semi-mature	15-25	Low	0.5	No
918	*Ficus microcarpa*	3	5-10	5-10	Good	Juvenile	15-25	Low	0.3	No
919	*Melia azaderach*	3	10-15	5-10	Average	Semi-mature	5-15	Low	0.5	No
920	*Unknown*	1	10-15	10-15	Good	Semi-mature	15-25	Medium	0.5	No
921	*Liquidambar styraciflua*	1	10-15	10-15	Good	Mature	25+	Medium	0.4	No
922	*Toona australis*	1	5-10	5-10	Good	Semi-mature	15-25	Medium	0.4	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
923	*Ulmus parvifolia*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.2	No
924	*Melia azaderach*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.3	No
925	*Lagenaria patersonia*	1	10-15	5-10	Good	Mature	15-25	Low	0.5	No
926	*Jacaranda mimosifolia*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.4	No
927	*Tipuana tipu*	1	10-15	5-10	Average	Semi-mature	5-15	Low	0.3	No
928	*Ulmus parvifolia*	1	5-10	5-10	Excellent	Juvenile	25+	Low	0.2	No
929	*Tipuana tipu*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.5	No
930	*Acacia sp.*	1	5-10	5-10	Poor	Mature	0-5	Low	0.4	No
931	*Agonis flexuosa*	1	5-10	5-10	Average	Semi-mature	15-25	Low	0.5	No
932	*Allocasuarina fraseriana*	1	5-10	1-5	Poor	Semi-mature	0-5	Low	0.4	No
933	*Banksia attenuata*	1	1-5	5-10	Average	Mature	5-15	Low	0.3	No
934	*Eucalyptus grandis*	1	15-20	10-15	Average	Semi-mature	15-25	Low	0.55	No
935	*Eucalyptus citriodora*	1	10-15	10-15	Good	Semi-mature	25+	Medium	0.4	No
936	*Platanus acerifolia*	1	10-15	5-10	Poor	Juvenile	5-15	Low	0.2	No
937	*Eucalyptus citriodora*	1	15-20	10-15	Excellent	Semi-mature	25+	High	0.5	No
938	*Banksia attenuata*	1	5-10	5-10	Average	Mature	5-15	Low	0.4	No
939	*Corymbia maculata*	1	15-20	10-15	Excellent	Semi-mature	25+	Medium	0.5	No
940	*Eucalyptus cladocalyx*	1	15-20	10-15	Average	Semi-mature	15-25	Low	0.6	No
941	*Eucalyptus marginata*	1	10-15	5-10	Average	Juvenile	15-25	Low	0.6	No
942	*Corymbia citriodora*	1	15-20	10-15	Excellent	Mature	25+	High	0.6	No
943	*Corymbia citriodora*	1	15-20	5-10	Good	Semi-mature	25+	Medium	0.4	No
944	*Eucalyptus grandis*	1	25+	10-15	Good	Mature	25+	High	1.3	No
945	*Eucalyptus grandis*	1	15-20	10-15	Average	Mature	15-25	Low	0.8	No
946	*Eucalyptus grandis*	1	15-20	10-15	Average	Mature	15-25	Low	0.7	No
947	*Corymbia citriodora*	1	10-15	5-10	Average	Semi-mature	15-25	Low	0.4	No
948	*Eucalyptus marginata*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.4	No
949	*Ficus microcarpa*	1	10-15	10-15	Good	Semi-mature	15-25	Low	0.5	No
950	*Corymbia maculata*	1	10-15	5-10	Good	Semi-mature	15-25	Low	0.45	No
951	*Corymbia citriodora*	1	10-15	10-15	Good	Semi-mature	25+	Medium	0.5	No
952	*Corymbia maculata*	1	15-20	10-15	Good	Mature	25+	Medium	0.5	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
953	*Corymbia citriodora*	1	15-20	10-15	Good	Semi-mature	15-25	Low	0.7	No
954	*Eucalyptus cladocalyx*	4	10-15	5-10	Good	Juvenile	15-25	Low	0.2	No
955	*Banksia attenuata*	2	5-10	5-10	Average	Semi-mature	5-15	Low	0.3	No
956	*Corymbia citriodora*	1	10-15	1-5	Good	Juvenile	15-25	Low	0.2	No
957	*Eucalyptus sp.*	1	5-10	5-10	Good	Juvenile	15-25	Low	0.3	No
958	*Eucalyptus camaldulensis*	4	10-15	5-10	Good	Juvenile	15-25	Low	0.3	No
959	*Corymbia maculata*	1	10-15	1-5	Good	Juvenile	15-25	Low	0.3	No
960	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.4	No
961	*Corymbia maculata*	1	10-15	5-10	Good	Semi-mature	15-25	Medium	0.4	No
962	*Eucalyptus sp.*	1	5-10	5-10	Poor	Semi-mature	0-5	Low	0.3	No
963	*Corymbia maculata*	1	10-15	1-5	Good	Juvenile	15-25	Low	0.3	No
964	*Eucalyptus marginata*	1	1-5	5-10	Good	Juvenile	5-15	Low	0.2	No
965	*Eucalyptus marginata*	1	10-15	10-15	Average	Mature	5-15	Low	0.6	No
966	*Corymbia citriodora*	1	5-10	1-5	Good	Juvenile	15-25	Low	0.2	No
967	*Eucalyptus grandis*	1	15-20	10-15	Good	Semi-mature	25+	Medium	0.5	No
968	*Eucalyptus cladocalyx*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.2	No
969	*Eucalyptus camaldulensis*	2	10-15	5-10	Average	Juvenile	5-15	Low	0.3	No
970	*Corymbia citriodora*	1	5-10	1-5	Good	Juvenile	15-25	Low	0.2	No
971	*Cupressus sp.*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.4	No
972	*Banksia attenuata*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.3	No
973	*Eucalyptus nicholii*	1	10-15	10-15	Good	Mature	25+	Medium	0.7	No
974	*Banksia attenuata*	2	1-5	1-5	Good	Juvenile	5-15	Low	0.2	No
975	*Acacia sp.*	1	5-10	10-15	Average	Mature	5-15	Low	0.5	No
976	*Banksia attenuata*	2	5-10	1-5	Average	Semi-mature	5-15	Low	0.2	No
977	*Platanus acerifolia*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.2	No
978	*Corymbia maculata*	1	5-10	1-5	Good	Juvenile	15-25	Low	0.2	No
979	*Banksia attenuata*	1	5-10	1-5	Average	Mature	15-25	Medium	0.3	No
980	*Eucalyptus nicholii*	1	5-10	5-10	Good	Semi-mature	25+	Medium	0.5	No
981	*Corymbia citriodora*	1	10-15	5-10	Good	Juvenile	15-25	Low	0.3	No
982	*Liquidambar styraciflua*	1	5-10	1-5	Poor	Juvenile	0-5	Low	0.1	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
983	*Platanus acerifolia*	1	5-10	5-10	Poor	Juvenile	0-5	Low	0.2	No
984	*Ficus microcarpa*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.4	No
985	*Ficus microcarpa*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.4	No
986	*Ficus microcarpa*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.4	No
987	*Eucalyptus leucoxylon*	1	5-10	10-15	Average	Mature	5-15	Low	0.6	No
988	*Jacaranda mimosifolia*	1	5-10	5-10	Poor	Juvenile	0-5	Low	0.2	No
989	*Acacia sp.*	1	5-10	10-15	Poor	Mature	0-5	Low	0.8	No
990	*Corymbia maculata*	1	10-15	1-5	Average	Juvenile	5-15	Low	0.3	No
991	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.5	No
992	*Araucaria heterophylla*	1	10-15	5-10	Average	Juvenile	15-25	Low	0.3	No
993	*Eucalyptus grandis*	1	15-20	10-15	Average	Mature	15-25	Medium	1.3	No
994	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.2	No
995	*Cinnamomum camphora*	1	5-10	10-15	Good	Semi-mature	15-25	Low	0.6	No
996	*Corymbia citriodora*	1	15-20	10-15	Average	Mature	25+	Low	0.7	No
997	*Eucalyptus cladocalyx*	1	10-15	1-5	Average	Juvenile	15-25	Low	0.3	No
998	*Eucalyptus cladocalyx*	1	10-15	5-10	Average	Juvenile	15-25	Low	0.4	No
999	*Eucalyptus cladocalyx*	1	10-15	5-10	Average	Semi-mature	5-15	Low	0.4	No
1000	*Corymbia ficifolia*	1	5-10	1-5	Good	Juvenile	15-25	Low	0.2	No
1017	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Juvenile	15-25	Low	0.3	No
1019	*Eucalyptus camaldulensis*	1	10-15	5-10	Good	Juvenile	15-25	Low	0.4	No
1020	*Eucalyptus cladocalyx*	1	10-15	1-5	Good	Juvenile	15-25	Low	0.3	No
1021	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.3	No
1022	*Fraxinus sp.*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.2	No
1023	*Eucalyptus grandis*	1	15-20	10-15	Average	Semi-mature	15-25	Low	0.5	No
1024	*Eucalyptus grandis*	1	15-20	10-15	Average	Semi-mature	15-25	Medium	0.5	No
1025	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.5	No
1026	*Corymbia maculata*	1	10-15	5-10	Good	Semi-mature	15-25	Low	0.4	No
1027	*Eucalyptus grandis*	1	15-20	10-15	Average	Semi-mature	15-25	Medium	0.7	No
1028	*Eucalyptus nicholii*	1	10-15	5-10	Good	Mature	25+	Medium	0.6	No
1029	*Corymbia maculata*	1	10-15	5-10	Good	Juvenile	25+	Medium	0.35	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
1030	*Corymbia citriodora*	1	15-20	10-15	Average	Semi-mature	15-25	Low	0.7	No
1031	*Eucalyptus leucoxylon*	1	5-10	10-15	Good	Semi-mature	25+	Medium	0.5	No
1032	*Eucalyptus grandis*	1	15-20	10-15	Average	Mature	15-25	Low	0.6	No
1033	*Corymbia maculata*	1	15-20	10-15	Excellent	Mature	25+	Medium	0.55	No
1034	*Erythrina sykseii*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.5	No
1035	*Platanus acerifolia*	1	10-15	5-10	Average	Semi-mature	5-15	Low	0.3	No
1036	*Eucalyptus leucoxylon*	1	5-10	10-15	Average	Mature	5-15	Low	0.5	No
1037	*Corymbia maculata*	1	15-20	10-15	Excellent	Mature	25+	Medium	0.5	No
1038	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.3	No
1039	*Cupressus sp.*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.4	No
1040	*Eucalyptus grandis*	1	20-25	10-15	Good	Mature	15-25	Medium	0.7	No
1041	*Eucalyptus leucoxylon*	1	5-10	10-15	Good	Mature	15-25	Medium	0.6	No
1042	*Eucalyptus nicholii*	1	10-15	10-15	Good	Mature	25+	Medium	0.8	No
1043	*Erythrina sykseii*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.4	No
1044	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Mature	5-15	Low	0.5	No
1045	*Brachychiton acerifolius*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.2	No
1046	*Eucalyptus grandis*	1	20-25	15-20	Average	Mature	15-25	Medium	0.6	No
1047	*Liquidambar styraciflua*	1	10-15	5-10	Good	Juvenile	15-25	Low	0.3	No
1048	*Melia azaderach*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.5	No
1049	*Melia azaderach*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.4	No
1050	*Melia azaderach*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.35	No
1051	*Melia azaderach*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.3	No
1052	*Melia azaderach*	1	5-10	5-10	Poor	Juvenile	5-15	Low	0.3	No
1053	*Unknown*	1	10-15	10-15	Average	Mature	5-15	Low	0.5	No
1054	*Ficus microcarpa*	1	10-15	10-15	Excellent	Semi-mature	15-25	Medium	0.6	No
1055	*Melia azaderach*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.3	No
1056	*Corymbia maculata*	1	15-20	10-15	Excellent	Mature	25+	High	0.8	No
1057	*Araucaria heterophylla*	1	10-15	1-5	Poor	Juvenile	5-15	Low	0.2	No
1058	*Melia azaderach*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.4	No
1059	*Acacia sp.*	1	10-15	5-10	Poor	Mature	0-5	Low	0.6	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
1060	*Corymbia maculata*	1	15-20	5-10	Good	Mature	25+	Medium	0.5	No
1061	*Eucalyptus camaldulensis*	1	15-20	15-20	Good	Mature	25+	High	0.8	No
1063	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Juvenile	5-15	Low	0.3	No
1064	*Eucalyptus grandis*	1	15-20	10-15	Good	Mature	15-25	Medium	0.8	No
1065	*Melia azaderach*	2	10-15	5-10	Average	Juvenile	5-15	Low	0.4	No
1066	*Unknown*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.2	No
1067	*Corymbia citriodora*	1	15-20	5-10	Average	Semi-mature	15-25	Low	0.5	No
1068	*Eucalyptus leucoxylon*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.2	No
1069	*Platanus acerifolia*	1	10-15	5-10	Average	Semi-mature	5-15	Low	0.3	No
1070	*Corymbia maculata*	1	10-15	5-10	Good	Mature	15-25	Medium	0.5	No
1071	*Eucalyptus grandis*	1	20-25	15-20	Good	Mature	25+	Medium	0.8	No
1072	*Platanus acerifolia*	1	5-10	5-10	Poor	Semi-mature	0-5	Low	0.3	No
1073	*Unknown*	1	5-10	10-15	Good	Mature	15-25	Low	0.5	No
1074	*Tipuana tipu*	1	10-15	5-10	Average	Semi-mature	5-15	Low	0.3	No
1075	*Eucalyptus grandis*	1	20-25	15-20	Good	Mature	15-25	Medium	1	No
1076	*Eucalyptus leucoxylon*	1	5-10	10-15	Average	Mature	15-25	Low	0.55	No
1077	*Brachychiton acerifolius*	1	5-10	1-5	Average	Semi-mature	5-15	Low	0.3	No
1078	*Callistemon sp.*	1	5-10	1-5	Average	Semi-mature	5-15	Low	0.2	No
1079	*Corymbia citriodora*	1	10-15	5-10	Good	Juvenile	25+	Low	0.5	No
1080	*Platanus acerifolia*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.35	No
1081	*Acacia sp.*	3	5-10	1-5	Average	Juvenile	5-15	Low	0.2	No
1082	*Eucalyptus grandis*	4	10-15	5-10	Average	Juvenile	15-25	Low	0.3	No
1083	*Liquidambar styraciflua*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.2	No
1084	*Acacia sp.*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.4	No
1085	*Eucalyptus grandis*	1	10-15	5-10	Average	Juvenile	25+	Low	0.3	No
1086	*Cupressus sp.*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.4	No
1087	*Acacia sp.*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.4	No
1088	*Eucalyptus grandis*	1	10-15	5-10	Good	Juvenile	15-25	Low	0.3	No
1089	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.5	No
1090	*Eucalyptus grandis*	1	10-15	5-10	Average	Juvenile	15-25	Low	0.3	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
1091	*Eucalyptus grandis*	1	10-15	5-10	Average	Juvenile	15-25	Medium	0.3	No
1092	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Mature	15-25	Medium	0.5	No
1093	*Acacia sp.*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.2	No
1094	*Eucalyptus sp.*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.3	No
1095	*Eucalyptus patens*	1	1-5	5-10	Average	Juvenile	5-15	Low	0.2	No
1096	*Eucalyptus camaldulensis*	1	10-15	15-20	Good	Mature	25+	High	0.8	No
1097	*Corymbia citriodora*	1	10-15	5-10	Good	Semi-mature	15-25	Low	0.3	No
1098	*Eucalyptus grandis*	1	15-20	10-15	Good	Mature	15-25	Medium	0.6	No
1099	*Eucalyptus grandis*	1	15-20	10-15	Average	Mature	15-25	Low	0.8	No
1100	*Lagenaria patersonia*	1	5-10	1-5	Poor	Juvenile	0-5	Low	0.2	No
1101	*Eucalyptus grandis*	1	20-25	10-15	Good	Mature	25+	Medium	0.9	No
1102	*Erythrina sykseii*	1	5-10	5-10	Poor	Juvenile	0-5	Low	0.3	No
1103	*Eucalyptus camaldulensis*	3	5-10	1-5	Average	Juvenile	15-25	Low	0.25	No
1104	*Eucalyptus camaldulensis*	1	5-10	1-5	Average	Mature	5-15	Low	0.5	No
1105	*Cupressus sp.*	1	5-10	5-10	Poor	Semi-mature	0-5	Low	0.5	No
1106	*Callistemon sp.*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.2	No
1107	*Ulmus parvifolia*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.3	No
1108	*Corymbia calophylla*	1	5-10	5-10	Good	Juvenile	15-25	Medium	0.3	No
1109	*Eucalyptus cladocalyx*	1	5-10	1-5	Good	Juvenile	15-25	Low	0.2	No
1110	*Eucalyptus camaldulensis*	1	10-15	10-15	Good	Mature	15-25	Medium	0.7	No
1111	*Ficus microcarpa*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.4	No
1112	*Eucalyptus cladocalyx*	1	5-10	1-5	Average	Juvenile	15-25	Low	0.2	No
1113	*Eucalyptus cladocalyx*	3	5-10	1-5	Average	Juvenile	15-25	Low	0.2	No
1114	*Acacia sp.*	1	5-10	5-10	Poor	Semi-mature	0-5	Low	0.4	No
1115	*Eucalyptus nicholii*	1	5-10	5-10	Dead	Semi-mature	0-5	Low	0.4	No
1116	*Acacia sp.*	1	5-10	5-10	Poor	Semi-mature	0-5	Low	0.3	No
1117	*Corymbia maculata*	1	10-15	5-10	Excellent	Mature	25+	Medium	0.4	No
1118	*Unknown*	1	5-10	1-5	Poor	Juvenile	0-5	Low	0.1	No
1119	*Araucaria heterophylla*	1	10-15	5-10	Poor	Semi-mature	0-5	Low	0.4	No
1120	*Eucalyptus leucoxylon*	1	10-15	10-15	Good	Mature	15-25	Medium	0.7	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
1121	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.4	No
1122	*Eucalyptus leucoxylon*	1	10-15	10-15	Good	Mature	15-25	Medium	0.6	No
1123	*Acacia sp.*	1	10-15	5-10	Good	Semi-mature	5-15	Low	0.5	No
1124	*Ficus microcarpa*	1	10-15	5-10	Good	Semi-mature	15-25	Low	0.5	No
1125	*Acacia sp.*	1	10-15	5-10	Average	Mature	5-15	Low	0.7	No
1126	*Eucalyptus cladocalyx*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.2	No
1127	*Eucalyptus sp.*	1	15-20	10-15	Good	Semi-mature	25+	Medium	0.5	No
1128	*Acacia sp.*	1	10-15	1-5	Poor	Juvenile	5-15	Low	0.2	No
1129	*Eucalyptus grandis*	1	15-20	5-10	Good	Juvenile	15-25	Low	0.4	No
1130	*Acacia sp.*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.3	No
1131	*Eucalyptus cladocalyx*	3	10-15	1-5	Average	Juvenile	5-15	Low	0.2	No
1132	*Eucalyptus grandis*	1	10-15	5-10	Average	Juvenile	15-25	Low	0.3	No
1133	*Corymbia maculata*	1	15-20	10-15	Excellent	Mature	25+	High	0.8	No
1134	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.4	No
1135	*Eucalyptus leucoxylon*	1	5-10	10-15	Good	Mature	15-25	Medium	0.5	No
1136	*Toona australis*	1	5-10	5-10	Good	Juvenile	5-15	Low	0.2	No
1137	*Eucalyptus nicholii*	1	10-15	10-15	Good	Mature	25+	Medium	0.8	No
1138	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.4	No
1139	*Corymbia citriodora*	1	15-20	10-15	Average	Semi-mature	5-15	Low	0.5	No
1140	*Cinnamomum camphora*	1	10-15	5-10	Average	Juvenile	5-15	Low	0.3	No
1141	*Eucalyptus leucoxylon*	1	5-10	10-15	Average	Mature	5-15	Low	0.5	No
1142	*Eucalyptus grandis*	1	15-20	10-15	Good	Semi-mature	25+	Medium	0.5	No
1143	*Corymbia citriodora*	1	5-10	5-10	Good	Juvenile	15-25	Low	0.3	No
1145	*Ficus microcarpa*	1	5-10	10-15	Good	Semi-mature	15-25	Low	0.6	No
1146	*Eucalyptus cladocalyx*	1	5-10	5-10	Good	Juvenile	15-25	Low	0.25	No
1147	*Platanus acerifolia*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.2	No
1148	*Eucalyptus cladocalyx*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.35	No
1149	*Corymbia ficifolia*	1	1-5	5-10	Average	Juvenile	15-25	Low	0.35	No
1150	*Melia azaderach*	1	1-5	5-10	Poor	Juvenile	5-15	Low	0.3	No
1151	*Cupressus sempervirens*	1	5-10	1-5	Poor	Juvenile	5-15	Low	0.15	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
1152	*Araucaria heterophylla*	1	10-15	5-10	Average	Juvenile	15-25	Low	0.35	No
1153	*Eucalyptus grandis*	1	5-10	5-10	Good	Juvenile	15-25	Low	0.25	No
1154	*Eucalyptus camaldulensis*	1	5-10	1-5	Average	Juvenile	15-25	Low	0.2	No
1155	*Schinus molle*	1	5-10	5-10	Average	Semi-mature	15-25	Low	0.45	No
1156	*Eucalyptus camaldulensis*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.3	No
1157	*Jacaranda mimosifolia*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.35	No
1158	*Liquidambar styraciflua*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.15	No
1159	*Eucalyptus platypus*	1	1-5	5-10	Good	Juvenile	15-25	Low	0.3	No
1160	*Eucalyptus cladocalyx*	1	10-15	5-10	Good	Juvenile	15-25	Low	0.25	No
1161	*Melia azaderach*	1	10-15	10-15	Average	Mature	5-15	Low	0.5	No
1162	*Eucalyptus leucoxylon*	1	1-5	1-5	Average	Juvenile	5-15	Low	0.15	No
1163	*Corymbia maculata*	1	10-15	10-15	Excellent	Semi-mature	25+	Medium	0.45	No
1164	*Ulmus parvifolia*	1	5-10	10-15	Good	Semi-mature	15-25	Medium	0.35	No
1165	*Fraxinus sp.*	1	5-10	10-15	Average	Mature	15-25	Medium	0.4	No
1166	*Unknown*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.25	No
1167	*Unknown*	1	5-10	1-5	Poor	Semi-mature	0-5	Low	0.15	No
1168	*Cupressus sp.*	1	5-10	1-5	Poor	Semi-mature	0-5	Low	0.35	No
1169	*Eucalyptus grandis*	1	20-25	15-20	Average	Mature	15-25	Medium	0.65	No
1170	*Olea europaea*	1	5-10	5-10	Excellent	Semi-mature	25+	Low	0.3	No
1171	*Melia azaderach*	1	10-15	5-10	Good	Semi-mature	15-25	Low	0.35	No
1172	*Agonis flexuosa*	1	5-10	10-15	Good	Mature	25+	Medium	0.7	No
1173	*Eucalyptus cladocalyx*	1	10-15	5-10	Average	Juvenile	5-15	Low	0.4	No
1174	*Eucalyptus camaldulensis*	1	10-15	5-10	Good	Semi-mature	25+	Medium	0.4	No
1175	*Eucalyptus cladocalyx*	1	10-15	5-10	Good	Juvenile	15-25	Low	0.35	No
1176	*Cupressus sp.*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.45	No
1177	*Eucalyptus grandis*	1	5-10	1-5	Good	Juvenile	15-25	Low	0.2	No
1178	*Eucalyptus grandis*	1	5-10	1-5	Good	Juvenile	15-25	Low	0.2	No
1179	*Agonis flexuosa*	1	5-10	5-10	Average	Mature	15-25	Low	0.6	No
1180	*Platanus acerifolia*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.4	No
1181	*Schinus terebinthifolia*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.4	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
1182	*Erythrina sykseii*	1	10-15	10-15	Excellent	Mature	15-25	Low	0.65	No
1183	*Eucalyptus nicholii*	1	10-15	10-15	Good	Semi-mature	15-25	Medium	0.5	No
1184	*Acacia sp.*	1	10-15	5-10	Poor	Mature	0-5	Low	0.8	No
1185	*Platanus acerifolia*	1	10-15	10-15	Good	Semi-mature	15-25	Medium	0.5	No
1186	*Eucalyptus leucoxylon*	1	10-15	10-15	Good	Mature	25+	Medium	0.75	No
1187	*Eucalyptus grandis*	1	20-25	10-15	Good	Mature	25+	Medium	0.85	No
1188	*Melia azaderach*	1	5-10	1-5	Poor	Juvenile	0-5	Low	0.25	No
1189	*Liquidambar styraciflua*	1	5-10	5-10	Excellent	Juvenile	15-25	Medium	0.3	No
1190	*Eucalyptus leucoxylon*	1	5-10	5-10	Good	Mature	15-25	Low	0.5	No
1191	*Melia azaderach*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.4	No
1192	*Melia azaderach*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.3	No
1193	*Eucalyptus grandis*	1	20-25	10-15	Good	Mature	25+	Medium	1.35	No
1194	*Brachychiton acerifolius*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.35	No
1195	*Melia azaderach*	1	10-15	5-10	Average	Semi-mature	5-15	Low	0.45	No
1196	*Fraxinus sp.*	1	5-10	10-15	Good	Semi-mature	15-25	Medium	0.35	No
1197	*Platanus acerifolia*	1	10-15	10-15	Good	Mature	25+	Medium	0.6	No
1198	*Unknown*	1	5-10	5-10	Average	Mature	5-15	Low	0.35	No
1199	*Araucaria heterophylla*	1	10-15	5-10	Average	Semi-mature	5-15	Low	0.5	No
1200	*Jacaranda mimosifolia*	1	5-10	5-10	Good	Semi-mature	5-15	Low	0.35	No
1201	*Liquidambar styraciflua*	1	5-10	1-5	Good	Juvenile	5-15	Low	0.25	No
1202	*Acacia sp.*	1	5-10	5-10	Poor	Mature	0-5	Low	0.6	No
1203	*Ficus microcarpa*	1	10-15	10-15	Good	Mature	15-25	Medium	0.5	No
1204	*Corymbia maculata*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.45	No
1205	*Washingtonia robusta*	1	10-15	1-5	Average	Semi-mature	15-25	Low	0.5	No
1206	*Eucalyptus patens*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.4	No
1207	*Brachychiton acerifolius*	1	5-10	1-5	Poor	Juvenile	0-5	Low	0.25	No
1208	*Melia azaderach*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.45	No
1209	*Corymbia maculata*	1	10-15	5-10	Good	Mature	25+	Medium	0.45	No
1210	*Platanus acerifolia*	1	5-10	5-10	Good	Juvenile	15-25	Low	0.2	No
1211	*Platanus acerifolia*	1	5-10	5-10	Good	Juvenile	15-25	Low	0.25	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
1212	*Eucalyptus sp.*	1	10-15	1-5	Excellent	Juvenile	25+	Low	0.25	No
1213	*Corymbia ficifolia*	1	1-5	5-10	Average	Juvenile	5-15	Low	0.2	No
1214	*Corymbia ficifolia*	1	5-10	5-10	Average	Semi-mature	15-25	Medium	0.4	No
1215	*Corymbia maculata*	1	10-15	10-15	Good	Semi-mature	25+	Medium	0.55	No
1216	*Eucalyptus camaldulensis*	1	10-15	10-15	Good	Semi-mature	25+	Medium	0.65	No
1217	*Eucalyptus camaldulensis*	1	10-15	10-15	Average	Semi-mature	25+	Medium	0.5	No
1218	*Eucalyptus camaldulensis*	1	10-15	10-15	Average	Semi-mature	15-25	Low	0.5	No
1219	*Eucalyptus camaldulensis*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.35	No
1220	*Eucalyptus camaldulensis*	1	10-15	15-20	Good	Mature	25+	High	1	No
1221	*Eucalyptus cladocalyx*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.15	No
1222	*Eucalyptus camaldulensis*	1	10-15	1-5	Average	Juvenile	5-15	Low	0.2	No
1223	*Unknown*	1	1-5	5-10	Average	Juvenile	5-15	Low	0.15	No
1224	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Juvenile	5-15	Low	0.3	No
1225	*Corymbia calophylla*	1	10-15	10-15	Average	Mature	15-25	Medium	0.55	No
1226	*Eucalyptus cladocalyx*	1	5-10	1-5	Average	Juvenile	15-25	Low	0.15	No
1227	*Cinnamomum camphora*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.35	No
1228	*Corymbia ficifolia*	1	5-10	5-10	Poor	Juvenile	0-5	Low	0.5	No
1229	*Corymbia citriodora*	1	5-10	5-10	Average	Juvenile	15-25	Low	0.25	No
1230	*Eucalyptus camaldulensis*	1	5-10	1-5	Poor	Juvenile	5-15	Low	0.2	No
1231	*Eucalyptus cladocalyx*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.2	No
1232	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Juvenile	5-15	Low	0.25	No
1233	*Eucalyptus camaldulensis*	1	5-10	1-5	Average	Juvenile	15-25	Low	0.25	No
1234	*Eucalyptus camaldulensis*	1	10-15	5-10	Average	Semi-mature	15-25	Low	0.4	No
1237	*Eucalyptus cladocalyx*	1	5-10	5-10	Good	Juvenile	15-25	Low	0.35	No
1238	*Eucalyptus patens*	1	5-10	5-10	Average	Juvenile	5-15	Low	0.4	No
1239	*Unknown*	1	10-15	10-15	Good	Mature	25+	Medium	0.65	No
1240	*Melia azaderach*	1	5-10	5-10	Good	Semi-mature	15-25	Low	0.5	No
1241	*Eucalyptus sp.*	1	5-10	5-10	Poor	Juvenile	0-5	Low	0.2	No
1242	*Corymbia maculata*	1	15-20	10-15	Excellent	Mature	15-25	Medium	0.5	No
1243	*Eucalyptus leucoxylon*	1	5-10	5-10	Average	Mature	5-15	Low	0.6	No

Tag No.	Species name	No. Individuals	Height (m)	Width (m)	Health	Age	ULE	Retention Value	DBH (m)	Black cockatoo habitat tree
1244	*Eucalyptus camaldulensis*	1	5-10	1-5	Poor	Semi-mature	0-5	Low	0.55	No
1245	*Corymbia ficifolia*	1	5-10	1-5	Average	Juvenile	5-15	Low	0.2	No
1246	*Eucalyptus camaldulensis*	1	5-10	1-5	Poor	Semi-mature	0-5	Low	0.45	No
1247	*Eucalyptus leucoxylon*	1	10-15	10-15	Good	Mature	25+	Medium	0.5	No
1248	*Eucalyptus platypus*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.25	No
1249	*Eucalyptus camaldulensis*	1	5-10	1-5	Poor	Juvenile	5-15	Low	0.25	No
1250	*Eucalyptus camaldulensis*	1	5-10	1-5	Poor	Juvenile	5-15	Low	0.25	No
1251	*Erythrina sykseii*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.55	No
1252	*Eucalyptus leucoxylon*	1	5-10	5-10	Poor	Semi-mature	0-5	Low	0.4	No
1253	*Jacaranda mimosifolia*	1	5-10	5-10	Good	Semi-mature	5-15	Low	0.3	No
1254	*Melia azaderach*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.5	No
1255	*Lagenaria patersonia*	1	5-10	1-5	Good	Juvenile	5-15	Low	0.2	No
1256	*Unknown*	1	5-10	5-10	Average	Semi-mature	5-15	Low	0.3	No
1257	*Eucalyptus sp.*	1	5-10	5-10	Poor	Mature	5-15	Low	0.6	No
1258	*Acacia sp.*	1	5-10	5-10	Poor	Juvenile	0-5	Low	0.25	No

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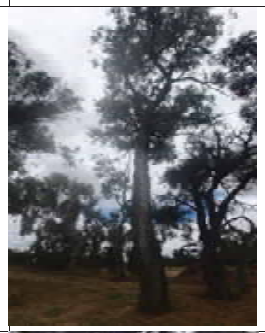
2	
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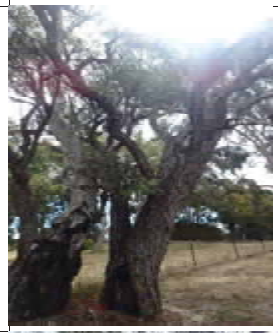
5	
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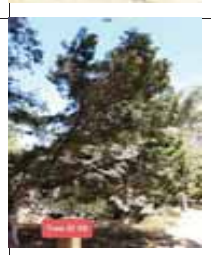
88	
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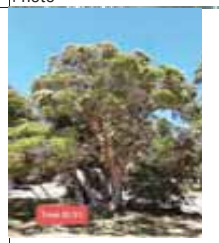
91	
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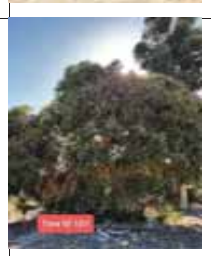
101	
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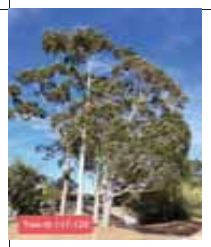
117	
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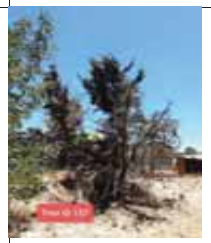
157	
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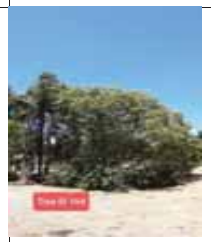
164	
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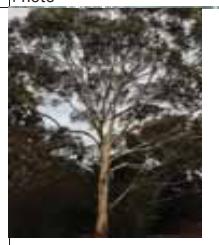
286	
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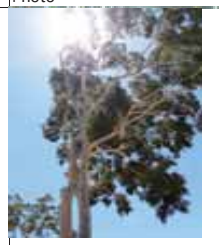
675	
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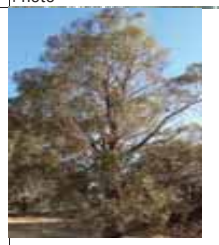
864	
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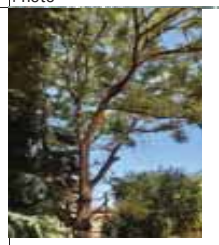
924	
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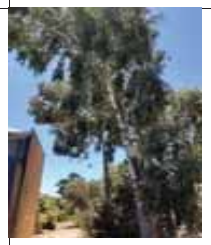
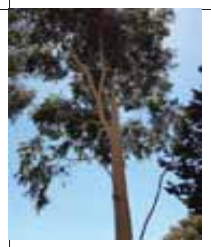
969	
970	
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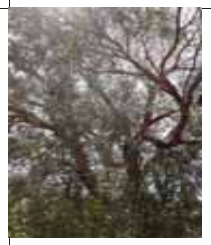
973	
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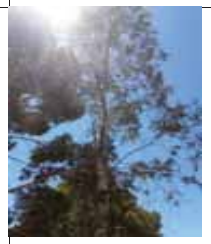
997	
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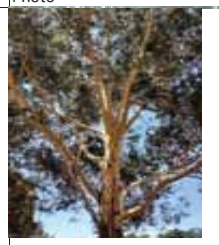
1142	
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Appendix G

Acoustic Assessment

GLEN IRIS GOLF COURSE

DEAN RD, JANDAKOT

STRUCTURE PLAN
ACOUSTIC ASSESSMENT

SEPTEMBER 2021

OUR REFERENCE: 27789-5-20325

Rochdale Holdings Pty Ltd A.B.N. 85 009 049 067 trading as:
HERRING STORER ACOUSTICS
P.O. Box 219, Como, W.A. 6952
(08) 9367 6200
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DOCUMENT CONTROL PAGE

ACOUSTIC ASSESSMENT
GLEN IRIS GOLF COURSE

Job No: 20325

Document Reference: 27789-5-20325

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Date of Issue :	24 May 2021		

REVISION HISTORY

Revision	Description	Date	Author	Checked
1	Issued For comment	24/05/2022	PLD	TR
2	Incorporate City Cockburn Comments (RFI 2/8/21)	16/09/2021	PLD	TR
3	Incorporate City Cockburn Comments (Environ Health Dept)	21/04/2022	PLD	
4	MRWA comments addressed	30/06/2022	PLD	
5	Updated for Schedule of Modifications as per WAPC approval	21/08/2023	PLD	

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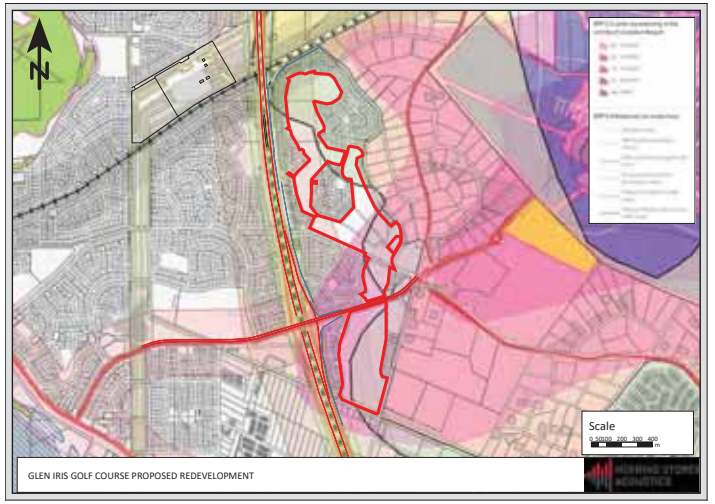
EXECUTIVE SUMMARY

Herring Storer Acoustics have been commissioned by Acumen Development Solutions to carry out an acoustical assessment of the proposed development of the Glen Iris Golf Course into residential land use.

This acoustic assessment is provided in support of the Structure Plan process, therefore provides high level acoustic advice for the proposed development to inform the development team and regulatory authorities of the potential noise issues and associated noise controls. It is noted that detailed design for these requirements can be applied at subdivision staging, once further information is available.

The proposed residential estate is potentially impacted by noise from road traffic (Kwinana Freeway and Berigan Drive), rail traffic (Yangebup Freight Rail Line and future Thornlie to Cockburn Passenger Rail Line) and aircraft associated with Jandakot Airport with the figure below showing the PlanWa advice regarding noise impacts. Consideration has also been given to the potential impact from noise related to existing industry to the south of the development on Prinsep Road.



Based on the above, the following criteria are proposed for this development:

ROAD TRAFFIC AND RAIL NOISE

External

Day	Maximum of 55 dB(A) L_{Aeq}
Night	Maximum of 50 dB(A) L_{Aeq}
Outdoor Living Areas*	Maximum of 50 dB(A) $L_{Aeq\ (night\ period)}$

*This is a suggested noise level; noise is to be reduced as far as practicably possible.

Internal

Sleeping Areas	35 dB(A) $L_{Aeq(night)}$
Living Areas	40 dB(A) $L_{Aeq(day)}$

AIRCRAFT NOISE

Internal

Sleeping areas	50 dB(A) L_{Amax}
Other habitable spaces	55 dB(A) L_{Amax}

ROAD NOISE

Based on the development plan, it is proposed that areas are to be constructed for the purpose of residential with some commercial usage for the section to the north of Berrigan Drive. Noise levels for the future road traffic are such, that at some of the lot façades, the noise could exceed the 55 dB(A) noise Target. Therefore, amelioration in the form of Quiet House Design is required. These areas have been identified and general "deemed to satisfy packages" as per the SPP 5.4 guidelines applied. Detailed design for these requirements can be applied at subdivision staging once further information is available.

Given the noise levels, the lot façades would require Quiet House Design in the form of Package A. Appendix F contains the deemed to satisfy packages or Quiet House Design requirements and an area plan outlining the effected Lots.

Additionally, as they are over the "Target" noise level, the lots in this area would require notification on titles of the Freeway and Berrigan Drive noise impact.

RAIL NOISE

For train noise associated with the Yangebup Freight Line, due to the topography (line being in a cutting) and the noise wall and residential housing between the rail line and the development, the noise levels for the worst-case future scenario of one train per hour have been assessed as being below the night time noise Target criteria at the façade lots of the development boundary, hence there are no acoustic requirements.

Information was sought from the Metronet and the EPA as to the proposed design and impact of noise levels from the proposed future passenger rail and freight rail lines.

As there are existing residential premises located on the proposed rail line, development of the future rail line operations needs to consider these highly noise sensitive premises.

Review of the preliminary design noise levels, as provided in the *Thornnlie-Cockburn Link Noise and Vibration Assessment Report Number 675.10409.00100-R01* shows that noise levels to these existing residential premises will be designed such that the target noise levels (as per SPP 5.4) will be met.

As the Glen Iris development is set back behind these residential premises, noise levels would be less than those at the lot façades, hence compliance with the requirements of SPP 5.4 would be achieved. Therefore, noise modelling of the future proposed Freight / Passenger Rail would not be required for this development as the infrastructure provide will meet the requirements of SPP 5.4 for existing residential premises closer to the rail line.

Notwithstanding the above, confirmation assessment of the freight rail has been undertaken and calibrated to existing noise levels. These noise levels have been increased for future rail freight movements of one per hour. This is based on the current built form, including the noise wall

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Our ref: 27789-5-20325

located along the existing residence boarding the rail line. When the proposed passenger rail development is constructed, the noise mitigation requirements would incorporate the freight rail, hence noise levels would be less than those considered in this assessment. This provides a conservative acoustic assessment for the proposed development, where the future freight rail increases, and no further noise attenuation works are carried out.

AIRCRAFT NOISE

Based on guidance from SPP 5.3, the majority of the northern section of the proposed development site is acceptable for residential development, as indicated in Figure 5.3.

The blue area (ANEF 20 to 25) is also acceptable for residential development, although it requires conditions. These conditions are such that the internal noise level (for aircraft noise events) are to meet the criteria contained in AS2021. The affected lots within this development are those within the blue contour as noted in Figure 5.3.

Further to the criteria contained in SPP 5.3, the City of Cockburn LPP 1.12 contains advice as follows:

> *Consideration should be given to noise attenuation for noise sensitive premises within the Frame area corresponding to the requirements of Western Australian Planning Commission publication "Aircraft Noise Insulation for Residential Development in the Vicinity of Perth Airport" 2004 (such as the installation of 6.38mm laminated glazing), in order to ensure that residential amenity is adequately protected within noise sensitive developments.*

Therefore, whilst at this stage of the development the lot configuration and layout are not known, a preliminary "deemed to satisfy construction" has been provided within this report for areas within the ANEF 20-25 noise contour. This can form the basis of future concept designs and can be refined at subdivision staging. For area outside the ANEF 20 but contained within the Frame Area upgraded glazing would be required (as per LPP 1.12).

INDUSTRY NOISE

Based on the City of Cockburn Intramaps, there is industrial zoned land use to the south of the proposed residential development, as shown in Figure 5.4.

As there are existing residential premises located on Imlah Court, located at a closer distance to the industrial premises than the proposed development, expectations are that compliance with Regulatory criterial contained in the *Environmental Protection (Noise) Regulations 1997* would be achieved for the existing situation at these locations. However, consideration of the potential for noise impact from this area has been undertaken for the proposed residential development.

Three forms of noise amelioration have been considered for the future residence located on the southern end of the Glen Iris development, with these being as follows:

1. Noise Wall (Prinsep Road)
2. Upgrade Building Design (As per SPP 5.3)
3. Setback

Given the implementation of the above, noise levels can be managed, regardless of compliance with the regulatory criteria.

1.0 INTRODUCTION

Herring Storer Acoustics have been commissioned by Acumen Development Solutions to carry out an acoustical assessment of the proposed development of the Glen Iris Golf Course into residential land use.

The proposed residential estate is potentially impacted by noise from the following noise sources:

- Road Traffic Noise- Kwinana Freeway and Berrigan Drive.
- Rail Traffic Noise - Existing Yangebup Freight Rail Line and proposed Thornlie to Cockburn Passenger Rail Line.
- Aircraft Noise – Aircrafts associated with Jandakot Airport.
- Industrial Noise – Existing Industry located on Prinsep Road.

The objectives of the study were to:

- Measure existing noise levels at the proposed development from vehicles travelling on Kwinana Freeway and Berrigan Drive.
- Measure existing noise levels at the proposed development from trains travelling on the Yangebup Freight Rail Line.
- Determine by noise modelling the noise levels that would be received at residences within the development from vehicles travelling on the future Kwinana Freeway, Berrigan Drive and Yangebup freight Rail Line and proposed passenger rail.
- Assess the predicted noise levels received at residence for compliance with the requirements of the WAPC State Planning Policy 5.4 "Road and Rail Noise" (SPP 5.4).
- If exceedances are predicted, comment on possible noise amelioration options for compliance with the appropriate criteria.
- Assess the predicted noise levels received at residence for compliance with the requirements of the WAPC State Planning Policy 5.3 "Land Use Planning in the Vicinity of Jandakot Airport" (SPP 5.3).
- Consider impacts of industrial noise associated with existing industry located on Prinsep Road, in accordance with the City of Cockburn's Local Planning Policy 1.12 (LPP 1.12).

This acoustic assessment is provided in support of the Structure Plan process, therefore provides high level acoustic advice for the proposed development to inform the development team and regulatory authorities of the potential noise issues and associated noise controls. It is noted that detailed design for these requirements can be applied at subdivision staging, once further information is available.

2.0 CRITERIA

2.1 NOISE INGRESS INTO DEVELOPMENT

The Western Australian Planning Commission (WAPC) released on 6th September 2019 State Planning Policy 5.4 *"Road and Rail Noise".* The requirements of State Planning Policy 5.4 are outlined below.

POLICY APPLICATION (Section 4)

When and where it applies (Section 4.1)

SPP 5.4 applies to the preparation and assessment of planning instruments, including region and local planning schemes; planning strategies, structure plans; subdivision and development proposals in Western Australia, where there is proposed:

*a) noise-sensitive land-use within the policy's trigger distance of a transport corridor as specified in **Table 1**;*

*b) New or major upgrades of roads as specified in **Table 1** and maps **(Schedule 1,2 and 3);** or*

*c) New railways or major upgrades of railways as specified in maps (**Schedule 1, 2 and 3);** or any other works that increase capacity for rail vehicle storage or movement and will result in an increased level of noise.*

Policy trigger distances (Section 4.1.2)

***Table 1** identifies the State's transport corridors and the trigger distances to which the policy applies.*

*The designation of land within the trigger distances outlined in **Table 1** should not be interpreted to imply that land is affected by noise and/or that areas outside the trigger distances are un-affected by noise.*

*Where any part of the lot is within the specified trigger distance, an assessment against the policy is required to determine the likely level of transport noise and management/ mitigation required. An initial screening assessment (**guidelines: Table 2: noise exposure forecast**) will determine if the lot is affected and to what extent."*

TABLE 1: TRANSPORT CORRIDOR CLASSIFICATION AND TRIGGER DISTANCES

Transport corridor classification	*Trigger distance*	*Distance measured from*
Roads		
Strategic freight and major traffic routes *Roads as defined by Perth and Peel Planning Frameworks and/or roads with either 500 or more Class 7 to 12 Austroads vehicles per day, and/or 50,000 per day traffic volume*	*300 metres*	*Road carriageway edge*
Other significant freight/traffic routes *These are generally any State administered road and/or local government road identified as being a future State administered road (red road) and other roads that meet the criteria of either >=23,000 daily traffic count (averaged equivalent to 25,000 vehicles passenger car units under region schemes)*	*200 metres*	*Road carriageway edge*
Passenger railways		
	100 metres	*Centreline of the closest track*
Freight railways		
	200 metres	*Centreline of the closest track*

Proponents are advised to consult with the decision making authority as site specific conditions (significant differences in ground levels, extreme noise levels) may influence the noise mitigation measures required, that may extend beyond the trigger distance.

POLICY MEASURES (Section 6)

The policy applies a performance-based approach to the management and mitigation of transport noise. The policy measures and resultant noise mitigation will be influenced by the function of the transport corridor and the type and intensity of the land-use proposed. Where there is risk of future land-use conflict in close proximity to strategic freight routes, a precautionary approach should be applied. Planning should also consider other broader planning policies. This is to ensure a balanced approach takes into consideration reasonable and practical considerations.

Noise Targets (Section 6.1)

***Table 2** sets out noise targets that are to be achieved by proposals under which the policy applies. Where exceeded, an assessment is required to determine the likely level of transport noise and management/mitigation required.*

In the application of the noise targets the objective is to achieve:

- *indoor noise levels as specified in **Table 2** in noise sensitive areas (for example, bedrooms and living rooms of houses, and school classrooms); and*
- *a reasonable degree of acoustic amenity for outdoor living areas on each residential lot. For non-residential noise-sensitive developments, for example schools and child care centres the design of outdoor areas should take into consideration the noise target.*

It is recognised that in some instances, it may not be reasonable and/or practicable to meet the outdoor noise targets. Where transport noise is above the noise targets, measures are expected to be implemented that balance reasonable and practicable considerations with the need to achieve acceptable noise protection outcomes.

TABLE 2: NOISE TARGETS

Proposals	New/Upgrade	Noise Targets		
		Outdoor		Indoor
		Day (L_{Aeq}(Day) dB) (6 am-10 pm)	Night (L_{Aeq}(Night)dB) (10 pm-6 am)	(L_{Aeq} dB)
Noise-sensitive land-use and/or development	New noise sensitive land use and/or development within the trigger distance of an existing/proposed transport corridor	55	50	L_{Aeq} (Day) 40(Living and work areas) L_{Aeq} (Night) 35 (bedrooms)
Roads	New	55	50	N/A
	Upgrade	60	55	N/A
Railways	New	55	50	N/A
	Upgrade	60	55	N/A

Notes:

- *The noise target is to be measured at one metre from the most exposed, habitable façade of the proposed building, which has the greatest exposure to the noise-source. A habitable room has the same meaning as defined in State Planning Policy 3.1 Residential Design Codes.*
- *For all noise-sensitive land-use and/or development, indoor noise targets for other room usages may be reasonably drawn from Table 1 of Australian Standard/New Zealand Standard AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors (as amended) for each relevant time period.*
- *The 5dB difference in the criteria between new and upgrade infrastructure proposals acknowledges the challenges in achieving noise level reduction where existing infrastructure is surrounded by existing noise-sensitive development.*
- *Outdoor targets are to be met at all outdoor areas as far as is reasonable and practical to do so using the various noise mitigation measures outlined in the guidelines. For example, it is likely unreasonable for a transport infrastructure provider to achieve the outdoor targets at more than 1 or 2 floors of an adjacent development with direct line of sight to the traffic.*

Noise Exposure Forecast (Section 6.2)

*When it is determined that SPP 5.4 applies to a planning proposal as outlined in Section 4, proponents and/or decision makers are required to undertake a preliminary assessment using **Table 2**: noise exposure forecast in the guidelines. This will provide an estimate of the potential noise impacts on noise-sensitive land-use and/ or development within the trigger distance of a specified transport corridor. The outcomes of the initial assessment will determine whether:*

- *no further measures is required;*
- *noise-sensitive land-use and/or development is acceptable subject to deemed-to-comply mitigation measures; or*
- *noise-sensitive land-use and/or development is not recommended. Any noise-sensitive land-use and/ or development is subject to mitigation measures outlined in a noise management plan."*

2.2 STATE PLANNING POLICY 5.3 LAND USE IN THE VICINITY OF JANDAKOT AIRPORT

AS2021: Acoustics – Aircraft Noise Intrusion-Building Siting and Construction, provides guidelines for determines the type of building construction necessary to provide a given noise reduction, given that external windows and doors are closed.

Additionally, guidance has been sought from *State Planning Policy 5.3 Land use in the vicinity of Jandakot airport.*

2.2.1 Building Site Acceptability

AS2021:2015 lists the building types compared to the acceptable ANEF contour in Table 2.1 of AS2021:2015. The applicable building types are reproduced in Table 1 below.

TABLE 1 – ANEF ACCEPTABILITY FOR SITING AND CONSTRUCTION

Building Type	ANEF zone of Site		
	Acceptable	Conditionally Acceptable	Unacceptable
House, home unit, flat, caravan park	Less than 20 ANEF	20 to 25 ANEF	Greater than 25 ANEF

AS2021:2015 *"Acoustics – Aircraft Noise Intrusion-Building Siting and Construction"* provides guidelines for determining the type of building construction necessary to provide a given noise reduction, given that external windows and doors are closed.

Indoor design sound levels for determination of aircraft noise reductions are given as follows:

Sleeping areas	-	50 dB(A)
Other habitable spaces	-	55 dB(A)

For commercial buildings:

Private offices	-	55 dB(A)
Open offices	-	65 dB(A)
Shops, showrooms etc.	-	75 dB(A)
Industrial	-	75 dB(A)

We note that the above noise levels are maximum noise levels.

2.3 CITY OF COCKBURN LOCAL PLANNING POLICY 1.12 – NOISE ATTENUATION

An Acoustic Report must accompany a Structure Plan, variations to a Structure Plan that materially alter the Plans intent or a Local Development Plan. The Acoustic Report shall be prepared in accordance with the attached City of Cockburn Noise Attenuation Guidelines where:

1. Noise sensitive development is proposed in the vicinity of an existing or future major road, rail infrastructure or a freight handling facility as required by SPP 5.4;
2. The land is located within either the Core Area or Frame Area for Jandakot Airport as identified by SPP 5.3; or
3. Noise sensitive development and commercial, industrial or light industry land uses or essential infrastructure are proposed in close proximity.

2.3.1 NOISE INTRUSION (NOISE SENSITIVE DEVELOPMENT)

1. Noise sensitive developments are to be designed to achieve the following sound levels:

   (a) Leq 35 dB(A) in sleeping areas (bedrooms); and
   (b) Leq 40 dB(A) in living/work areas and other habitable rooms.

   IMPORTANT NOTE:
   The Leq level should not be unduly biased toward the lower frequencies of the octave band spectrum. If lower frequencies are dominant in sound levels taken during the sampling phase of reporting (below 200Hz or a 15-20dB difference between LA and LC levels), the Acoustic Consultant shall discuss the findings with the City in developing appropriate solutions to ensure that low frequency noise is appropriately attenuated, prior to the submission of the final Acoustic Report.

2. For all other developments, noise intrusion is to be controlled to achieve the indoor design sound levels for buildings as set out in Australian Standard AS/NZS2107: "Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors".
3. For noise sensitive developments in close proximity to road and rail infrastructure, the report must address the requirements of SPP 5.4, including the requirement for a reasonable degree of acoustic amenity in at least one outdoor living area.
4. For noise sensitive developments in close proximity to freight rail infrastructure or other sources of vibration, the Acoustic Report should also address ground borne vibration levels to ensure that occupants of the development are not exposed to an unacceptable level of vibration. The report should make reference to:
   (a) Australian Standard 2670.2-1990 "Evaluation of human exposure to whole-body vibration; Part 2: Continuous and shock induced vibration in buildings (1 to 80 Hz)"
   (b) ISO 2631-2:2003 "Evaluation of human exposure to whole-body vibration Part 2: Vibration in buildings (1 Hz to 80 Hz)";
   (c) British Standard BS6472-2008: "Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)".
5. Residential developments are to be constructed to meet the requirements of the National Construction Code (as amended) and the Building Code of Australia Part F5 (as amended).

2.3.2 NOISE SOURCE IDENTIFICATION

Acoustic reports must identify all noise sources relevant to a development, including those which may require detailed assessment at a later stage. Ambient environmental noise sources that are relevant within the City of Cockburn include the following:

1. Noise from Road, Rail and Freight Infrastructure
2. Breakout and Street Noise
3. Mechanical Plant and Equipment
4. Co-existing Land Uses
5. Noise Sensitive Developments in Proximity to Jandakot Airport

2.4 APPROPRIATE CRITERIA

Based on the above, the following criteria are proposed for this development:

ROAD TRAFFIC AND RAIL NOISE

External

Day	Maximum of 55 dB(A) L_{Aeq}
Night	Maximum of 50 dB(A) L_{Aeq}
Outdoor Living Areas*	Maximum of 50 dB(A) $L_{Aeq\ (night\ period)}$

*This is a suggested noise level; noise is to be reduced as far as practicably possible.

Internal

Sleeping Areas	35 dB(A) $L_{Aeq(night)}$
Living Areas	40 dB(A) $L_{Aeq(day)}$

AIRCRAFT NOISE

Internal

Sleeping areas	50 dB(A) L_{Amax}
Other habitable spaces	55 dB(A) L_{Amax}

3.0 NOISE MONITORING

Noise monitoring was undertaken as part of the study with the results used to calibrate the noise model.

In summary, the monitoring was undertaken over seven-day period commencing Monday 2nd December 2020. Monitoring was conducted at two locations, firstly at the northern end of the golf course, with the second location being in the south of the golf course

The results of this monitoring are summarised in Table 3.1.

TABLE 3.1 : SUMMARY OF MEASURED ROAD TRAFFIC NOISE LEVELS (dB(A))

Date	Day of week	North Monitor		South Monitor	
		$L_{Aeq,day}$ (6am to 10pm)	$L_{Aeq,night}$ (10pm to 6am)	$L_{Aeq,day}$ (6am to 10pm)	$L_{Aeq,night}$ (10pm to 6am)
2/12/2020	Wednesday	-	-	55.9	48.0
3/12/2020	Thursday	56.7	49.8	55.4	48.4
4/12/2020	Friday	57.4	48.0	57.3	48.6
5/12/2020	Saturday	56.8	49.1	55.2	49.3
6/12/2020	Sunday	55.1	50.2	53.6	47.4
7/12/2020	Monday	54.3	47.0	51.9	47.4
8/12/2020	Tuesday	54.6	48.1	52.5	45.7
Average (Weekdays)		**55.8**	**48.2**	**54.6**	**47.6**

Note: Based on the results of the noise monitoring the difference between the L_{Aeq} (Day) and L_{Aeq} (Night) is greater than 5 dB(A). Hence, achieving compliance with the day period criteria would also result in compliance with the night period criteria. Thus, the day period has been used for the assessment.

A third measurement location was included to calibrate noise levels for Berrigan Drive. The measurement was conducted on 14th September 2021. Short term (15 minute), noise levels were measured during peak traffic volumes, as referenced from the MRWA traffic count web site. The $L_{Aeq(15minute)}$ has been used as the overall L_{Aeq} day, based on current traffic volumes.

This method was used in place of continuous monitoring over 3 weekdays due to the potential change in traffic speeds etc and due to the construction of Jandakot Road, which was impacting Berrigan Drive in this area.

The short-term measurement of road traffic has been shown (previously) as being a conservative method when assessing noise levels for an existing roadway. This is due to the L_{Aeq} noise level measurement being based on peak traffic flows, hence is generally higher than the L_{Aeaday}, when measured over a 16-hour period.

This method provides information for the Structure Plan, which is used to inform the general acoustic requirements, and once Berrigan Drive returns to normal traffic conditions on the completion of the Jandakot Road works, then confirmation noise levels can be conducted.

The summarised results are contained in table 3.2.

TABLE 3.2 : SUMMARY OF MEASURED ROAD TRAFFIC NOISE LEVELS BERRIGAN DRIVE (dB(A))

Date	Day of week	L_{Aeq}	L_{A10}	L_{A90}
14/09/2021	Tuesday	68.8	72.5	56.7

For information, the results of the monitoring are shown graphically in Appendix E, with Figure 3.1 showing the location map, and Figure 3.2 showing the monitors in situ.

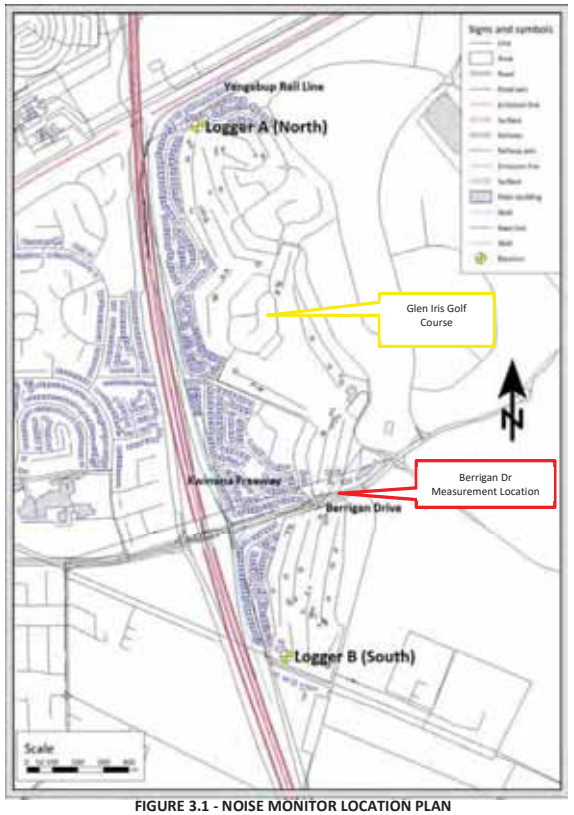


FIGURE 3.1 - NOISE MONITOR LOCATION PLAN

FIGURE 3.2 - NOISE MONITOR IN SITU

4.0 METHODOLOGY

4.1 ROAD TRAFFIC

The future road traffic volumes were based on information provided by the MRWA traffic modelling department. ROM24 2016 validation plots for 2016 and 2041 link volume plots were provided.

Predictive noise modelling has allowed for the following traffic data. It is noted that where available on the MRWA traffic maps site, current traffic counts were used to calibrate the measured noise levels.

Other information relevant to the calculations are shown below in Table 4.1.

TABLE 4.1 - NOISE MODELLING INPUT DATA

Parameter	Traffic Flow VPD Current	Traffic Flow VPD Future (2041)	Traffic Speed km/hr	Road Surface
Traffic flows VPD Kwinana Freeway South Bound	*48,368 (13%)	124,300 (11%)	100	Dense Graded Asphalt
Traffic flows VPD Kwinana Freeway North Bound	*55,082 (14%)	118,000 (11%)	100	Dense Graded Asphalt
Kwinana Freeway (South Bound) Berrigan Drive Offramp	9,000 (13%)	20,900 (11%)	60	Dense Graded Asphalt
Berrigan Drive to Kwinana Freeway (South Bound) Onramp	2,300 (17%)	7,700 (11%)	60	Dense Graded Asphalt
Berrigan Drive East of Kwinana Freeway (East Bound)	*27,780 (11%)*	20,000 (9%)	70	Dense Graded Asphalt
Berrigan Drive East of Kwinana Freeway (West Bound)		17,300 (11%)	70	Dense Graded Asphalt

* Based on current traffic counts (2018 to 2021)

Other input data for the model included:

- Traffic data from MRWA (https://mrapps.mainroads.wa.gov.au/TrafficMap/)
- Noise source heights for the three road source strings (Passenger Vehicles, Heavy Vehicles Engine and Heavy Vehicle Exhausts) are +0.5, +1.5 and +3.6m, with a noise correction of -0.8 and -8.0 applied to the heavy vehicles engine and exhaust noise sources.

- Topographical data, with the ground level within the development based on natural ground levels as surveys conducted.
- A +2.5 dB adjustment to allow for façade reflection.
- Development receiver heights at 1.4m above ground level.
- Calculations based on CoRTN algorithms.
- Other parameter listed in SPP 5.4 as to guidance for modelling road traffic noise / assessment.

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'.

The following scenario have been modelled:

- Current Traffic flows, with existing walls and surrounding residential housing.
- Future traffic flows, with existing walls and surrounding residential housing

Based on the above, the noise contours plot for day period for the above modelling scenario is attached in Appendix B.

4.2 RAIL TRAFFIC

4.2.1 FREIGHT RAIL

To determine the requirements of noise associated with the Yangebup freight Line, acoustic modelling was carried out using the computer program 'SoundPlan' using Nord2000 calculation methodology.

As the Freeway is the dominant noise source in the area, it is impacting the ability to measure current noise levels of train movements on the freight line and provide a basis for a statistical analysis. Additionally, the freight line is contained within a cutting for this section of track, as well as there being a noise wall and two storey residential buildings between the development and the rail line.

Reference was made to other monitoring conducted on the Cockburn freight line as to the validity of using an $L_{Aeq(1hour)}$ level for calibration of this assessment. Previous studies resulted in an $L_{Aeq(130seconds)}$ of 68.7 dB(A) for busier sections of the freight line. This was at a monitoring point 20m from the freight line. For information, calculating this noise level to the equivalent $L_{Aeq(1hour)}$ gives a resultant noise level of 54.3 dB(A).

Freight rail movements generally involved S class locomotives, with up to 150 wagons. Speeds were generally posted as 70km per hour.

Based on the calibrated freight rail line, the following scenarios were modelled:

1. Ultimate capacity volumes, i.e. 24 per 24 hours at 1 per hour, with existing walls and residential buildings between train line and proposed development.

Based on the above, the noise contours plots for day and night period for the above modelling scenarios are attached in Appendix C with the resultant level discussed further in the next section.

4.2.2 PROPOSED FUTURE FREIGHT / PASSENGER RAIL

Information was sought from the Metronet and the EPA as to the proposed design and impact of noise levels from the proposed future passenger rail and freight rail lines.

As there are existing residential premises located on the proposed rail line, development of the future rail line operations needs to consider these highly noise sensitive premises.

Review of the preliminary design noise levels, as provided in the *Thornnlie-Cockburn Link Noise and Vibration Assessment Report Number 675.10409.00100-R01* shows that noise levels to these existing residential premises will be designed such that the target noise levels (as per SPP 5.4) will be met.

As the Glen Iris development is set back behind these residential premises, noise levels would be less than those at the façade lots, hence compliance with the requirements of SPP 5.4 would be achieved. Therefore, noise modelling of the future proposed Freight / Passenger Rail would not be required for this development as the infrastructure provide will meet the requirements of SPP 5.4 for existing residential premises closer to the rail line.

It is noted that assessment of the freight rail has been undertaken and calibrated to existing noise levels. These noise levels have been increased for future rail freight movements of one per hour. This is based on the current built form, including the noise wall located along the existing residence boarding the rail line, and the two storey dwellings currently in place. If the proposed passenger rail development goes ahead, the noise mitigation requirements would incorporate the freight rail, hence noise levels would be less than those considered in this assessment. This provides as conservative acoustic assessment for the proposed development, where the future freight rail increases, and no further noise attenuation works are carried out.

5.0 RESULTS / ASSESSMENT

5.1 ROAD TRAFFIC

Under the WAPC State Planning Policy 5.4, for this development, the appropriate "Noise Targets" to be achieved under SPP 5.4, external to a residence are:

External	
Day	Maximum of 55 dB(A) L_{Aeq}
Night	Maximum of 50 dB(A) L_{Aeq}

The policy states that the "outdoor targets are to be met at all outdoor areas as far as reasonable and practical to do so using the various noise mitigation measures outlined in the guidelines". The Policy also states, under Section 6 – Policy Measures that "a reasonable degree of acoustic amenity for living areas on each residential lot". The policy recognises that "it may not be practicable to meet the outdoor noise targets".

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)

For this development, compliance with the requirements of SPP 5.4, noise modelling and assessment are based on the day period.

The results of the acoustic assessment indicate that noise received at the proposed residential development would generally comply with the "Noise Targets" as outlined in SPP 5.4 with the exception of three main areas. These are identified below in Figure 5.1 and are discussed further below.

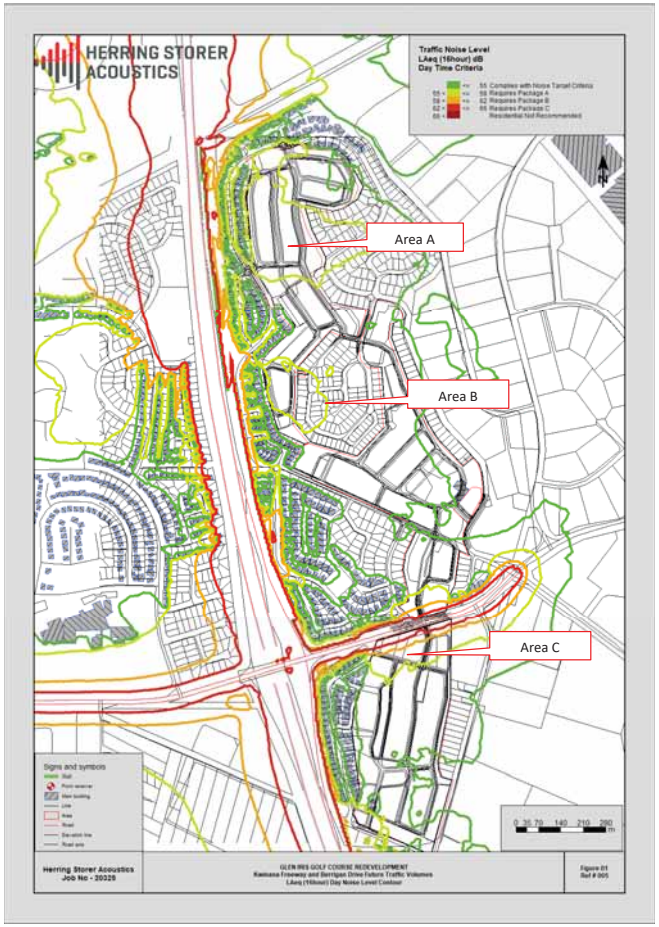


FIGURE 5.1 – FUTURE ROAD TRAFFIC NOISE LEVELS

5.1.1 AREA A - NORTH

Based on the development plan, it is proposed that areas are to be constructed for the purpose of residential. As per Figure 5.2 the areas exceed the 55 dB(A) noise Target, however only marginally and likely at only the façade Lots. This is shown by the spread of noise through the existing dwellings located between the development and the Freeway.

Given the noise levels, the façade lots would require quiet house design in the form of Package A for ground floor locations. Appendix F contains the quiet house design requirements and an area plan outlining the effected Lots. It is noted that for upper levels, it is likely Package B would be applied, however specialist acoustic advice will be detailed at subdivision staging.

Additionally, as they are over the Target noise level, the lots in this area would require notification on titles of the Freeway noise impact.

FIGURE 5.2 – FUTURE ROAD TRAFFIC NOISE LEVELS, AREA A - NORTH

5.1.1 AREA B - CENTRAL

Based on the development plan, it is proposed that areas are to be constructed for the purpose of residential. As per Figure 5.3, the areas exceed the 55 dB(A) noise Target, however only marginally and likely at only the façade Lots. This is shown by the spread of noise through the existing dwellings located between the development and the Freeway.

Given the noise levels, the façade lots would require quiet house design in the form of Package A for ground floor locations. Appendix F contains the quiet house design requirements and an area plan outlining the effected Lots. It is noted that for upper levels, it is likely Package B would be applied, however specialist acoustic advice will be detailed at subdivision staging.

Additionally, as they are over the Target noise level, the lots in this area would require notification on titles of the Freeway noise impact.

FIGURE 5.3 – FUTURE ROAD TRAFFIC NOISE LEVELS, AREA B - CENTRAL

5.1.1 AREA C – BERRIGAN DRIVE AND SOUTH

Based on the development plan, it is proposed that areas are to be constructed for the purpose of residential south of Berrigan Drive, and Commercial for the section to the north of Berrigan Drive. As per Figure 5.4 the areas exceed the 55 dB(A) noise Target, however only marginally and likely at only the façade Lots.

Given the noise levels, the façade lots would require quiet house design in the form of Package A for ground floor locations. Appendix F contains the quiet house design requirements and an area plan outlining the effected Lots. It is noted that for upper levels, it is likely Package B would be applied, however specialist acoustic advice will be detailed at subdivision staging.

Additionally, as they are over the Target noise level, the lots in this area would require notification on titles of the Freeway and Berrigan Drive noise impact.

FIGURE 5.4 – FUTURE ROAD TRAFFIC NOISE LEVELS, AREA C - SOUTH

5.2 RAIL TRAFFIC

Under the WAPC State Planning Policy 5.4, for this development, the appropriate "Noise Targets" to be achieved under SPP 5.4, external to a residence are:

External

Day	Maximum of 55 dB(A) L_{Aeq}
Night	Maximum of 50 dB(A) L_{Aeq}

The policy states that the "outdoor targets are to be met at all outdoor areas as far as reasonable and practical to do so using the various noise mitigation measures outlined in the guidelines". The Policy also states, under Section 6 – Policy Measures that "a reasonable degree of acoustic amenity for living areas on each residential lot". The policy recognises that "it may not be practicable to meet the outdoor noise targets".
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)

For this development, compliance with the requirements of SPP 5.4, noise modelling and assessment are based on the night period.

The results of the acoustic assessment indicate that noise received at the proposed residential development would comply with the "Noise Targets" as outlined in SPP 5.4. The resultant noise level for the future night period, considering one train movement per hour is shown below in Figure 5.5.

FIGURE 5.5 – FUTURE FREIGHT RAIL NOISE LEVELS

It is noted that the existing freight rail as per Section 4.2.1, has been undertaken and calibrated to existing noise levels. These noise levels have been increased for future rail freight movements of one per hour. This is based on the current built form, including the noise wall located along the existing residence boarding the rail line. If the proposed passenger rail development goes ahead, the noise mitigation requirements would incorporate the freight rail, hence noise levels would be less than those considered in this assessment. This provides as conservative acoustic assessment for the proposed development, where the future freight rail increases, and no further noise attenuation works are carried out.

5.3 AIRCRAFT NOISE

Based on guidance from SPP 5.3, the majority of the northern section of the proposed development site is acceptable for residential development, as indicated in Figure 5.6.

The blue area (ANEF 20 to 25) is also acceptable for residential development, although it requires conditions. These conditions are such that the internal noise level (for aircraft noise events) is to meet the criteria contained in AS2021. The affected lots within this development are those within the blue contour as noted in Figure 5.6.

Whilst at this stage of the development the lot configuration and layout are not known, a preliminary "deemed to satisfy construction" has been provided below for development within the ANEF 20-25 contour. This can form the basis of future concept designs and can be refined at subdivision staging.

Glazing:

Bedrooms:

- Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10mm single or 6mm-12mm-10mm double insulated glazing (R_w+C_{tr} 28 dB). Sealed awning or casement windows may use 6 mm glazing instead.
- Up to 60% floor area: as per above but must be sealed awning or casement type windows (R_w+C_{tr} 31dB).

Indoor living and work areas:

- Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulated glazing (R_w+C_{tr} 25dB).
- Up to 60% floor area: As per Bedrooms at up to 40% area (R_w+C_{tr} 28 dB).
- Up to 80% floor area: As per Bedrooms at up to 60% area (R_w+C_{tr} 31dB).

Walls:

Bedroom and indoor living and work areas to R_w+C_{tr} 45dB:

- One row of 92mm studs at 600mm centres with:
  - Resilient steel channels fixed to the outside of the studs; and
  - 9.5mm hardboard or 9mm fibre cement sheeting or 11mm fibre cement weatherboards or one layer of 19mm board cladding fixed to the outside of the channels; and
  - 75mm glass wool (11kg/m3) or 75mm polyester (14kg/m3) insulation, positioned between the studs; and
  - Two layers of 16mm fire-protective grade plasterboard fixed to the inside face of the studs.
  - Single leaf of 150mm brick masonry with 13mm cement render on each face.
  - Double brick: two leaves of 90mm clay brick masonry with a 20mm cavity between leaves.

Roof and Ceiling:

Tiled or colorbond roof with sarking and 10mm plasterboard ceiling R_w+C_{tr} 35.

Additional to the above there is a requirement where the lots within the ANEF 20 noise contour require notifications on titles for aircraft noise. The wording for the notification on title is as follows:

Notification:

"This lot is situated in the vicinity of Jandakot Airport, and is currently affected, or may in the future, be affected by aircraft noise. Noise exposure levels are likely to increase in the future as a result of increases in numbers of aircraft using the airport, changes in aircraft type or other operational changes. Further information about aircraft noise, including development restrictions and noise insulation requirements for noise-affected properties, are available on request from the relevant local government offices."

Further to the criteria contained in SPP 5.3, the City of Cockburn LPP 1.12 contains advice as follows:

> *Consideration should be given to noise attenuation for noise sensitive premises within the Frame area corresponding to the requirements of Western Australian Planning Commission publication "Aircraft Noise Insulation for Residential Development in the Vicinity of Perth Airport" 2004 (such as the installation of 6.38mm laminated glazing), in order to ensure that residential amenity is adequately protected within noise sensitive developments.*

Therefore, development outside of the ANEF 20-25 contour, but within the Frame Area would require upgraded glazing in the form of 6.38 laminate.

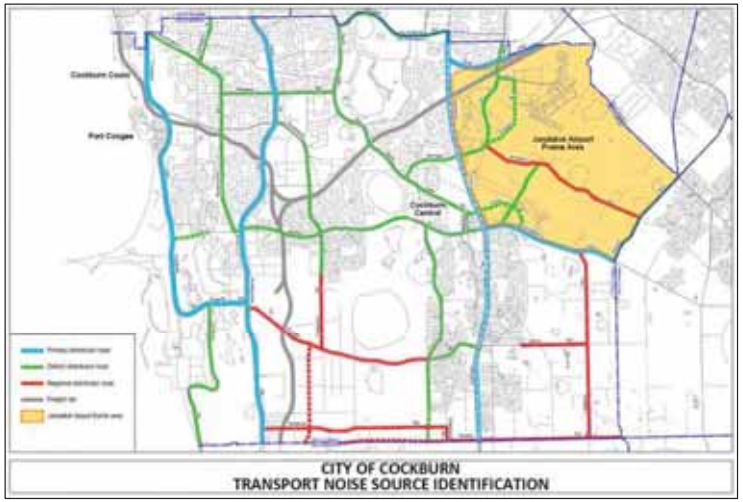


FIGURE 5.6 – JANDAKOT AIRPORT FRAME AREA NOISE CONSIDERATIONS

5.4 INDUSTRY NOISE

Based on the City of Cockburn Intramaps, there is industrial zoned land use to the south of the proposed residential development, as shown in Figure 5.7.

As there are existing residential premises located on Imlah Court, located at a closer distance to the industrial premises than the proposed development, expectations are that compliance with Regulatory criterial contained in the *Environmental Protection (Noise) Regulations 1997* would be achieved for the existing situation at these locations. However, consideration of the potential for noise impact from this area has been undertaken for the proposed residential development.

Three forms of noise amelioration have been considered for the future residence located on the southern end of the Glen Iris development, with these being as follows:

1. Noise Wall

   A solid, masonry barrier has been allowed for on the eastern boundary of the development, bounding Prinsep Road. The height of the wall has been set at 1.8m. As the proposed Lots are to back onto Prinsep Road, this will provide protection od outdoor living areas for noise associated with surrounding land use.

2. Upgrade Building Design

   As the proposed Lots for the southern section of the development lay within the Frame Area / ANEF 20/25 for Jandakot Airport, these residential dwellings will be required to meet the upgrade design as per SPP 5.4 / LPP 1.12. This will provide attenuation for other noise sources, such as industrial noise within the surrounding area.

3. Setback

As per the development plan attached in Appendix A, there is a 50m setback of lots from the southern boundary of the development. This will provide further amelioration in the form of distance attenuation.

FIGURE 5.7 – PLANNING LAND USE MAP

6.0 CONCLUSION

ROAD NOISE

Based on the development plan, it is proposed that areas are to be constructed for the purpose of residential with some commercial usage for the section to the north of Berrigan Drive. Noise levels for the future road traffic are such, that at some of the lot façades, the noise could exceed the 55 dB(A) noise Target. Therefore, amelioration in the form of Quiet House Design is required. These areas have been identified and general "deemed to satisfy packages" as per the SPP 5.4 guidelines applied. Detailed design for these requirements can be applied at subdivision staging once further information is available.

Given the noise levels, the lot façades would require Quiet House Design in the form of Package A. Appendix F contains the deemed to satisfy packages or Quiet House Design requirements and an area plan outlining the effected Lots.

Additionally, as they are over the "Target" noise level, the lots in this area would require notification on titles of the Freeway and Berrigan Drive noise impact.

RAIL NOISE

For train noise associated with the Yangebup Freight Line, due to the topography (line being in a cutting) and the noise wall and residential housing between the rail line and the development, the noise levels for the worst-case future scenario of one train per hour have been assessed as being below the night time noise Target criteria at the façade lots of the development boundary, hence there are no acoustic requirements.

Information was sought from the Metronet and the EPA as to the proposed design and impact of noise levels from the proposed future passenger rail and freight rail lines.

As there are existing residential premises located on the proposed rail line, development of the future rail line operations needs to consider these highly noise sensitive premises.

Review of the preliminary design noise levels, as provided in the *Thornnlie-Cockburn Link Noise and Vibration Assessment Report Number 675.10409.00100-R01* shows that noise levels to these existing residential premises will be designed such that the target noise levels (as per SPP 5.4) will be met.

As the Glen Iris development is set back behind these residential premises, noise levels would be less than those at the lot façades, hence compliance with the requirements of SPP 5.4 would be achieved. Therefore, noise modelling of the future proposed Freight / Passenger Rail would not be required for this development as the infrastructure provide will meet the requirements of SPP 5.4 for existing residential premises closer to the rail line.

Notwithstanding the above, confirmation assessment of the freight rail has been undertaken and calibrated to existing noise levels. These noise levels have been increased for future rail freight movements of one per hour. This is based on the current built form, including the noise wall located along the existing residence boarding the rail line. When the proposed passenger rail development is constructed, the noise mitigation requirements would incorporate the freight rail, hence noise levels would be less than those considered in this assessment. This provides a conservative acoustic assessment for the proposed development, where the future freight rail increases, and no further noise attenuation works are carried out.

AIRCRAFT NOISE

Based on guidance from SPP 5.3, the majority of the northern section of the proposed development site is acceptable for residential development, as indicated in Figure 5.3.

The blue area (ANEF 20 to 25) is also acceptable for residential development, although it requires conditions. These conditions are such that the internal noise level (for aircraft noise events) are to meet the criteria contained in AS2021. The affected lots within this development are those within the blue contour as noted in Figure 5.3.

Further to the criteria contained in SPP 5.3, the City of Cockburn LPP 1.12 contains advice as follows:

> *Consideration should be given to noise attenuation for noise sensitive premises within the Frame area corresponding to the requirements of Western Australian Planning Commission publication "Aircraft Noise Insulation for Residential Development in the Vicinity of Perth Airport" 2004 (such as the installation of 6.38mm laminated glazing), in order to ensure that residential amenity is adequately protected within noise sensitive developments.*

Therefore, whilst at this stage of the development the lot configuration and layout are not known, a preliminary "deemed to satisfy construction" has been provided within this report for areas within the ANEF 20-25 noise contour. This can form the basis of future concept designs and can be refined at subdivision staging. For area outside the ANEF 20 but contained within the Frame Area upgraded glazing would be required (as per LPP 1.12).

INDUSTRY NOISE

Based on the City of Cockburn Intramaps, there is industrial zoned land use to the south of the proposed residential development, as shown in Figure 5.4.

As there are existing residential premises located on Imlah Court, located at a closer distance to the industrial premises than the proposed development, expectations are that compliance with Regulatory criterial contained in the *Environmental Protection (Noise) Regulations 1997* would be achieved for the existing situation at these locations. However, consideration of the potential for noise impact from this area has been undertaken for the proposed residential development.

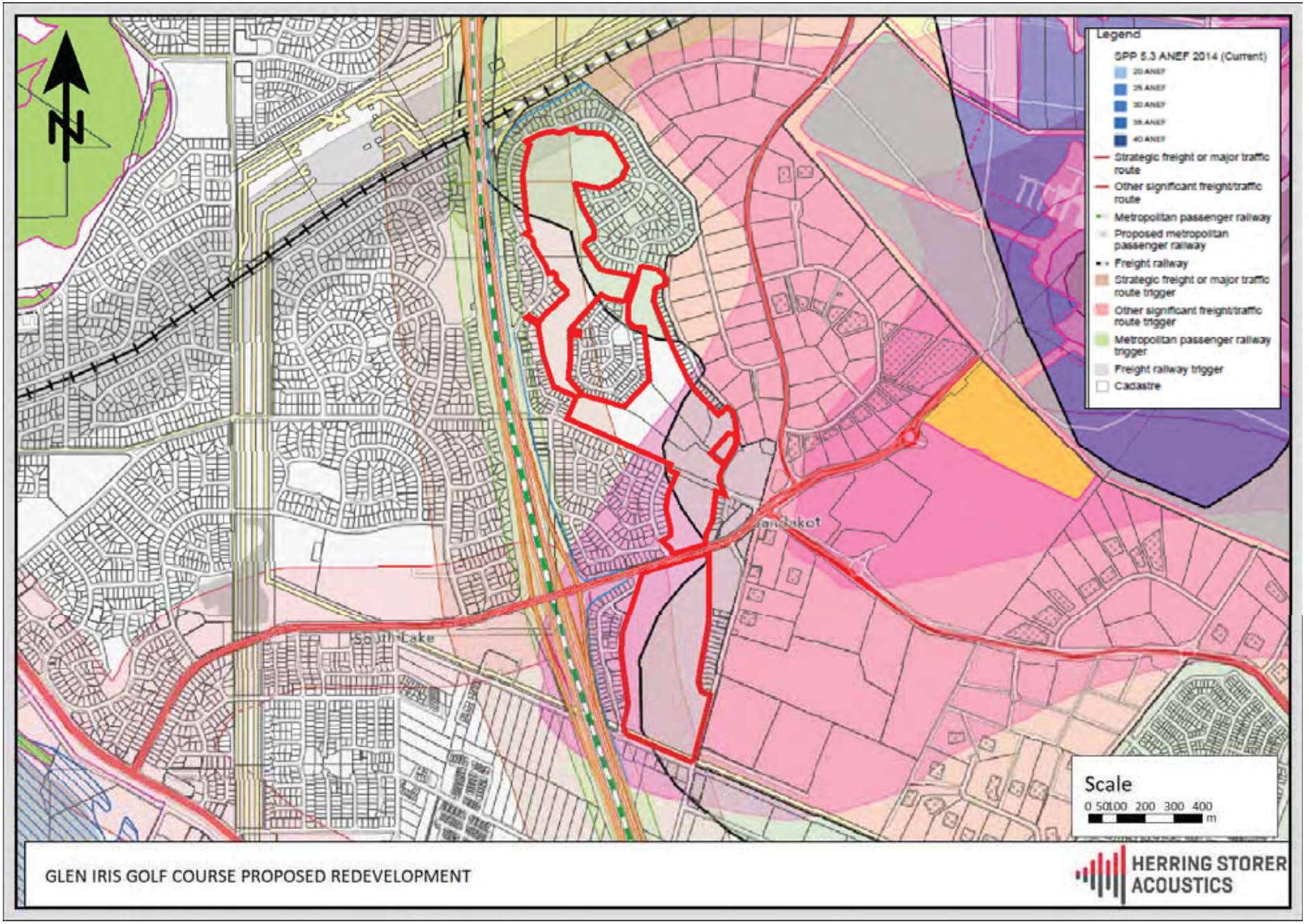
Three forms of noise amelioration have been considered for the future residence located on the southern end of the Glen Iris development, with these being as follows:

1. Noise Wall (Prinsep Road)
2. Upgrade Building Design (As per SPP 5.3)
3. Setback

Given the implementation of the above, noise levels can be managed, regardless of compliance with the regulatory criteria.

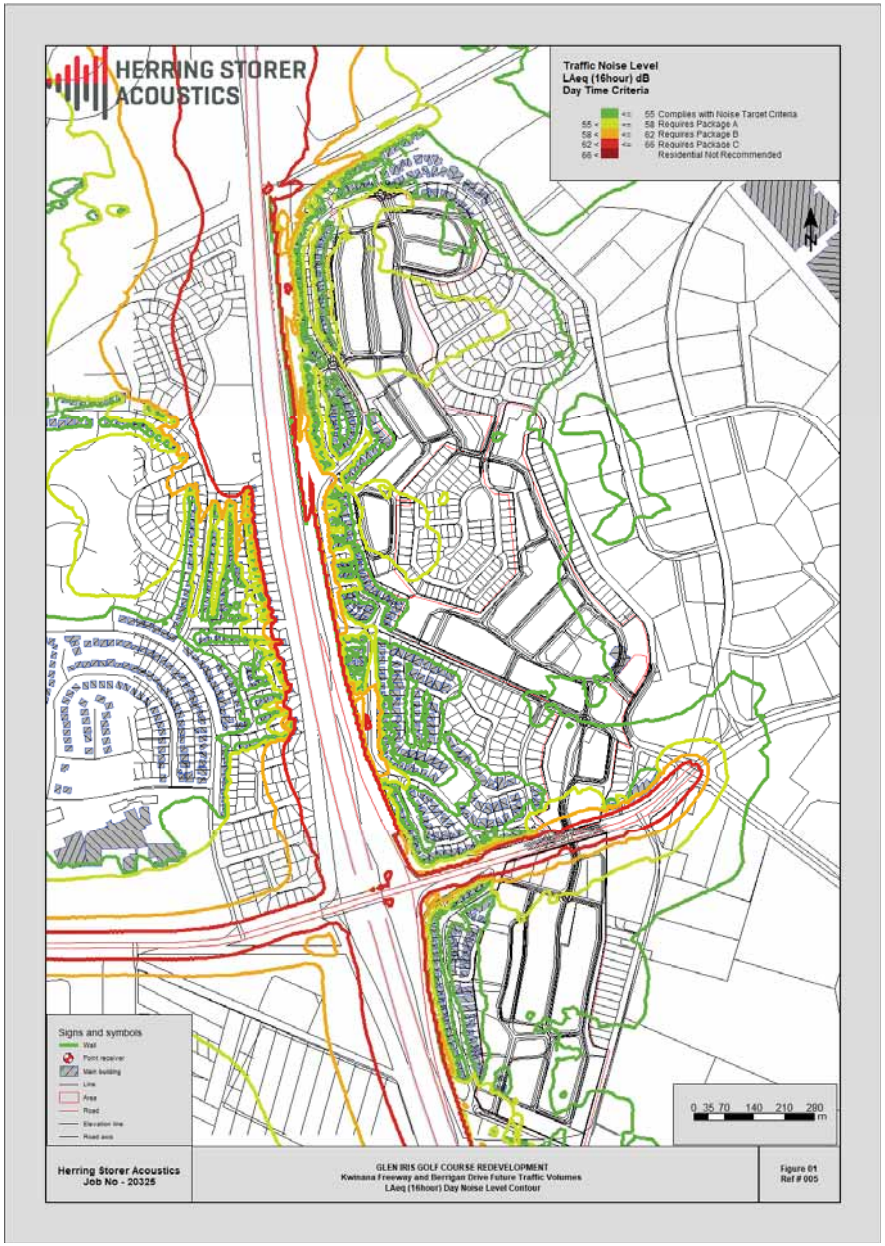
APPENDIX A

Area Plan


N
Legend
SPP 5.3 ANEF 2014 (Current)
20 ANEF
25 ANEF
30 ANEF
35 ANEF
40 ANEF
Strategic freight or major traffic route
Other significant freight/traffic route
Metropolitan passenger railway
Proposed metropolitan passenger railway
Freight railway
Strategic freight or major traffic route trigger
Other significant freight/traffic route trigger
Metropolitan passenger railway trigger
Freight railway trigger
Cadastre
South Lake
Scale
0 50 100 200 300 400
m
GLEN IRIS GOLF COURSE PROPOSED REDEVELOPMENT
HERRING STORER ACOUSTICS

APPENDIX B

$L_{Aeq(16hr)}$ DAY
NOISE CONTOURS FOR FUTURE KWINANA FREEWAY and BERRIGAN DRIVE


HERRING STORER ACOUSTICS
Traffic Noise Level
LAeq (16hour) dB
Day Time Criteria
55 Complies with Noise Target Criteria
58 Requires Package A
62 Requires Package B
66 Requires Package C
Residential Not Recommended
N
Signs and symbols
Wall
Point receiver
Main building
Line
Area
Road
Elevation line
Road axis
0 35 70 140 210 280
m
Herring Storer Acoustics
Job No - 20325
GLEN IRIS GOLF COURSE REDEVELOPMENT
Kwinana Freeway and Berrigan Drive Future Traffic Volumes
LAeq (16hour) Day Noise Level Contour
Figure 01
Ref # 005

APPENDIX C

$L_{Aeq(8hr)}$ NIGHT
NOISE CONTOURS FOR FUTURE YANGEBUP FREIGHT LINE

Herring Storer Acoustics
Job No - 20325

GLEN IRIS GOLF COURSE
Future Traffic Volumes - Yangebup Freight Rail Line
LAeq (8hour) Night Noise Level Contour

Figure C2
Ref # 009

APPENDIX D

TRAFFIC FLOW VOLUMES – KWINANA FREEWAY and BERRIGAN DRIVE

mainroads

SITE 8450

Hourly Volume

2017/18
Monday to Friday

Kwinana Fwy (H015)

NB At Bridge Under Berrigan Dr (SLK 16.89)

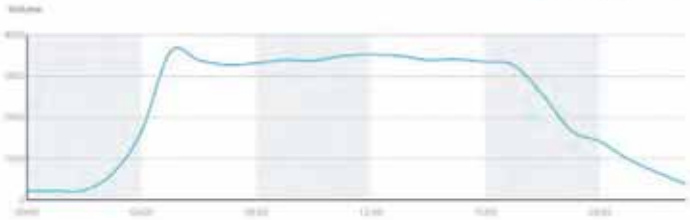
All Vehicles

	NB
00:00	214
01:00	221
02:00	230
03:00	627
04:00	7586
05:00	6487
06:00	7396
07:00	7277
08:00	7101
09:00	3401
10:00	2085
11:00	2402
12:00	2533
13:00	2499
14:00	2601
15:00	2619
16:00	2594
17:00	2613
18:00	2524
19:00	1866
20:00	1423
21:00	881
22:00	619
23:00	366
TOTAL	63882

Peak Statistics

AM	TIME	02:15
	VOL	8804
PM	TIME	17:15
	VOL	2720

Information Not Available



mainroads

SITE 8437

Hourly Volume

2017/18
Monday to Friday

Kwinana Fwy (H015)

SB At Bridge Under Berrigan Dr (SLK 16.90)

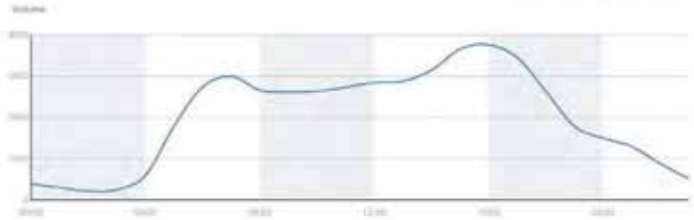
All Vehicles

	SB
00:00	204
01:00	200
02:00	213
03:00	79
04:00	103
05:00	780
06:00	2746
07:00	2739
08:00	2668
09:00	2691
10:00	2685
11:00	2776
12:00	2851
13:00	2683
14:00	2752
15:00	3040
16:00	3768
17:00	3854
18:00	2535
19:00	1792
20:00	1509
21:00	1299
22:00	901
23:00	216
TOTAL	46368

Peak Statistics

AM	TIME	02:15
	VOL	2208
PM	TIME	15:15
	VOL	2791

Information Not Available

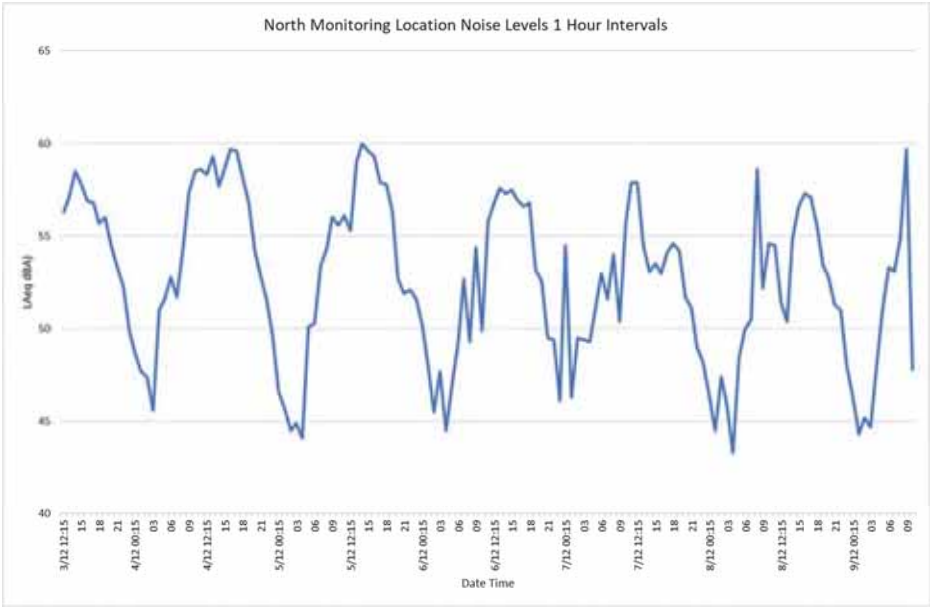


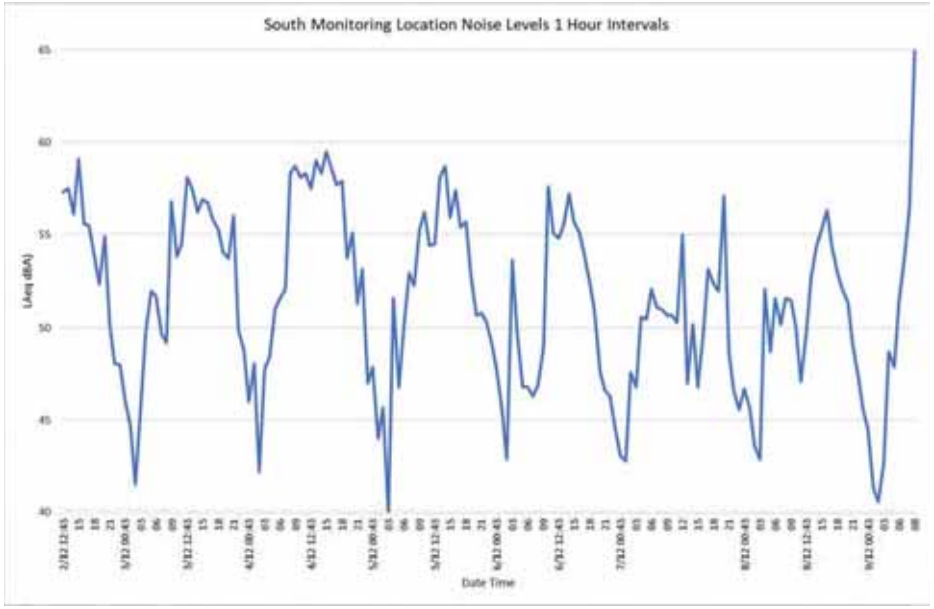
2016 ROM24 Scenario - Link Volume Plot for Berrigan Dr, Jandakot Noise Assessment
All Day
MLUFS Version 1.4 land use assumption with 20-Year Road Network Development Plan
MODEL ASSUMPTIONS
ROM24 Multi-Modal Model V4.40
24-Hour Traffic Volumes (Factor X 100)
mainroads
1 Lane Each Direction
2 Lanes Each Direction
3 Lanes Each Direction
>=4 Lanes Each Direction
Heavy Vehicle Percentage

2041 ROM24 Scenario - Link Volume Plot for Berrigan Dr, Jandakot Noise Assessment
All Day
MLUFS Version 1.4 land use assumption with 20-Year Road Network Development Plan
MODEL ASSUMPTIONS
ROM24 Multi-Modal Model V4.40
24-Hour Traffic Volumes (Factor X 100)
mainroads
1 Lane Each Direction
2 Lanes Each Direction
3 Lanes Each Direction
>=4 Lanes Each Direction
Heavy Vehicle Percentage

APPENDIX E

MONITORING DATA

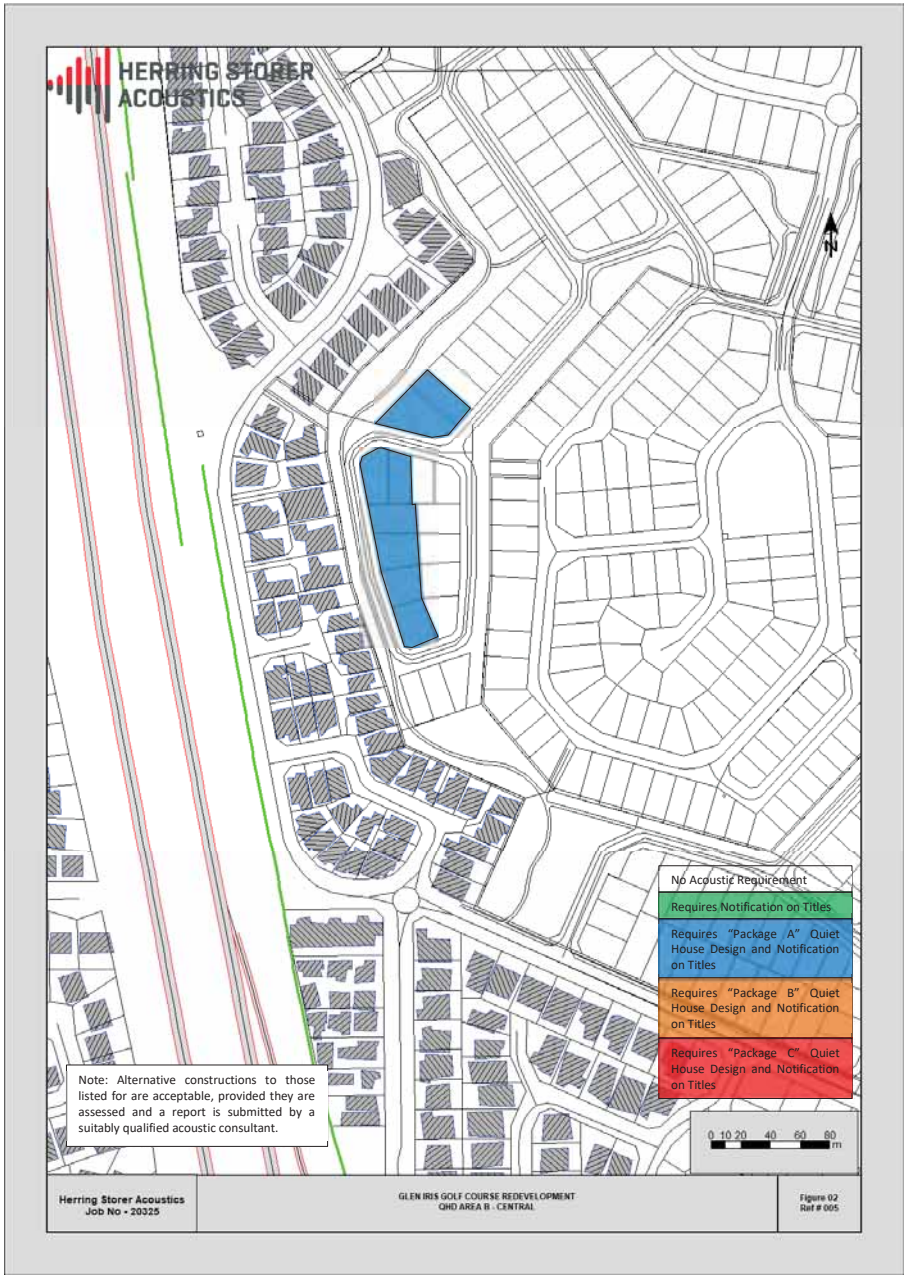

North Monitoring Location Noise Levels 1 Hour Intervals
LAeq dBA)
Date Time

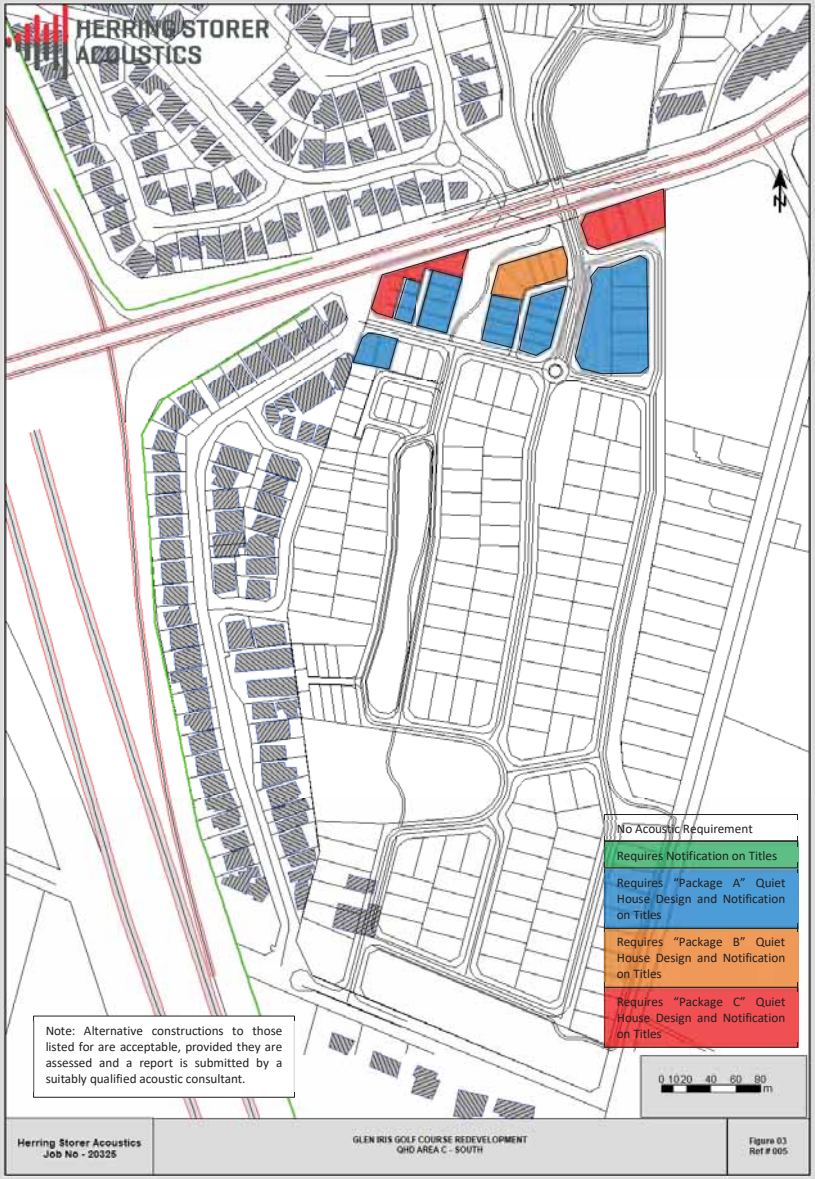

South Monitoring Location Noise Levels 1 Hour Intervals
LAeq dBA)
Date Time

APPENDIX F

QUIET HOUSE DESIGN REQUIREMENTS

HERRING STORER ACOUSTICS
N
No Acoustic Requirement
Requires Notification on Titles
Requires "Package A" Quiet House Design and Notification on Titles
Requires "Package B" Quiet House Design and Notification on Titles
Requires "Package C" Quiet House Design and Notification on Titles
Note: Alternative constructions to those listed for are acceptable, provided they are assessed and a report is submitted by a suitably qualified acoustic consultant.
0 10 20 40 60 80 m
Herring Storer Acoustics
Job No - 20325
GLEN IRIS GOLF COURSE REDEVELOPMENT
QHD AREA A - NORTH
Figure 01
Ref # 005


HERRING STORER ACOUSTICS
N
No Acoustic Requirement
Requires Notification on Titles
Requires "Package A" Quiet House Design and Notification on Titles
Requires "Package B" Quiet House Design and Notification on Titles
Requires "Package C" Quiet House Design and Notification on Titles
Note: Alternative constructions to those listed for are acceptable, provided they are assessed and a report is submitted by a suitably qualified acoustic consultant.
0 10 20 40 60 80 m
Herring Storer Acoustics
Job No - 20325
GLEN IRIS GOLF COURSE REDEVELOPMENT
QHD AREA B - CENTRAL
Figure 02
Ref # 005


HERRING STORER ACOUSTICS
N
No Acoustic Requirement
Requires Notification on Titles
Requires "Package A" Quiet House Design and Notification on Titles
Requires "Package B" Quiet House Design and Notification on Titles
Requires "Package C" Quiet House Design and Notification on Titles
Note: Alternative constructions to those listed for are acceptable, provided they are assessed and a report is submitted by a suitably qualified acoustic consultant.
0 10 20 40 60 80 m
Herring Storer Acoustics
Job No - 20325
GLEN IRIS GOLF COURSE REDEVELOPMENT
QHD AREA C - SOUTH
Figure 03
Ref # 005

Road Traffic and Passenger Rail
Quiet House Requirements
(*Based on Table 3 of State Planning Policy 5.4 2019*)

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					Mechanical ventilation/air conditioning considerations
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	
A **Quiet House A**	**Facing**	**Bedroom and Indoor Living and work areas to Rw + Ctr 45dB** **Stud Frame Walls** ➢ One row of 92mm studs at 60mm centres with: ➢ Resilient steel channels fixed to the outside of the studs; and ➢ 9.5mm hardboard or 9mm fibre cement weatherboards or one layer of 19mm board cladding fixed to the outside of the channels; and ➢ 75mm glass wool (11kg/m3) or 75mm polyester (14kg/m3) insulation, positioned between the studs; and ➢ -Two layers of 16mm fire-protective grade plasterboard fixed to the inside face of the studs. **Brick Walls** ➢ Single leaf of 150mm brick masonry with 13mm cement render on each face: **OR** ➢ Double brick: two leaves of 90 mm clay brick masonry with a 20mm cavity between leaves.	**Bedrooms**: ➢ Fully glazed hinged door with certified **R_w+C_{tr} 28dB** rated door and frame including seals and 6mm glass **Indoor Living and work areas:** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10 mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 28 dB**). Sealed awning or casement windows may use 6 mm glazing instead**: OR** ➢ Up to 60% floor area: as per above but must be sealed awning or casement type windows (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 25dB**)**: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr28 dB : OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 31 dB**).	**To R_w+C_{tr} 35dB** ➢ Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard ceiling	➢ At least one outdoor living area located on the opposite side of the building from the transport corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum **2 metres** height above ground level	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of **Rw 40dB** into sensitive spaces ➢ Evaporative systems require attenuated ceiling air vents to allow closed windows ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable
	Side On		As per "Facing" above, except R_w+C_{tr} values may be 3dB less, e.g. glazed sliding door with 10 mm glass and weather seals for bedrooms	As above, except R_w+C_{tr} values may be 3dB less, or max % area increased by 20%			
	Opposite		No specific requirements	No specific requirements			

Freight Rail
Quiet House Requirements
(*Based on Table 3 of State Planning Policy 5.4 2019*)

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					Mechanical ventilation/air conditioning considerations
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	
A+ **Quiet House A+**	**All Facades**	**Brick Walls Only** ➢ Double brick: two leaves of 90 mm clay brick masonry with a 20mm cavity between leaves.	**Bedrooms**: ➢ No external doors for bedrooms with entry facing rail corridor and for other facades, fully glazed hinged door with certified **R_w+C_{tr} 28dB** rated door and frame including seals and 6mm glass **Indoor Living and work areas:** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ All windows comprise minimum 6mm thick laminated or toughened glass in sealed awning or casement type frames. Polymer (e.g. uPVC) window framing should be used (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 25dB**). **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr28 dB**) **: OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 31 dB**).	**To R_w+C_{tr} 35dB** ➢ Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard ceiling	➢ At least one outdoor living area located on the opposite side of the building from the transport corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum **2 metres** height above ground level	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of **Rw 40dB** into sensitive spaces ➢ Evaporative systems not recommended ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable

Road Traffic and Passenger Rail
Quiet House Requirements
(*Based on Table 3 of State Planning Policy 5.4 2019*)

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					Mechanical ventilation/air conditioning considerations
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	
B **Quiet House B**	**Facing**	**Bedroom and indoor living and work areas to R_w+C_{tr} 50dB** **Single leaf of 90 mm clay brick masonry with:** ➢ A row of 70 mm x 35 mm timber studs or 64 mm steel studs at 600 mm centres; ➢ A cavity of 25 mm between leaves; ➢ 50 mm glass wool or polyester cavity insulation (R2.0+) insulation between studs; and ➢ One layer of 10mm plasterboard fixed to the inside face ➢ Single leaf of 220mm brick masonry with 13mm cement render on each face ➢ 150mm thick unlined concrete panel or 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face **Double brick: two leaves of 90mm clay brick masonry with:** ➢ A 50mm cavity between leaves ➢ 50mm glass wool or polyester cavity insulation (R2.0+) ➢ Resilient ties where required to connect leaves **Double brick: two leaves of 110mm clay brick masonry with** ➢ 50mm cavity between leaves and R2.0+ cavity insulation	**Bedrooms** ➢ Fully glazed hinged door with certified **R_w+C_{tr} 31dB** rated door and frame including seals and 10mm glass **Indoor Living and work areas** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor areas: Fixed sash, awning or casement with minimum 6mm single or 6mm-12mm-6mm double insulted glazing (**Rw+Ctr 31dB**). ➢ Up to 60% floor area: as per above but must be minimum10mm single or 6mm-12mm-10mm double insulated glazing (**Rw+Ctr 34dB**) **Indoor Living and work areas** ➢ Up to 40% floor area; Sliding or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (R_w+C_{tr} 28dB). Sealed awning or casement windows may use 6mm glazing instead. **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**R_w+C_{tr} 31dB**). **: OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 34dB).**	**To R_w+C_{tr} 35dB** ➢ Concrete or terracotta tile sarking and at least 10mm plasterboard ceiling, R3.0+ insulation **OR** ➢ Metal sheet roof, sarking and at least 10mm plasterboard ceiling, R3.0+ insulation	➢ At least one outdoor living area located on the opposite side of the building from the corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum **2.4 metres** height above ground level	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of **Rw 40dB** into sensitive spaces ➢ Evaporative systems require attenuated ceiling air vents to allow closed windows ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable
	Side-On		**Bedrooms**: ➢ Fully glazed hinged door with certified **R_w+C_{tr} 28dB** rated door and frame including seals and 6mm glass **Indoor Living and work areas:** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10 mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 28 dB**). Sealed awning or casement windows may use 6 mm glazing instead. **: OR** ➢ Up to 60% floor area: as per above but must be sealed awning or casement type windows (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 25dB**). **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr28 dB**) **: OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 31 dB**).			
	Opposite		As above, except R_w+C_{tr} values may be 3dB less, or max % area increased by 20%	As above, except R_w+C_{tr} values may be 3dB less, or max % area increased by 20%			

Freight Rail
Quiet House Requirements

(*Based on Table 3 of State Planning Policy 5.4 2019*)							
Exposure Category	**Orientation to corridor**	**Acoustic rating and example constructions**					**Mechanical ventilation/air conditioning considerations**
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	
B+ **Quiet House B**	**All Facades**	**Double brick: two leaves of 90mm clay brick masonry with:** ➢ A 50mm cavity between leaves ➢ 50mm glass wool or polyester cavity insulation (R2.0+) ➢ Resilient ties where required to connect leaves **Double brick: two leaves of 110mm clay brick masonry with** ➢ 50mm cavity between leaves and R2.0+ cavity insulation	**Bedrooms** **Bedrooms**: ➢ No external doors for bedrooms with entry facing or side on to rail corridor and for other facades, fully glazed hinged door with certified **R_w+C_{tr} 31dB** rated door and frame including seals and 10mm glass **Indoor Living and work areas** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ All windows comprise minimum 6mm thick laminated or toughened glass in sealed awning or casement type frames. Polymer (e.g. uPVC) window framing should be used (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 28dB**) **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr31 dB**) **: OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 34 dB**).	**To R_w+C_{tr} 40dB** ➢ To all bedrooms, 2 layers of 10mm plasterboard, or one layer 13mm high density sealed plasterboard (minimum surface density of 12.5 kg/m2), affixed using steel furring channels beneath ceiling rafters/supports**: and** ➢ R3.0+ insulation batts laid in cavity**: and** ➢ Concrete or terracotta tile roof with sarking, or metal sheet roof with foil backed R2.0+ fibre insulation between steel sheeting and roof battens	➢ At least one outdoor living area located on the opposite side of the building from the corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum **2.4 metres** height above ground level	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of **Rw 40dB** into sensitive spaces ➢ Evaporative systems not recommended ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable

Road Traffic and Passenger Rail
Quiet House Requirements
(*Based on Table 3 of State Planning Policy 5.4 2019*)

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	**Mechanical ventilation/air conditioning considerations**
C **Quiet House C**	**Facing**	**Bedroom and indoor living and work areas to R_w+C_{tr} 50dB** **Single leaf of 90 mm clay brick masonry with:** ➢ A row of 70 mm x 35 mm timber studs or 64 mm steel studs at 600 mm centres; ➢ A cavity of 25 mm between leaves; ➢ 50 mm glass wool or polyester cavity insulation (R2.0+) insulation between studs; and ➢ One layer of 10mm plasterboard fixed to the inside face ➢ Single leaf of 220mm brick masonry with 13mm cement render on each face ➢ 150mm thick unlined concrete panel or 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face **Double brick: two leaves of 90mm clay brick masonry with:** ➢ A 50mm cavity between leaves ➢ 50mm glass wool or polyester cavity insulation (R2.0+) ➢ Resilient ties where required to connect leaves **Double brick: two leaves of 110mm clay brick masonry with** ➢ 50mm cavity between leaves and R2.0+ cavity insulation	**Bedrooms** ➢ External doors to bedrooms facing the corridor are not recommended. **Indoor Living and work areas** ➢ Fully glazed hinged door with certified **Rw+Ctr 31dB** rated door and frame including seals and 10mm glass**: OR** 40mm solid core timber frame and door (without glass or with glass inserts not less than 6mm), side hinged with certified **Rw 32dB** acoustically rated door and frame system including seals	**Bedrooms**: ➢ Total external door and window system area up to 20% of room floor area: Fixed sash, awning or casement with minimum 6mm single or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 31dB): OR** ➢ Up to 40% floor area; as per above but must be minimum 10mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 34dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulated glazing (**R_w+C_{tr} 31dB**). Sealed awning or casement windows may use 6mm glazing instead**: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr 34dB)**	**To R_w+C_{tr} 40dB** ➢ To al bedrooms, 2 layers of 10mm plasterboard, or one layer 13mm high density sealed plasterboard (minimum surface density of 12.5 kg/m2), affixed using steel furring channels beneath ceiling rafters/supports**: and** ➢ R3.0+ insulation batts laid in cavity **: and** ➢ Concrete or terracotta tile roof with sarking, or metal sheet roof with foil backed R2.0+ fibre insulation between steel sheeting and roof battens	➢ At least one outdoor living area located on the opposite side of the building from the corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum **2.4 metres** height above ground level	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of Rw 40dB into sensitive spaces. ➢ Evaporative systems require attenuated ceiling air cents to allow closed windows. ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, close or relocated to building sides facing away from the corridor where practicable.
	Side-on	**Bedrooms** ➢ Fully glazed hinged door with certified **R_w+C_{tr} 31dB** rated door and frame including seals and 10mm glass **Indoor Living and work areas** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals					
	Opposite	**Bedrooms**: ➢ Fully glazed hinged door with certified **R_w+C_{tr} 28dB** rated door and frame including seals and 6mm glass **Indoor Living and work areas:** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals		**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10 mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 28 dB**). Sealed awning or casement windows may use 6 mm glazing instead**: OR** ➢ Up to 60% floor area: as per above but must be sealed awning or casement type windows (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 25dB): OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr28 dB : OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 31 dB**).			

Freight Rail
Quiet House Requirements

(*Based on Table 3 of State Planning Policy 5.4 2019*)							
Exposure Category	**Orientation to corridor**	**Acoustic rating and example constructions**					
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	**Mechanical ventilation/air conditioning considerations**
C+ **Quiet House C+**	**All Facades**	**Double brick: two leaves of 90mm clay brick masonry with:** ➢ A 50mm cavity between leaves ➢ 50mm glass wool or polyester cavity insulation (R2.0+) ➢ Resilient ties where required to connect leaves **Double brick: two leaves of 110mm clay brick masonry with** ➢ 50mm cavity between leaves and R2.0+ cavity insulation	**Bedrooms** ➢ External doors to bedrooms facing or side onto the corridor are not recommended. **Indoor Living and work areas** ➢ Fully glazed hinged door with certified **Rw+Ctr 31dB** rated door and frame including seals and 10mm glass**: OR** ➢ 40mm solid core timber frame and door (without glass or with glass inserts not less than 6mm), side hinged with certified **Rw 32dB** acoustically rated door and frame system including seals	**Bedrooms**: ➢ All windows comprise minimum 6mm thick laminated or toughened glass in sealed awning or casement type frames. Polymer (e.g. uPVC) window framing should be used (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 31dB**) **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr34 dB**)	**To R_w+C_{tr} 45dB** ➢ To al bedrooms, 2 layers of 10mm plasterboard, affixed using steel furring channels beneath ceiling rafters/supports**: and** ➢ R3.0+ insulation batts laid in cavity **: and** ➢ Concrete or terracotta tile roof with sarking, (No metal sheet roofing)	➢ At least one outdoor living area located on the opposite side of the building from the corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum **2.4 metres** height above ground level	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of Rw 40dB into sensitive spaces. ➢ Evaporative systems require attenuated ceiling air cents to allow closed windows. ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, close or relocated to building sides facing away from the corridor where practicable.

Appendix H

EPA Decision to Not Assess Scheme Amendment Under Section 48A(1)(a) EP Act

Mr Tony Brun
Chief Executive Officer
City of Cockburn
PO Box 1215
BIBRA LAKE DC WA 6965

Our Ref: *CMS 18123*
Enquiries: *Renee Blandin, 6364 7259*
Email: *Renee.Blandin@dwer.wa.gov.au*

Dear Mr Brun

DECISION UNDER SECTION 48A(1)(a)
Environmental Protection Act 1986

SCHEME	**City of Cockburn Town Planning Scheme 3 Amendment 152**
LOCATION	**Former Glen Iris Golf Course on Berrigan Drive, Jandakot (Lots 6 and 7 Glen Iris Drive, Lots 3, 509 and 512 Dean Road and Lot 139 Imlah Court in Jandakot)**
RESPONSIBLE AUTHORITY	**City of Cockburn**
DECISION	**Referral Examined, Preliminary Investigations and Inquiries Conducted. Scheme Amendment Not to be Assessed Under Part IV of the EP Act. Advice Given. (Not Appealable)**

Thank you for referring the above scheme to the Environmental Protection Authority (EPA).

After consideration of the information provided by you, the EPA considers that the proposed scheme should not be assessed under Part IV Division 3 of the *Environmental Protection Act 1986* (EP Act) but nevertheless provides the attached advice and recommendations. I have also attached a copy of the Chair's determination of the scheme.

Please note the following:

- For the purposes of Part IV of the EP Act, the scheme is defined as an assessed scheme. In relation to the implementation of the scheme, please note the requirements of Part IV Division 4 of the EP Act.

- There is no appeal right in respect of the EPA's decision to not assess the scheme.

A copy of the Chair's determination, this letter and the attached advice and recommendations will be made available to the public via the EPA website.

Yours sincerely

Dr Shaun Meredith
Delegate of the Environmental Protection Authority
Executive Director
EPA Services

20 April 2022

Encl. Chair's Determination
Scheme Advice and Recommendations

ADVICE UNDER SECTION 48A(1)(a)
ENVIRONMENTAL PROTECTION ACT 1986

City of Cockburn Town Planning Scheme (LPS) 3 Amendment 152

Location: Former Glen Iris Golf Course on Berrigan Drive, Jandakot (Lots 6 and 7 Glen Iris Drive, Lots 3, 509 and 512 Dean Road and Lot 139 Imlah Court in Jandakot)

Determination: Scheme Not Assessed – Advice Given (Not Appealable)

Determination Published: 26 April 2022

Summary

The scheme amendment proposes to rezone various landholdings comprising the former Glen Iris Golf Club on Berrigan Drive, Jandakot from 'Special Use' and 'Residential R40' to the 'Development' zone.

The Environmental Protection Authority (EPA) has considered the scheme amendment in accordance with the requirements of the *Environmental Protection Act 1986* (EP Act). The EPA considers that the scheme amendment, as set out, is unlikely to have a significant effect on the environment and does not warrant formal assessment under Part IV of the EP Act. The EPA has based its decision on the scheme amendment documentation provided by the City of Cockburn (the City), and having considered this matter, the following advice is provided.

Environmental Factors

The EPA has identified the following preliminary environmental factor relevant to this scheme:

- Flora and Vegetation
- Terrestrial Fauna
- Social Surroundings
- Inland Waters

Advice and Recommendations regarding Environmental Factors

Flora and Vegetation and Terrestrial Fauna

The amendment area contains scattered area of remnant native vegetation, including 1.9 hectares potentially representative of Banksia Woodlands of the Swan Coastal Plain threatened ecological community, and also contains scattered planted vegetation.

Preliminary Fauna Surveys and a Targeted Black Cockatoo Habitat Assessment conducted by Emerge Associates (Environmental Assessment Report (EAR) (Project No. EP20-009(08))02/12/2021) identified 11 significant black cockatoo habitat trees.

The EAR also identified 4.76 hectares and 4.88 hectares of foraging habitat within the amendment area for Carnaby's black cockatoo and forest red-tailed black cockatoo respectively.

Department of Biodiversity, Conservation and Attractions (DBCA) have provided advice that the vegetation within the amendment area is considered to have value as black cockatoo habitat. DBCA has also advised the habitat is considered potentially suitable for roosting by black cockatoos utilising potential foraging habitat to the east and south-east of the site, based on water present on the site.

The EPA supports 'Development Area No.45' within Table 9 of the Scheme with the provision that a structure plan is required to address environmental impacts that may arise within the proposed amendment area.

The EPA notes that the City have provided modified draft scheme text for Table 9 Development Areas to provide further protection of black cockatoo habitat values. It is noted Western Australian Planning Commission and the City have also liaised regarding the intent to modify the scheme text prior to advertising, and the EPA supports this approach.

In addition to structure planning provisions, it is recommended the scheme provisions are modified to include reference to future development being required to prioritise black cockatoo habitat for retention.

Consistent with DBCA advice, it is recommended that through future stages of planning, vegetation containing black cockatoo habitat is set aside in public open space and enhanced through the planting of black cockatoo habitat species to mitigate the impacts from the development. Planting should be designed to reduce the risk to fauna of vehicle strike.

Social Surroundings

There is 'Industrial' zoned land and industrial development/operations to the south of the site.

Future residential development associated with the amendment may be subject to dust, noise and odour impacts from industrial land use.

EPA's Guidance Statement No. 3 *Separation Distances between Industrial and Sensitive Land Uses* should be considered in managing potential impacts to surrounding land uses prior to progressing urban development.

Inland Waters

Parts of the amendment area are located within the 'Jandakot Underground Water Pollution Control Area', a Priority 3 (P3) Priority Drinking Water Source Area (PDWSA), and within Wellhead Protection Zones (WPZ).

Future stages of planning should consider Water Quality Protection Note (WQPN) 25 *Land use compatibility tables for public drinking water source areas* (DWER 2021) and State Planning Policy (SPP) 2.3 *Jandakot Groundwater Protection* (WAPC 2017).

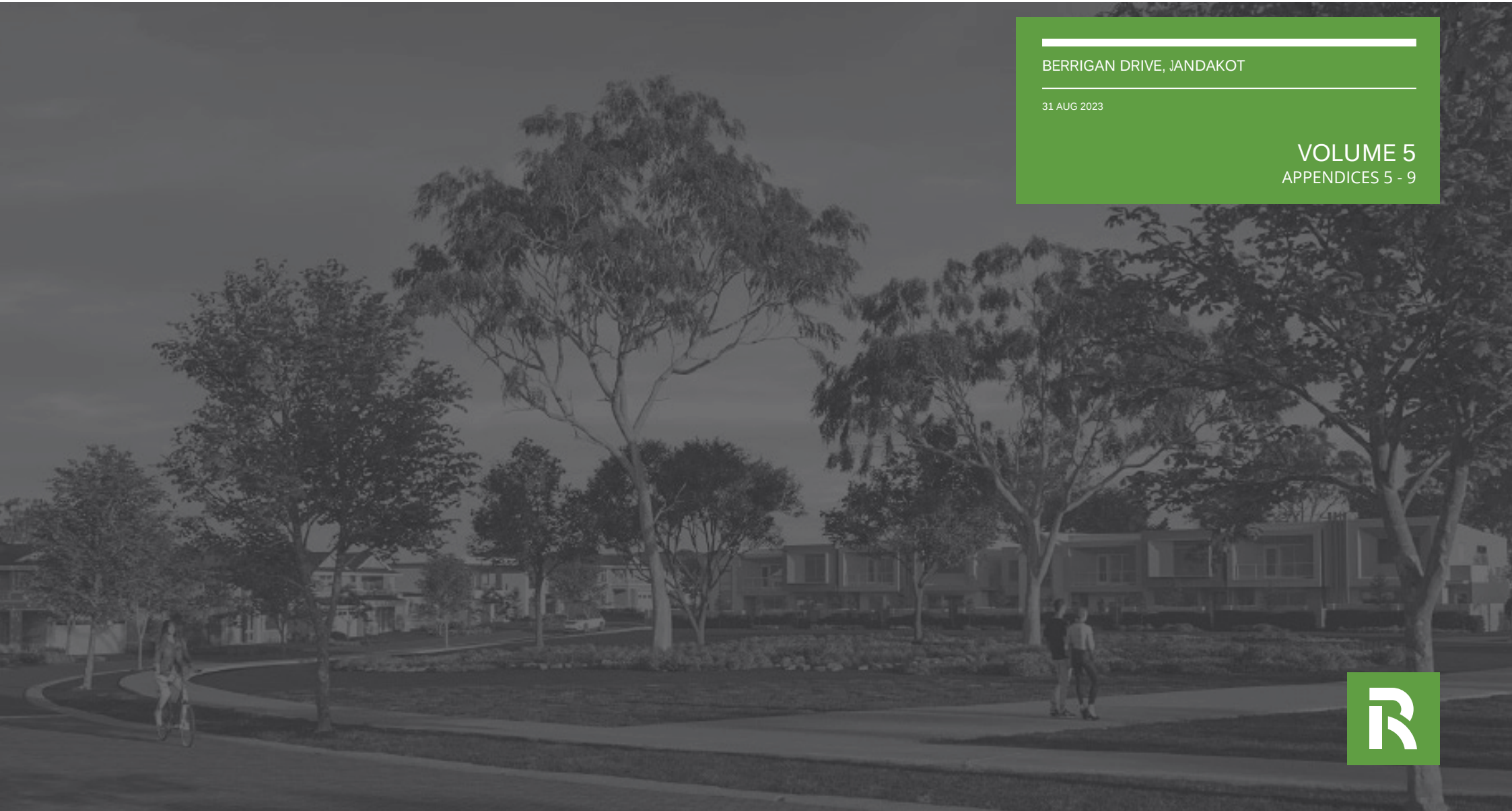
Future development should demonstrate best practice water management, consistent with *Better Urban Water Management* (WAPC 2008). Future water management plans should be prepared in consultation with Department of Water and Environmental Regulation to support local structure planning and subdivision, and should ensure that pre development hydrology is maintained post development, and that post development water quality is consistent with or improved in comparison to the pre development baseline.

Conclusion

The EPA concludes that the amendment can be managed to meet the EPA's environmental objectives through the proposed scheme provisions and existing planning controls. In addition, future planning processes and management measures will also manage potential impacts. The EPA recommends its advice is implemented to mitigate potential impacts to the above environmental factors.

GLEN IRIS ESTATE

STRUCTURE PLAN



BERRIGAN DRIVE, JANDAKOT

31 AUG 2023

VOLUME 5
APPENDICES 5 - 9

GLEN IRIS ESTATE

APPENDIX 5
BUSHFIRE MANAGEMENT PLAN

Bushfire Management Plan: Structure Plan: Glen Iris Estate

Acumen Development Solutions

DOCUMENT TRACKING

Project Name	Bushfire Management Plan: Structure Plan: Glen Iris Estate
Project Number	20PER-15185
Project Manager	Eva Cronin
Prepared by	Eva Cronin (BPAD Level 2 – 45482)
Reviewed by	Stephen Moore
Approved by	Eva Cronin (BPAD Level 2 – 45482
Status	Final
Version Number	v6
Last saved on	11 October 2023

This report should be cited as 'Eco Logical Australia 2023. Bushfire Management Plan: *Structure Plan: Glen Iris Estate*. Prepared for Acumen Development Solutions.

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Acumen Development Solutions

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Template 2.8.1

Version control	
Version	Purpose
v1	Draft – Submission to client
v2	Final – Submission to client
v3	Final – Revised in response to comments provided by the City of Cockburn
v4	Final – Revised in response to comments provided by the City of Cockburn
v5	Final – Revised in response to comments provided by the City of Cockburn
v6	Final – Revised in response to comments provided by the City of Cockburn

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1. Introduction

1.1 Proposal details

Eco Logical Australia (ELA) was commissioned by Acumen Development Solutions to prepare a Bushfire Management Plan (BMP) to support the Local Structure Plan for Glen Iris Estate (Lot 6 and 7 Glen Iris Drive, Lot 3 and 509 Dean Road and Lot 139 Imlah Court, hereafter referred to as the subject site, Figure 1). The Local Structure Plan will result in the subject site being developed to allow approximately 550 residential lots, 1 commercial lot, various Public Open Space (POS) and landscaping interface areas (Figure 2).

ELA have been advised that approval has been granted for the Local Structure Plan subject to a Schedule of Modifications issued by the Western Australian Planning Commission (WAPC). This report has been updated to address No 35 within this Schedule in relation to modifications required to the BMP.

The subject site is within a designated bushfire prone area as per the *Western Australia State Map of Bush Fire Prone Areas* (DFES 2021; Figure 3), which triggers bushfire planning requirements *under State Planning Policy 3.7 Planning in Bushfire Prone Areas* (SPP 3.7; WAPC 2015) and reporting to accompany submission of the development application in accordance with the associated *Guidelines for Planning in Bushfire Prone Areas v 1.3* (the Guidelines; WAPC 2017).

The subject site is bound by:

- Residential development and rail reserve to the north;
- Residential development and private industrial development to the south;
- Rural residential blocks and remnant vegetation to the east; and
- Residential development and Kwinana Freeway to the west.

This updated assessment has been prepared by ELA Senior Bushfire Consultant Eva Cronin with quality assurance undertaken by Senior Consultant Stephen Moore.

1.2 Purpose and application of the plan

The primary purpose of this BMP is to act as a technical supporting document to inform planning assessment. This BMP is also designed to provide guidance on how to plan for and manage the bushfire risk to the subject site through implementation of a range of bushfire management measures in accordance with the Guidelines.

1.3 Environmental considerations

Some bushfire prone areas also have high biodiversity values. SPP 3.7 policy objective 5.4 recognises the need to consider bushfire risk management measures alongside environmental, biodiversity and conservation values. No environmental approvals are being sought at this stage of development, however will be commenced as required to support future stages of planning.

A Landscape Strategy for the Local Structure Plan (Emerge 2023) has been developed and incorporates the following aspects:

- Pockets of retained Banksia scrub (north and south POS areas);
- Planted drainage basin;
- Streetscapes throughout the development - existing or new trees, irrigated grass, shrubs and groundcovers under 600 mm height in road reserves;
- Parks - irrigated grass, existing or new trees and low shrubs and groundcovers to any slopes and to define areas; and
- Screen planting along the edges of existing or proposed taller fences and walls to visually soften them, this is likely to comprise plantings between 2 - 3m tall and 2 - 3m wide.

The Landscape Strategy also broadly outlines the bushfire risk management landscape response within zones that provide Bushfire Attack Level (BAL) setbacks to residential lots from two retained pockets of Banksia scrub (north and south POS area). Landscaping design within this area will be required to meet Asset Protection Zone standards in the Guidelines. All other POS and Landscape interface areas will be maintained to a low threat state as per 2.2.3.2 (e) and (f) of the Guidelines (i.e. a combination of soft and hard landscaping in the form of maintained parklands, nature strips, etc).

These considerations are addressed further in sections 2.1 and 2.2 of this BMP. Any changes to revegetation and/or landscaping will be addressed in future BMPs.

Figure 1: Site Overview

Subject site
100m site assessment
150m site assessment

N

0 115 230 460
Metres

Datum/Projection:
GDA 1994 MGA Zone 50

20PER15185-SM Date: 23/08/2023

Figure 2: Site Plan - North

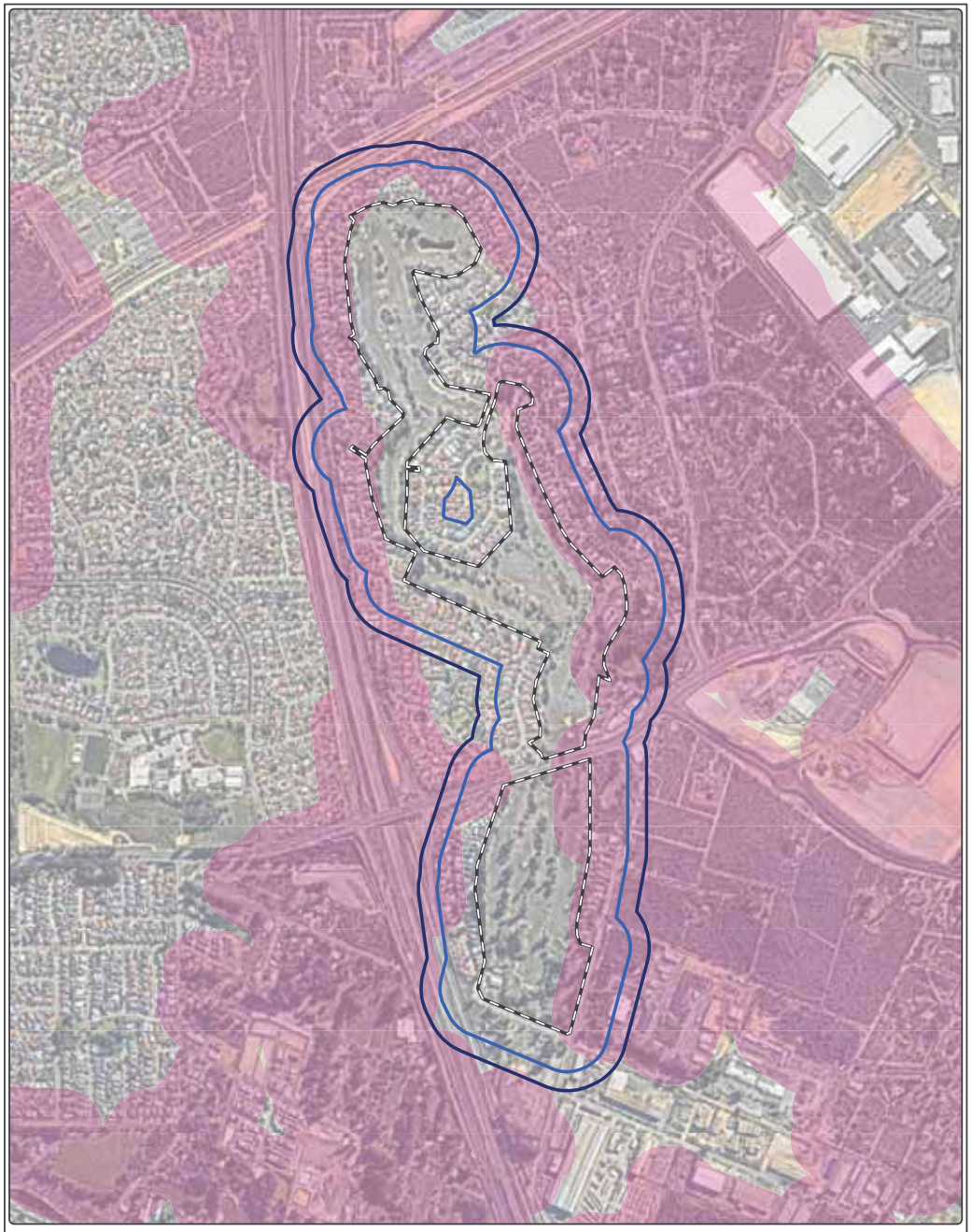

Figure 3: Bushfire Prone Areas

2. Bushfire assessment results

2.1 Bushfire assessment inputs

The following section is a consideration of spatial bushfire risk and has been used to inform the bushfire assessment in this report.

2.1.1 Fire Danger Index

A blanket Fire Danger Index (FDI) of FDI 80 is adopted for Western Australia, as outlined in Australian Standard *AS 3959: 2018 Construction of Buildings in Bushfire Prone Areas* (SA 2018) and endorsed by Australasian Fire and Emergency Service Authorities Council (AFAC).

2.1.2 Vegetation classification and slope under vegetation

Vegetation and effective slope (i.e. slope under vegetation) within the subject site and surrounding 150 m (the assessment area) were assessed in accordance with the Guidelines and *AS 3959: 2018* with regard given to the *Visual guide for bushfire risk assessment in Western Australia* (DoP 2016). Site assessment was undertaken on 12 April 2021.

The classified vegetation and effective slope for the subject site from each of the identified vegetation plots are identified below, Table 1 and Figure 4. Photographs relating to each area and vegetation type are included in Appendix A.

2.1.2.1 Post-development bushfire assessment

An assessment of vegetation and slope was undertaken based on the proposed development concept (Figure 2 and Appendix B). A summary of this assessment is provided below and is depicted in Figure 5:

- Majority of the subject site has been excluded to represent cleared areas for development, and low threat vegetation in the form of streetscapes, parks, planted drainage basins and screen planting;
- Two pockets of retained Banksia Class D scrub have been classified (within the northern and southern portions of the subject site);
- Asset Protection Zones (APZs) in accordance with Schedule 1 of the Guidelines will be implemented between proposed development and areas of retained Banksia Class D scrub to ensure acceptable BAL ratings of ≤BAL-29 can be achieved for future development (this will be addressed in detail in future BMPs to support subsequent planning applications);
- The retention of three isolated black cockatoo habitat trees within retained Banksia Class D scrub (within the northern portion of the site) will not change the predominant classifiable vegetation type in this area which is Class D Scrub; and
- The current extent of classified vegetation within the Western Power easement in the south of the subject site has been retained and therefore assessed as worst-case scenario. However, may be modified to low threat vegetation in future planning applications and supporting BMPs.

Dedicated irrigation sprays around retained Banksia Class D scrub (i.e. to assist with fire suppression activities) has been broadly considered within the bushfire risk management landscape response detailed in the Landscape Strategy for the site (Emerge 2023), however, the post-development bushfire assessment does not rely on this irrigation. The post-development bushfire assessment relies on the

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APZs between proposed development and retained vegetation meeting the minimum requirements set out in Schedule 1 of the Guidelines (Appendix C). Considerations in relation to regular irrigation within APZs for certain areas (i.e. for perennial grasses and where wood mulch is used) is detailed in the explanatory notes of the most recent Guidelines v1.4 (WAPC 2021). These strategies are considered to be best practice and are recommended to be incorporated (where possible) within APZ zones. Asset Protection Zones detailed in future BMPs will be required to meet APZ standards in accordance with Guidelines applicable at the time of planning application.

Future detailed landscaping plans will be developed for POS areas to support future planning applications which may modify these classifications. Updated BMPs will be prepared to address any changes.

Table 1: Classified vegetation as per AS 3959: 2018

Plot	Vegetation Classification	Effective Slope	Pre-development	Post-development
1	Class B woodland	All upslopes and flat land (0 degrees)	Present	Cleared
2	Class C Shrubland	All upslopes and flat land (0 degrees)	Present	Present
3	Class D Scrub	All upslopes and flat land (0 degrees)	Present	Present
4	Class G Grassland	All upslopes and flat land (0 degrees)	Present	Present
5	Excluded under clause 2.2.3.2 (e) and (f)	N/A	N/A	N/A

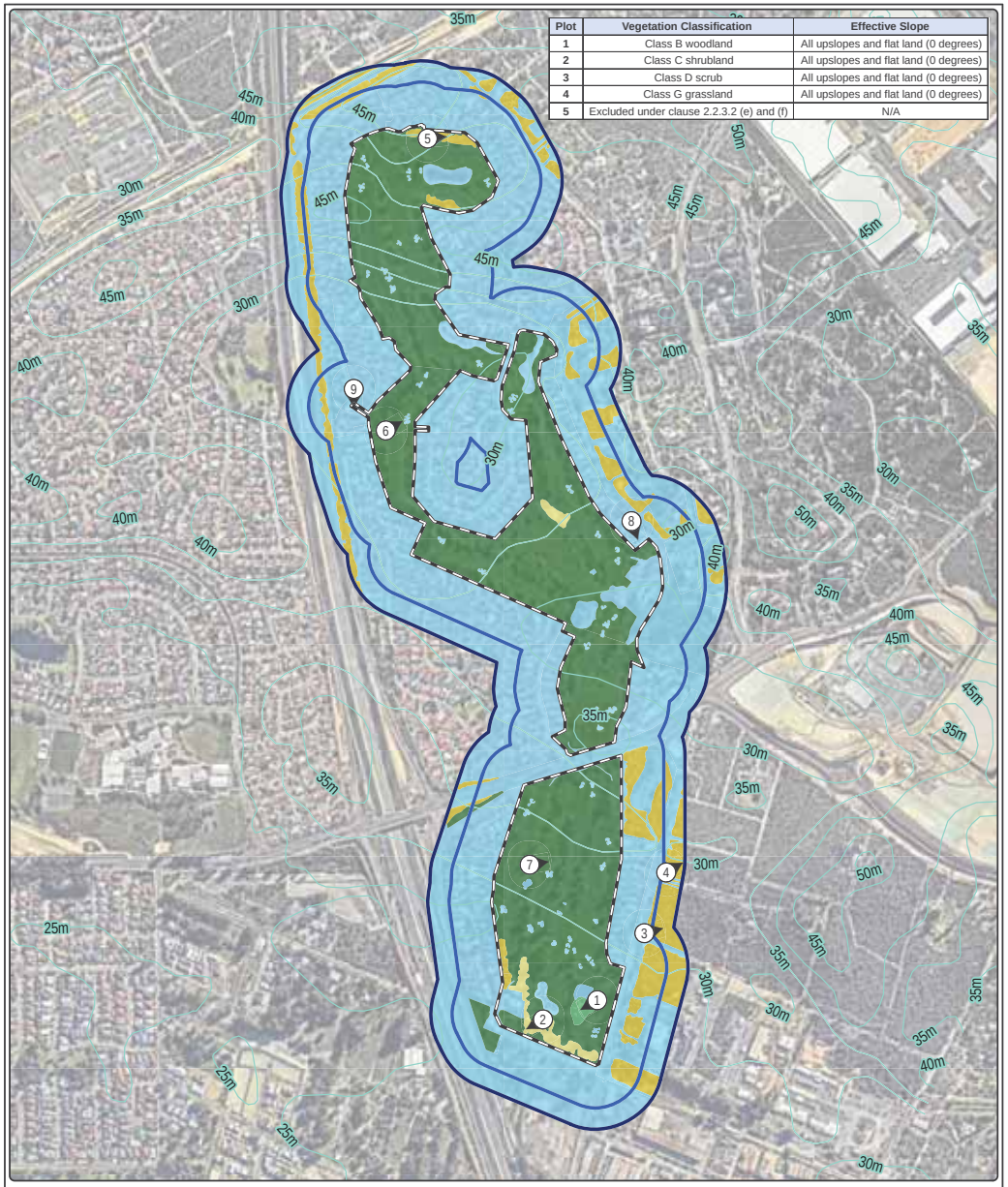

Figure 4: Vegetation Classification Pre-Development

- Subject site
- 100m site assessment
- 150m site assessment
- Photo location
- Contour (5m)

Vegetation classification

- Class B Woodland *(Plot 1)*
- Class C Shrubland *(Plot 2)*
- Class D Scrub *(Plot 3)*
- Class G Grassland *(Plot 4)*
- Excluded as per clause 2.2.3.2 (e) and (f) *(Plot 5)*

0 100 200 400
Metres

Datum/Projection:
GDA 1994 MGA Zone 50

20PER15185-SM Date: 23/08/2023

N

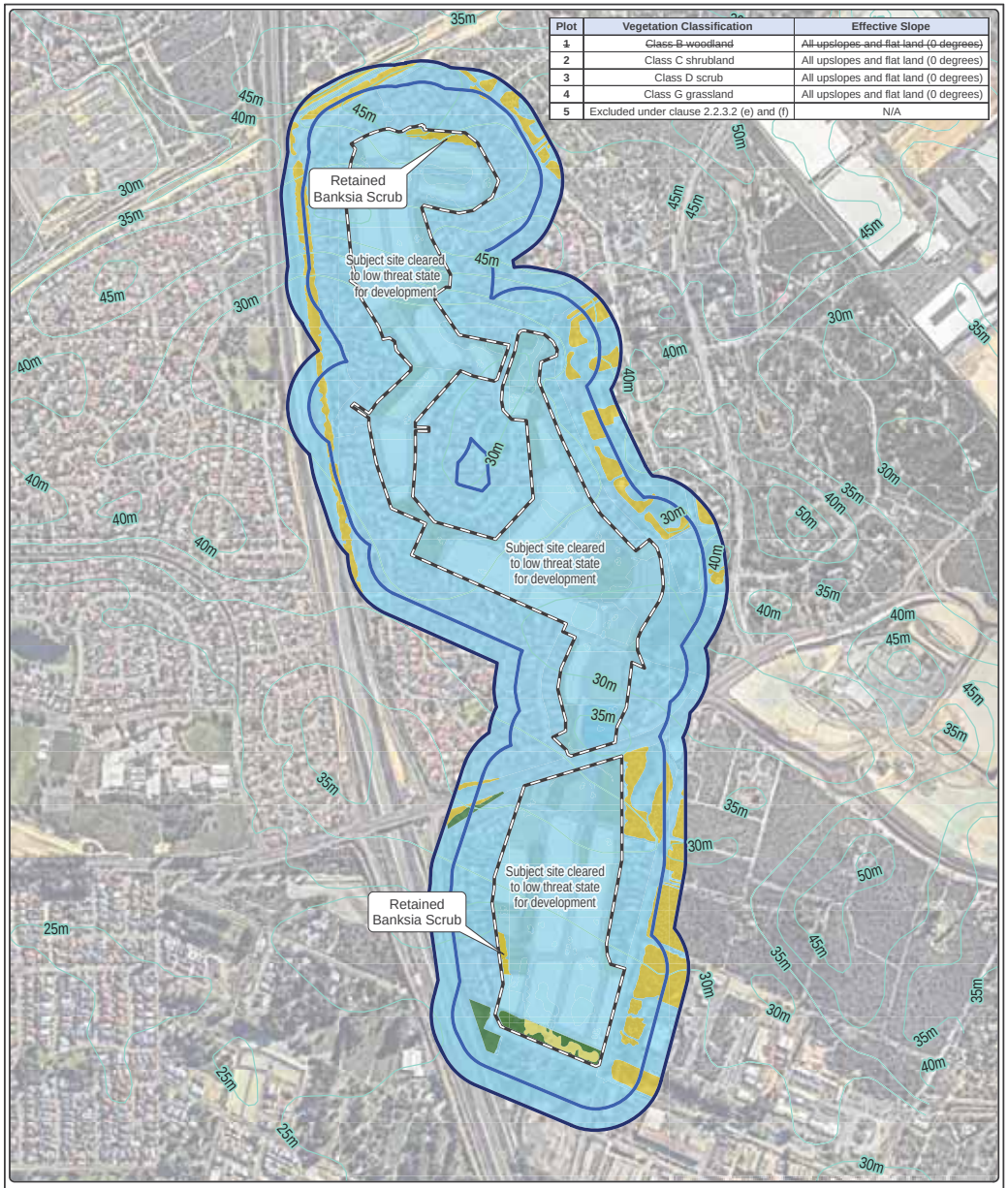

Figure 5: Vegetation Classification Post-Development

- Subject site
- 100m site assessment
- 150m site assessment
- Contour (5m)

Vegetation classification

- Class C Shrubland *(Plot 2)*
- Class D Scrub *(Plot 3)*
- Class G Grassland *(Plot 4)*
- Excluded as per clause 2.2.3.2 (e) and (f) *(Plot 5)*

0 100 200 400
Metres

Datum/Projection:
GDA 1994 MGA Zone 50

20PER15185-SM Date: 25/08/2023

N

2.2 Bushfire assessment outputs

A Bushfire Hazard Level (BHL) assessment has been undertaken in accordance with SPP 3.7, the Guidelines and the bushfire assessment inputs in Section 2.1.

2.2.1 BHL assessment

All land located within 100 m of the classified vegetation depicted in Figure 4 is considered bushfire prone and is subject to a BHL assessment in accordance with the Guidelines

Pre-development BHLs have been assessed for the subject site in accordance with the methodology contained within the Guidelines and incorporates the following factors:

- Vegetation class; and
- Slope under classified vegetation.

Table 2 contains a summary of the BHL assessment for each vegetation plot depicted in Figure 4. All land within 100 m of Extreme and Moderate BHLs has also been mapped as a Moderate hazard as per the Guidelines, and the final result is depicted in Figure 6. Descriptions of each vegetation classification are with each of the plates in Appendix A.

Clearing and landscaping will be undertaken within the subject site for development purposes, and consequently the pre-development BHLs are subject to change. A post development BHL assessment is provided in Table 2 and Figure 7 based on expected changes to vegetation within the subject site depicted in Figure 5.

Given an indicative lot layout is known at this stage of planning, an indicative Bushfire Attack Level (BAL) Contour map using the worst-case-scenario vegetation classification has been provided in Appendix D (Figure 10 and Figure 11).

Table 2: Bushfire Hazard Level assessment

Plot	Vegetation classification	Effective Slope	BHL Pre-development	BHL Post-development
1	Class B woodland	Upslope/ flat land	Extreme	N/A - Cleared
2	Class C shrubland	Upslope/ flat land	Moderate	Moderate
3	Class D scrub	Upslope/ flat land	Extreme	Extreme
4	Class G grassland	Upslope/ flat land	Moderate	Moderate
5	Excluded under clause 2.2.3.2 (e) and (f)	N/A	Low	Low

2.3 Identification of issues arising from the BAL assessment

The on-site vegetation extent is proposed to be cleared to enable development of a significant urban built footprint amongst areas of landscaped/managed Public Open Space (POS) and various easements. Therefore, for the purposes of strategic level planning, ELA does not consider the current on-site vegetation extent to be a bushfire hazard issue post-development, since these hazards can be managed through a staged clearing process, adequate separation of future built assets from classified vegetation (both external and internal [e.g. retained vegetation] to the subject site), and ongoing fuel management that can be undertaken in and around individual development stages.

The indicative BAL assessment (Figure 10 and Figure 11) highlights that the development will not result in a BAL rating of BAL-FZ or BAL-40, except for portions of one residential and one group housing cell adjacent to retained Banksia Class D Scrub and/or the Western Power easement. The indicative lot layout will be finalised at subdivision stage and will be designed so that all residential or group housing lots are subject to a BAL rating of ≤BAL-29. The internal road structure will be developed to allow separation from proposed residential lots and bushfire hazard interface, where appropriate.

On the basis of the above information, ELA considers that the bushfire hazards within and adjacent to the subject site and the associated bushfire risk is readily manageable through standard management responses and compliance with acceptable solutions outlined in the Guidelines. These management measures will need to be factored into the development design as early as possible to ensure a suitable, compliant and effective bushfire management outcome is achieved to ensure protection of future life and property assets.

Demonstration of compliance with the relevant requirements of SPP 3.7, the Guidelines and AS 3959: 2018 at future planning stages will also depend on the developer's ability to coordinate the timing and staging of clearing and development works within the subject site with the aim of avoiding bushfire impacts from temporary, retained vegetation.

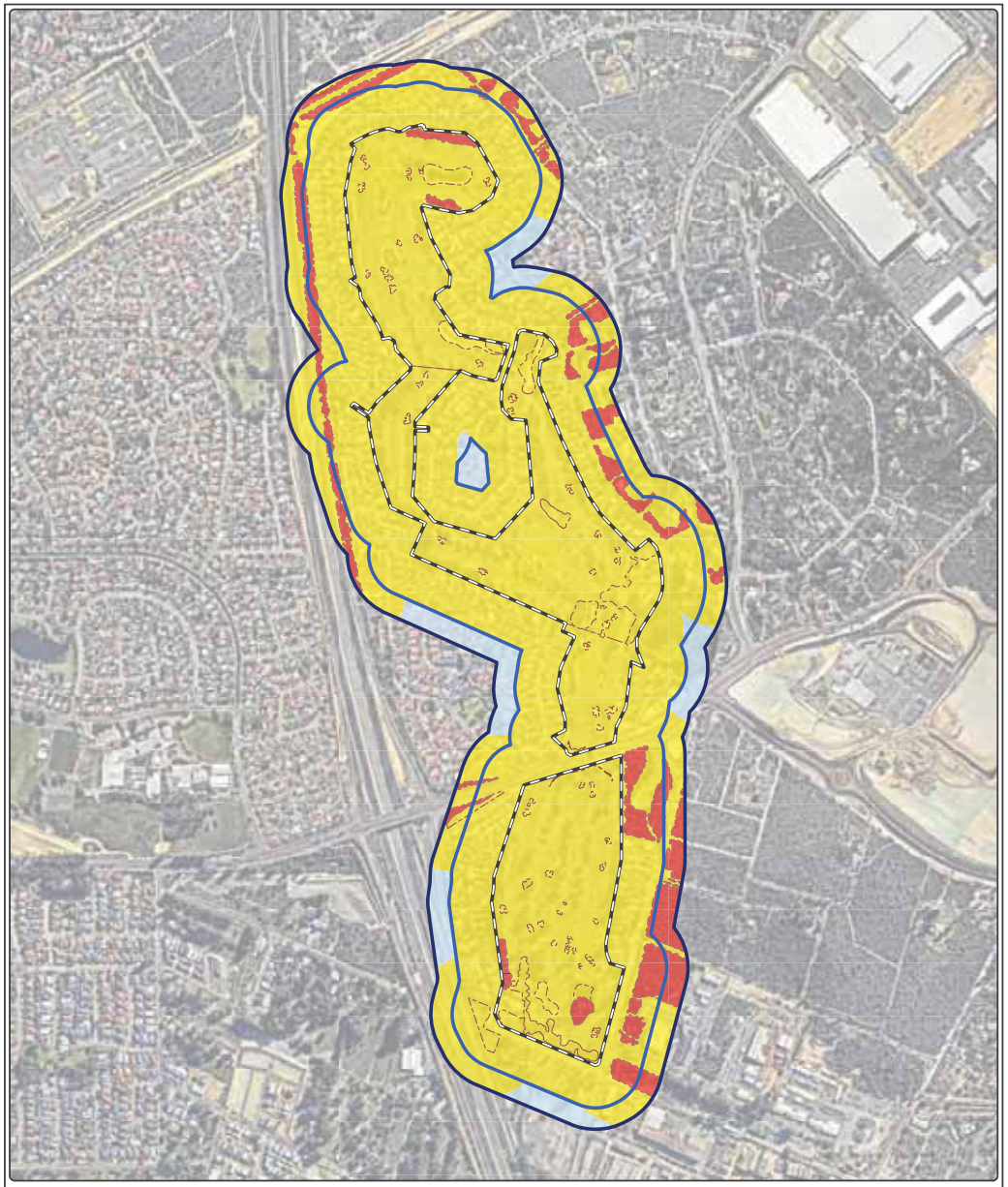

Figure 6: Bushfire Hazard Level (BHL) Assessment Pre-Development

- Subject site
- 100m site assessment
- 150m site assessment
- Bushfire hazard interface

Bushfire Hazard Level (BHL)

- Extreme
- Moderate
- Low

0 100 200 400
Metres

Datum/Projection:
GDA 1994 MGA Zone 50

20PER15185-SM Date: 24/08/2023

N

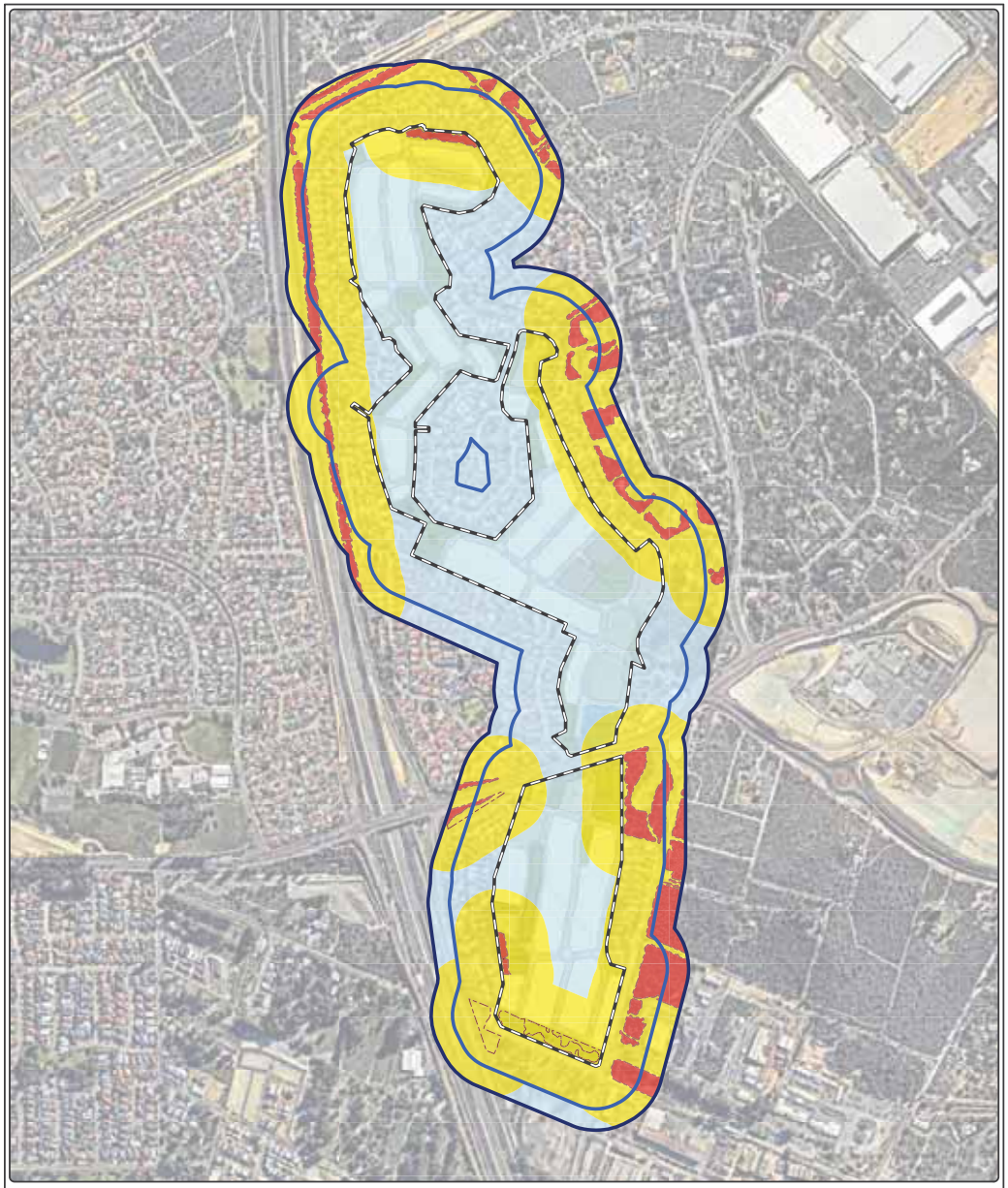

Figure 7: Bushfire Hazard Level (BHL) Assessment Post-Development

- Subject site
- 100m site assessment
- 150m site assessment
- Bushfire hazard interface

Bushfire Hazard Level (BHL)

- Extreme
- Moderate
- Low

0 100 200 400
Metres

Datum/Projection:
GDA 1994 MGA Zone 50

20PER15185-SM Date: 25/08/2023

N

3. Assessment against the Bushfire Protection Criteria

3.1 Compliance

The proposed Structure Plan is required to comply with policy measures 6.2 and 6.3 of SPP 3.7 and the Guidelines. Implementation of this BMP is expected to meet objectives 5.1 - 5.4 of SPP 3.7. Bushfire management measures have been devised for the proposed development in accordance with Guideline acceptable solutions to meet compliance with bushfire protection criteria.

In response to the above requirements of SPP 3.7 and the Guidelines, bushfire risk management measures, as outlined, have been devised for the Local Structure Plan in accordance with Guideline acceptable solutions to meet compliance with bushfire protection criteria.

Table 3 outlines the Acceptable Solutions (AS) that are relevant to the proposal and summaries how the intent of each Bushfire Protection Criteria has been achieved. No Performance Solutions (PS) have been proposed for this proposal. These management measures are depicted in Figure 8 where relevant.

The Structure Plan has been conditionally approved, therefore, the required updates to this BMP do not trigger assessment of the proposed development against the Bushfire Protection Criteria in the Guidelines for Planning in Bushfire Prone v1.4 (WAPC 2021). Future BMPs to support more detailed planning applications will address relevant legislative requirements applicable at the time of application.

Table 3: Summary of solutions used to achieve bushfire protection criteria

Bushfire Protection Criteria	AS	PS	N/A	Comment
Element 1: Location A1.1 Development location	☒	☐	☐	Post-development, all buildings within the subject site will be situated in areas subject to BHLs of Moderate or Low (refer to Figure 8). Whilst there are currently portions of one residential cell (adjacent to the Western Power easement and retained vegetation within a POS) and a portion of the Group Housing cell (adjacent to retained vegetation within a POS) that are subject to BAL-FZ and BAL-40 (Figure 11), the final lot layout in future planning applications will be amended a so that all residential lots achieve a BAL rating of BAL-29 or below. The proposed development is considered to be compliant with A1.1 as any issues can be addressed with refined design detail.
Element 2: Siting and design of development A2.1 Asset Protection Zone (APZ)	☐	☐	☒	As the lot layout is currently unconfirmed, APZs are unable to be prescribed at this level of planning. APZs will be defined in BMPs supporting future planning applications to ensure that all future lots will be subject to a BAL rating of BAL-29 or lower. Figure 8 demonstrates that APZs are able to be accommodated within the subject site to provide separation between future development and bushfire hazards that

Bushfire Protection Criteria	AS	PS	N/A	Comment
				will remain within the site post development (i.e. areas of retained Class D Banksia Scrub). The proposed development is considered to be compliant with A2.1.
Element 3: Vehicular access A3.1 Two access routes	☒	☐	☐	There are currently 12 proposed access points that join to the existing road network that lead to/from the subject site (Figure 8). The proposed development is considered to be compliant with A3.1.
A3.2 Public road	☒	☐	☐	The internal roads within the subject site will ensure that access and egress can be undertaken in a safe manner. These roads allow for regular passing and turn-around areas. All public roads will comply with vehicular access requirements (Appendix E). Additional details will be provided in future BMPs to support more detailed planning applications. The proposed development is considered to be compliant with A3.2.
A3.3 Cul-de-sac	☒	☐	☐	No cul-de-sacs proposed. If cul-de-sacs are required in the future, these will be confirmed at subdivision level and will be compliant with the guideline requirements. Additional details will be provided in future BMPs to support more detailed planning applications. The proposed development is considered to be compliant with A3.3.
A3.4 Battle-axe	☒	☐	☐	Design for the battle-axe lots (where proposed) will be finalised at subdivision stage. Additional details will be provided in future BMPs to support more detailed planning applications. The proposed development is considered to be compliant with A3.4
A3.5 Private Driveway longer than 50 m	☐	☐	☒	No private driveways longer than 50 m are proposed.
A3.6 Emergency Access way	☐	☐	☒	No emergency access ways are proposed or required as part of the development.
A3.7 Fire-service access routes	☐	☐	☒	No fire service access routes are required or proposed.
A3.8 Firebreak width	☐	☐	☒	No fire breaks are required or proposed as per the City of Cockburn Firebreak Notice 2023 (CoC 2023).
Element 4: Water A4.1 Reticulated areas	☒	☐	☐	The subject site will be connected to a reticulated water supply. The proposed development is considered to be compliant with A4.1.
A4.2 Non-Reticulated areas	☐	☐	☒	Reticulated water is present within the area.

Bushfire Protection Criteria	AS	PS	N/A	Comment
A4.3 Individual Lots within non-reticulated areas	☐	☐	☒	Reticulated water is present within the area.

NOTE – AS- ACCEPTABLE SOLUTION, PS- PERFORMANCE SOLUTION, N/A- NOT APPLICABLE

3.2 Additional bushfire risk considerations

The City of Cockburn has noted concerns regarding potential access limitations north of Berrigan Drive, whereby all connections head back to a very short portion of Berrigan Drive. ELA has considered this risk in preparation of the BMP, however are of the opinion that the level of risk exposure is low. The bushfire hazard affecting the subject site is associated with rural properties and small reserves in a narrow (approx. 800 m) band between the site and Jandakot airport (to the north and east). Emergency access south to Berrigan Drive, moving west towards the freeway will move evacuees away from the source of bushfire hazards. Providing an additional access route to the north was not considered appropriate as this would traverse the bushfire hazards adjacent to the subject site.

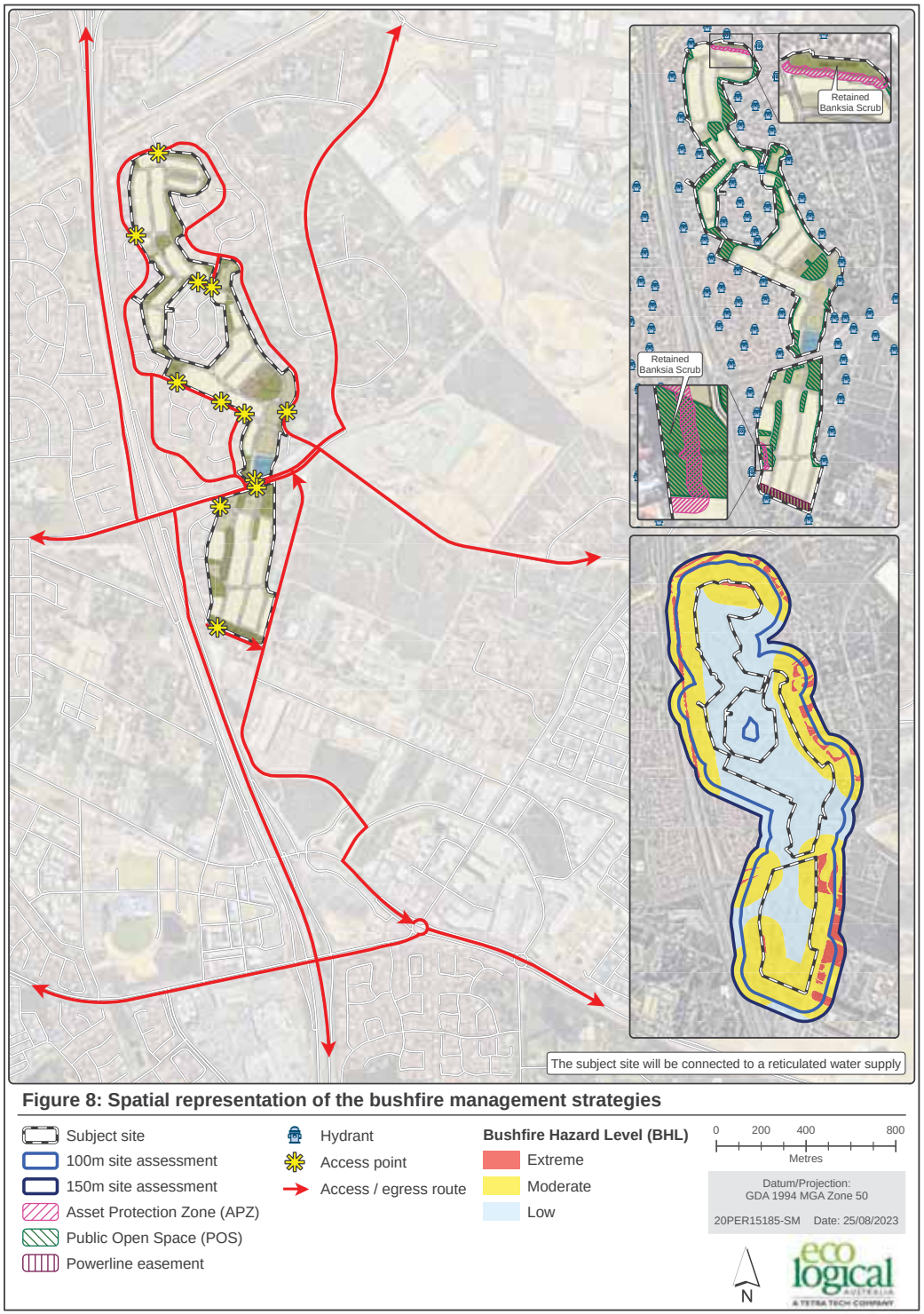

Figure 8: Spatial representation of the bushfire management strategies

4. Implementation and enforcement

Implementation of the BMP applies to Acumen Development Solutions, the City of Cockburn, and future landowners to ensure bushfire management measures are adopted and implemented on an ongoing basis. This BMP has been prepared as a strategic guide to demonstrate how development compliance will be delivered at future planning stages in accordance with the Guidelines. In this respect, management measures documented in Section 3, where applicable, will be incorporated into development design as early as possible and confirmed through subdivision design. Therefore, aside from the revision of this BMP or preparation of a BMP addendum to accompany future subdivision applications, there are no further items to implement, enforce or review at this stage of the planning process.

The revised BMPs or addendums to this BMP are required to meet the relevant commitments outlined in this strategic level BMP, address the relevant requirements of SPP 3.7 (i.e. Policy Measure 6.4) and demonstrate in detail how the proposed development will incorporate the relevant acceptable solutions to meet the performance requirements of the Guidelines. At a high-level, future BMPs (or addendums) are to include the following detailed information (where applicable):

- Proposed lot layout, including any public open space (POS), drainage areas and retained vegetation;
- Landscaping design/plans in regard to POS, drainage areas, retained vegetation and the Western power easement, consistent with the provisions of this BMP;
- Post-development classified vegetation extent and effective slope;
- A BAL contour map demonstrating that future dwellings can achieve BAL ratings of ≤BAL–29;
- Location and width of compliant APZs/setbacks where required;
- Details regarding how bushfire management will be addressed during development staging (i.e. staging buffers, vehicular access, etc);
- Vehicular access provisions, including demonstration that a minimum of two access routes will be achieved for each stage of development in accordance with Acceptable Solution A3.1;
- Water supply provisions with regards to reticulated water;
- Provisions for notification on Title for any future lots with BAL ratings ≥BAL–12.5 as a condition of subdivision;
- Compliance requirements with the current City's annual firebreak notice;
- Assessment and compliance with acceptable solutions and/or performance principles of the bushfire protection criteria in the Guidelines;
- Proposed implementation and audit program outlining all measures requiring implementation and the appropriate timing and responsibilities for implementation; and
- Requirements for construction of Class 1, 2, 3 or associated 10a buildings as well as Class 9b buildings (where applicable) in accordance with AS 3959 to the assessed BAL rating at the building/construction stage.

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5. Conclusion

In the author's professional opinion, the bushfire protection requirements listed in this assessment provide an adequate standard of bushfire protection for the proposed development. As such, the proposed development is consistent with the aim and objectives of SPP 3.7 and associated guidelines and is recommended for approval.

6. References

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Appendix A – Classified Vegetation Photos

Plot 1	Classification or Exclusion Clause	Class B Woodland

Photo Point 1

Classified vegetation within this plot is comprised of trees between 10 to 30 m tall with approximately 20 to 30% foliage cover. There is limited surface litter. Some grass and shrubs are present at the base of the trees.

Slope under the vegetation has been assessed as upslope/ flat land.

Plot 2	Classification or Exclusion Clause	Class C Shrubland

Photo Point 2

Classified vegetation within this plot is predominantly less than 2 m in height with a foliage cover greater than 30%. The understorey is widespread characterised by dense low shrubs. Some grasses are present.

Slope under the vegetation has been assessed as upslope/ flat land.

Plot 3	Classification or Exclusion Clause	Class D Scrub

Photo Point 3

This vegetation is representative of Class D scrub due to the vegetation height, composition and the canopy cover.

The predominant vegetation is *Banksia attenuata* and *Banksia menziesii* which grow to heights of 10 m and 7 m respectively (WA Herbarium, 1998-). The Banksia individuals in this plot are already mature and are approximately 6 m in height and therefore unlikely to grow any taller due to the environmental conditions of this remnant vegetation.

There are some emergent trees <10m in height and grasses present. However, the sparse distribution of these trees does not affect the predominant vegetation structure and the foliage cover is between 10 and 30%.

Slope under the vegetation has been assessed as upslope/ flat land.

Plot 3	Classification or Exclusion Clause	Class D Scrub

Photo Point 4

This vegetation is representative of Class D scrub due to the vegetation height, composition and the canopy cover.

The predominant vegetation is *Banksia attenuata* and *Banksia menziesii* which grow to heights of 10 m and 7 m respectively (WA Herbarium, 1998-). The Banksia individuals in this plot are already mature and are approximately 6 m in height and therefore unlikely to grow any taller due to the environmental conditions of this remnant vegetation.

There are some emergent trees <10m in height and grasses present. However, the sparse distribution of these trees does not affect the predominant vegetation structure and the foliage cover is between 10 and 30%.

Slope under the vegetation has been assessed as upslope/ flat land.

Plot 3	Classification or Exclusion Clause	Class D Scrub

Photo Point 5

This vegetation is representative of Class D scrub due to the vegetation height, composition and the canopy cover.

The predominant vegetation is *Banksia attenuata* and *Banksia menziesii* which grow to heights of 10 m and 7 m respectively (WA Herbarium, 1998-). The Banksia individuals in this plot are already mature and are approximately 6 m in height and therefore unlikely to grow any taller due to the environmental conditions of this remnant vegetation.

There are some emergent trees <10m in height and grasses present. However, the sparse distribution of these trees does not affect the predominant vegetation structure and the foliage cover is between 10 and 30%.

Slope under the vegetation has been assessed as upslope/ flat land.

Plot 4	Classification or Exclusion Clause	Class G Grassland

Photo Point 6

Classified vegetation within this plot is predominantly grassland with foliage cover from the over storey less than 10%. This plot represents the previously managed fairways within the Glen Iris Golf Course.

Slope under the vegetation has been assessed as upslope/ flat land.

Plot 4	Classification or Exclusion Clause	Class G Grassland

Photo Point 7

Classified vegetation within this plot is predominantly grassland with foliage cover from the over storey less than 10%. This plot represents the previously managed fairways within the Glen Iris Golf Course.

Slope under the vegetation has been assessed as upslope/ flat land.

Plot 5	Classification or Exclusion Clause	Excluded AS 3959: 2018 2.2.3.2 (e) and (f)

Photo Point 8

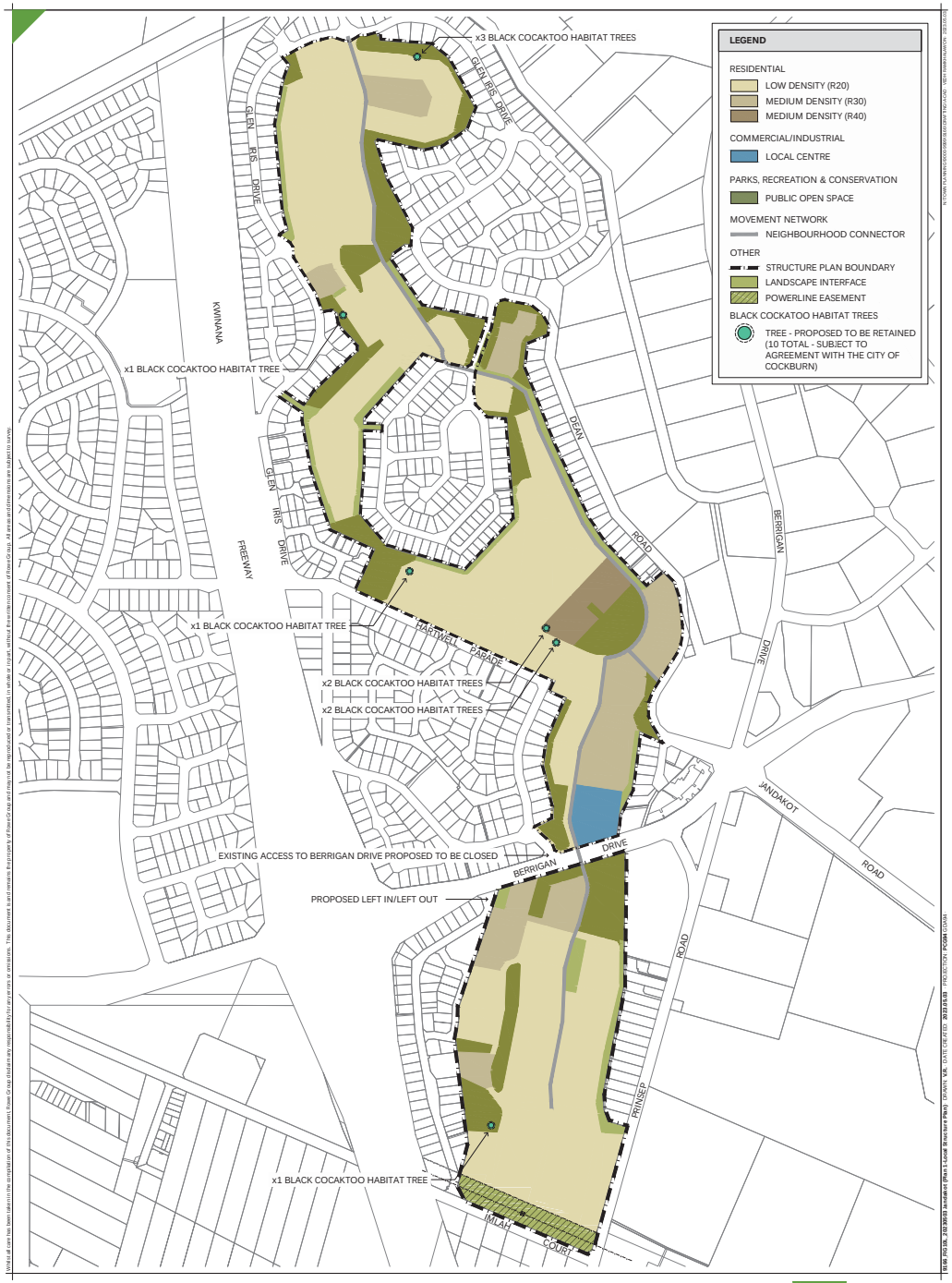
This plot has been excluded under Clause 2.2.3.2 (e) and (f) of AS 3959: 2018. This is an area of maintained front verges and road within a residential area.

Plot 4	Classification or Exclusion Clause	Excluded AS 3959: 2018 2.2.3.2 (e) and (f)

Photo Point 9

This plot has been excluded under Clause 2.2.3.2 (e) and (f) of AS 3959: 2018. This is an area of maintained front verges and road within a residential area.

Appendix B - Local Structure Plan



PLAN 1 - LOCAL STRUCTURE PLAN
GLEN IRIS DRIVE
JANDAKOT

Appendix C – Standards for Asset Protection Zones

The following standards have been extracted from the *Guidelines for Planning in Bushfire Prone Areas v 1.3* (WAPC 2017).

Every habitable building is to be surrounded by, and every proposed lot can achieve, an APZ depicted on submitted plans, which meets the following requirements:

a. Width: Measured from any external wall or supporting post or column of the proposed building, and of sufficient size to ensure the potential radiant heat impact of a fire does not exceed 29kW/m² (BAL-29) in all circumstances.

b. Location: the APZ should be contained solely within the boundaries of the lot on which a building is situated, except in instances where the neighbouring lot or lots will be managed in a low-fuel state on an ongoing basis, in perpetuity (see explanatory notes).

c. Management: the APZ is managed in accordance with the requirements of '*Standards for Asset Protection Zones*' (below):

- Fences: within the APZ are constructed from non-combustible materials (e.g. iron, brick, limestone, metal post and wire). It is recommended that solid or slatted non-combustible perimeter fences are used
- Objects: within 10 metres of a building, combustible objects must not be located close to the vulnerable parts of the building i.e. windows and doors
- Fine Fuel load: combustible dead vegetation matter less than 6 millimetres in thickness reduced to and maintained at an average of two tonnes per hectare
- Trees (> 5 metres in height): trunks at maturity should be a minimum distance of 6 metres from all elevations of the building, branches at maturity should not touch or overhang the building, lower branches should be removed to a height of 2 metres above the ground and or surface vegetation, canopy cover should be less than 15% with tree canopies at maturity well spread to at least 5 metres apart as to not form a continuous canopy (Error! Reference source not found.).

Figure 9: Illustrated tree canopy cover projection (WAPC 2017)

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- Shrubs (0.5 metres to 5 metres in height): should not be located under trees or within 3 metres of buildings, should not be planted in clumps greater than 5m^2 in area, clumps of shrubs should be separated from each other and any exposed window or door by at least 10 metres. Shrubs greater than 5 metres in height are to be treated as trees
- Ground covers (<0.5 metres in height): can be planted under trees but must be properly maintained to remove dead plant material and any parts within 2 metres of a structure, but 3 metres from windows or doors if greater than 100 millimetres in height. Ground covers greater than 0.5 metres in height are to be treated as shrubs
- Grass: should be managed to maintain a height of 100 millimetres or less.

Additional notes

The Asset Protection Zone (APZ) is an area surrounding a building that is managed to reduce the bushfire hazard to an acceptable level. Hazard separation in the form of using subdivision design elements or excluded and low threat vegetation adjacent to the lot may be used to reduce the dimensions of the APZ within the lot.

The APZ should be contained solely within the boundaries of the lot on which the building is situated, except in instances where the neighbouring lot or lots will be managed in a low-fuel state on an ongoing basis, in perpetuity. The APZ may include public roads, waterways, footpaths, buildings, rocky outcrops, golf courses, maintained parkland as well as cultivated gardens in an urban context, but does not include grassland or vegetation on a neighbouring rural lot, farmland, wetland reserves and unmanaged public reserves.

Appendix D – Indicative Bushfire Attack Level (BAL) Contour

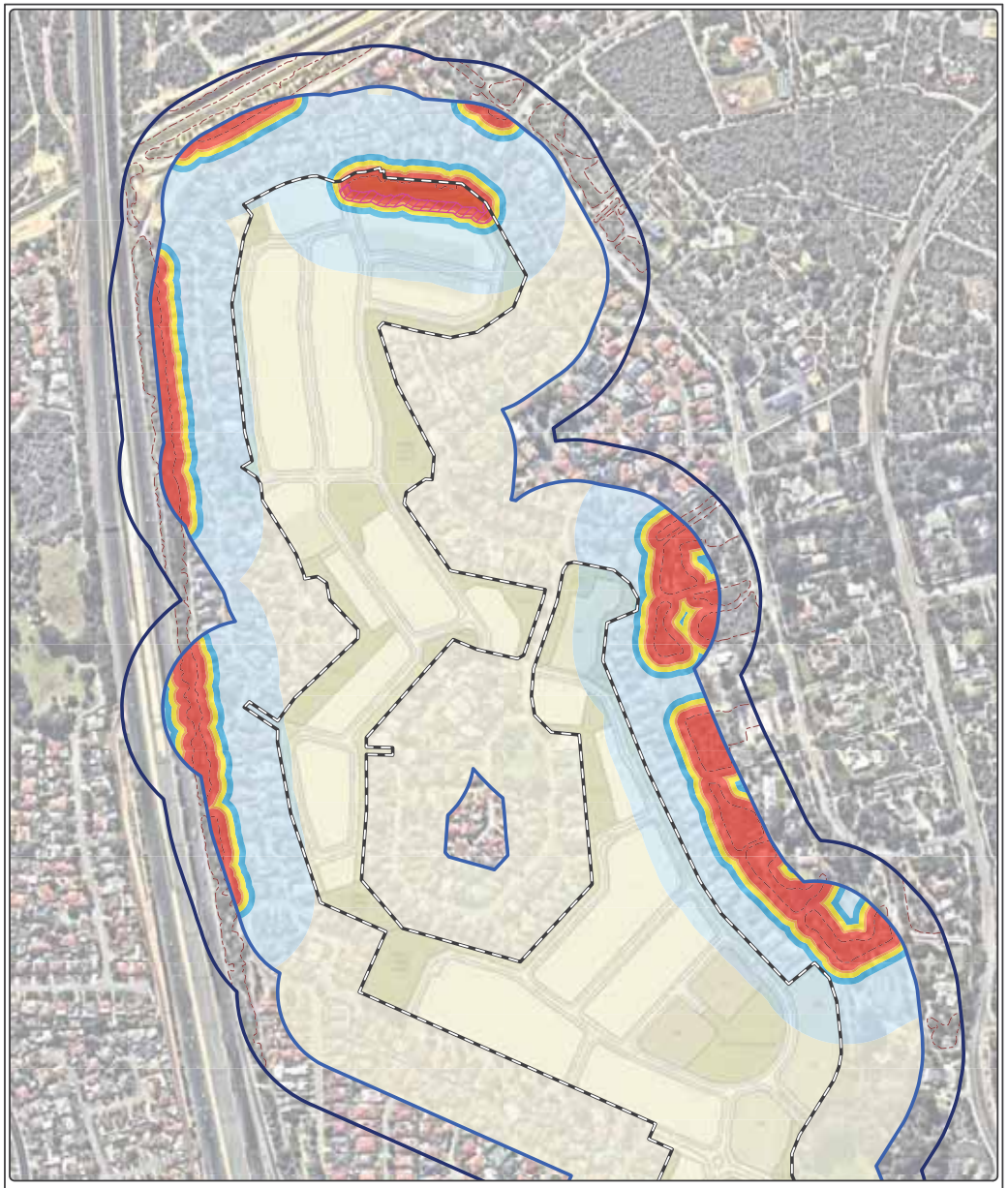

Figure 10: Indicative Bushfire Attack Level (BAL) Contours - North

- Subject site
- 100m site assessment
- 150m site assessment
- Bushfire hazard interface
- Asset Protection Zone (APZ)

Bushfire Attack Level (BAL)

- BAL - FZ
- BAL - 40
- BAL - 29
- BAL - 19
- BAL - 12.5
- BAL - LOW

0 50 100 200
Metres

Datum/Projection:
GDA 1994 MGA Zone 50

20PER15185-SM Date: 25/08/2023

N

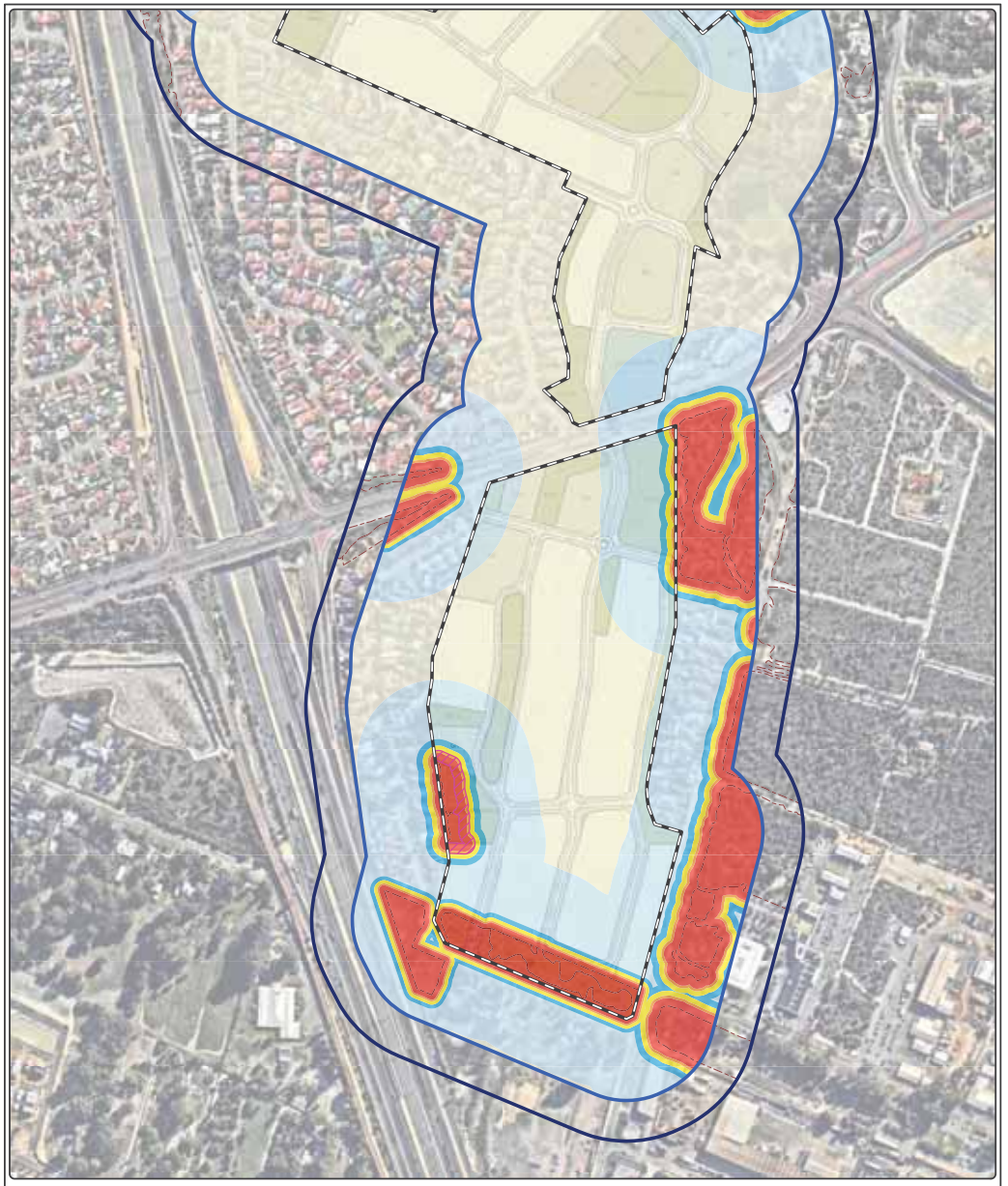

Figure 11: Indicative Bushfire Attack Level (BAL) Contours - South

- Subject site
- 100m site assessment
- 150m site assessment
- Bushfire hazard interface
- Asset Protection Zone (APZ)

Bushfire Attack Level (BAL)

- BAL - FZ
- BAL - 40
- BAL - 29
- BAL - 19
- BAL - 12.5
- BAL - LOW

0 50 100 200
Metres

Datum/Projection:
GDA 1994 MGA Zone 50

20PER15185-SM Date: 25/08/2023

N

Appendix E Vehicular access technical requirements (WAPC 2017)

Technical requirements	Public road	Cul-de-sac	Private driveway	Emergency access way	Fire service access route
Minimum trafficable surface (m)	6*	6	4	6*	6*
Horizontal distance (m)	6	6	6	6	6
Vertical clearance (m)	4.5	N/A	4.5	4.5	4.5
Maximum grade <50 m	1 in 10	1 in 10	1 in 10	1 in 10	1 in 10
Minimum weight capacity (t)	15	15	15	15	15
Maximum crossfall	1 in 33	1 in 33	1 in 33	1 in 33	1 in 33
Curves minimum inner radius	8.5	8.5	8.5	8.5	8.5
* Refer to E3.2 Public roads: Trafficable surface					

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GLEN IRIS ESTATE

APPENDIX 6
ACOUSTIC ASSESSMENT

GLEN IRIS GOLF COURSE

DEAN RD, JANDAKOT

STRUCTURE PLAN
ACOUSTIC ASSESSMENT

SEPTEMBER 2021

OUR REFERENCE: 27789-6-20325

Rochdale Holdings Pty Ltd A.B.N. 85 009 049 067 trading as:
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ACOUSTIC ASSESSMENT
GLEN IRIS GOLF COURSE

Job No: 20325

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2	Incorporate City Cockburn Comments (RFI 2/8/21)	16/09/2021	PLD	TR
3	Incorporate City Cockburn Comments (Environ Health Dept)	21/04/2022	PLD	
4	MRWA comments addressed	30/06/2022	PLD	
5	Updated for Schedule of Modifications as per WAPC approval	21/08/2023	PLD	
6	Figure 5.6 updated	20/08/2024	PLD	

DOCUMENT DISTRIBUTION

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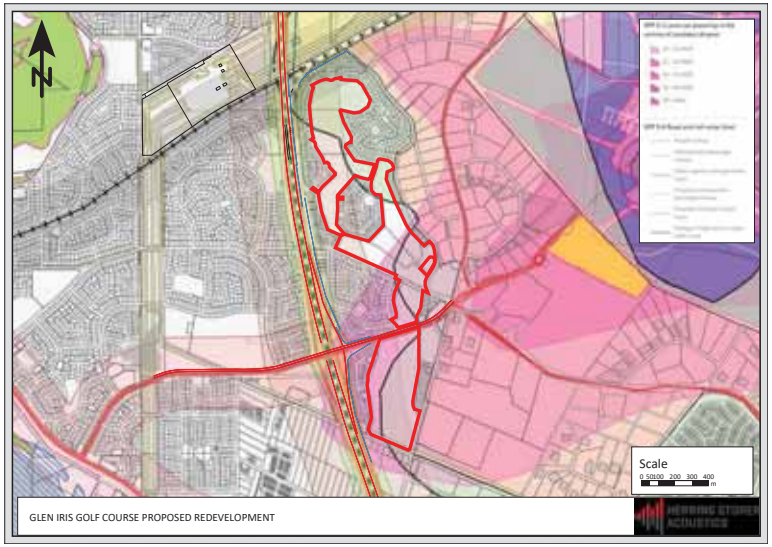
E	NOISE MONITORING DATA
F	QUIET HOUSE DESIGN

EXECUTIVE SUMMARY

Herring Storer Acoustics have been commissioned by Acumen Development Solutions to carry out an acoustical assessment of the proposed development of the Glen Iris Golf Course into residential land use.

This acoustic assessment is provided in support of the Structure Plan process, therefore provides high level acoustic advice for the proposed development to inform the development team and regulatory authorities of the potential noise issues and associated noise controls. It is noted that detailed design for these requirements can be applied at subdivision staging, once further information is available.

The proposed residential estate is potentially impacted by noise from road traffic (Kwinana Freeway and Berigan Drive), rail traffic (Yangebup Freight Rail Line and future Thornlie to Cockburn Passenger Rail Line) and aircraft associated with Jandakot Airport with the figure below showing the PlanWa advice regarding noise impacts. Consideration has also been given to the potential impact from noise related to existing industry to the south of the development on Prinsep Road.



Based on the above, the following criteria are proposed for this development:

ROAD TRAFFIC AND RAIL NOISE

External

Day	Maximum of 55 dB(A) L_{Aeq}
Night	Maximum of 50 dB(A) L_{Aeq}
Outdoor Living Areas*	Maximum of 50 dB(A) $L_{Aeq\ (night\ period)}$

*This is a suggested noise level; noise is to be reduced as far as practicably possible.

Internal

Sleeping Areas	35 dB(A) $L_{Aeq(night)}$
Living Areas	40 dB(A) $L_{Aeq(day)}$

AIRCRAFT NOISE

Internal

Sleeping areas	50 dB(A) L_{Amax}
Other habitable spaces	55 dB(A) L_{Amax}

ROAD NOISE

Based on the development plan, it is proposed that areas are to be constructed for the purpose of residential with some commercial usage for the section to the north of Berrigan Drive. Noise levels for the future road traffic are such, that at some of the lot façades, the noise could exceed the 55 dB(A) noise Target. Therefore, amelioration in the form of Quiet House Design is required. These areas have been identified and general "deemed to satisfy packages" as per the SPP 5.4 guidelines applied. Detailed design for these requirements can be applied at subdivision staging once further information is available.

Given the noise levels, the lot façades would require Quiet House Design in the form of Package A. Appendix F contains the deemed to satisfy packages or Quiet House Design requirements and an area plan outlining the effected Lots.

Additionally, as they are over the "Target" noise level, the lots in this area would require notification on titles of the Freeway and Berrigan Drive noise impact.

RAIL NOISE

For train noise associated with the Yangebup Freight Line, due to the topography (line being in a cutting) and the noise wall and residential housing between the rail line and the development, the noise levels for the worst-case future scenario of one train per hour have been assessed as being below the night time noise Target criteria at the façade lots of the development boundary, hence there are no acoustic requirements.

Information was sought from the Metronet and the EPA as to the proposed design and impact of noise levels from the proposed future passenger rail and freight rail lines.

As there are existing residential premises located on the proposed rail line, development of the future rail line operations needs to consider these highly noise sensitive premises.

Review of the preliminary design noise levels, as provided in the *Thornnlie-Cockburn Link Noise and Vibration Assessment Report Number 675.10409.00100-R01* shows that noise levels to these existing residential premises will be designed such that the target noise levels (as per SPP 5.4) will be met.

As the Glen Iris development is set back behind these residential premises, noise levels would be less than those at the lot façades, hence compliance with the requirements of SPP 5.4 would be achieved. Therefore, noise modelling of the future proposed Freight / Passenger Rail would not be required for this development as the infrastructure provide will meet the requirements of SPP 5.4 for existing residential premises closer to the rail line.

Notwithstanding the above, confirmation assessment of the freight rail has been undertaken and calibrated to existing noise levels. These noise levels have been increased for future rail freight movements of one per hour. This is based on the current built form, including the noise wall

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Our ref: 27789-6-20325

located along the existing residence boarding the rail line. When the proposed passenger rail development is constructed, the noise mitigation requirements would incorporate the freight rail, hence noise levels would be less than those considered in this assessment. This provides a conservative acoustic assessment for the proposed development, where the future freight rail increases, and no further noise attenuation works are carried out.

AIRCRAFT NOISE

Based on guidance from SPP 5.3, the majority of the northern section of the proposed development site is acceptable for residential development, as indicated in Figure 5.3.

The blue area (ANEF 20 to 25) is also acceptable for residential development, although it requires conditions. These conditions are such that the internal noise level (for aircraft noise events) are to meet the criteria contained in AS2021. The affected lots within this development are those within the blue contour as noted in Figure 5.3.

Further to the criteria contained in SPP 5.3, the City of Cockburn LPP 1.12 contains advice as follows:

> *Consideration should be given to noise attenuation for noise sensitive premises within the Frame area corresponding to the requirements of Western Australian Planning Commission publication "Aircraft Noise Insulation for Residential Development in the Vicinity of Perth Airport" 2004 (such as the installation of 6.38mm laminated glazing), in order to ensure that residential amenity is adequately protected within noise sensitive developments.*

Therefore, whilst at this stage of the development the lot configuration and layout are not known, a preliminary "deemed to satisfy construction" has been provided within this report for areas within the ANEF 20-25 noise contour. This can form the basis of future concept designs and can be refined at subdivision staging. For area outside the ANEF 20 but contained within the Frame Area upgraded glazing would be required (as per LPP 1.12).

INDUSTRY NOISE

Based on the City of Cockburn Intramaps, there is industrial zoned land use to the south of the proposed residential development, as shown in Figure 5.4.

As there are existing residential premises located on Imlah Court, located at a closer distance to the industrial premises than the proposed development, expectations are that compliance with Regulatory criterial contained in the *Environmental Protection (Noise) Regulations 1997* would be achieved for the existing situation at these locations. However, consideration of the potential for noise impact from this area has been undertaken for the proposed residential development.

Three forms of noise amelioration have been considered for the future residence located on the southern end of the Glen Iris development, with these being as follows:

1. Noise Wall (Prinsep Road)
2. Upgrade Building Design (As per SPP 5.3)
3. Setback

Given the implementation of the above, noise levels can be managed, regardless of compliance with the regulatory criteria.

1.0 INTRODUCTION

Herring Storer Acoustics have been commissioned by Acumen Development Solutions to carry out an acoustical assessment of the proposed development of the Glen Iris Golf Course into residential land use.

The proposed residential estate is potentially impacted by noise from the following noise sources:

- Road Traffic Noise- Kwinana Freeway and Berrigan Drive.
- Rail Traffic Noise - Existing Yangebup Freight Rail Line and proposed Thornlie to Cockburn Passenger Rail Line.
- Aircraft Noise – Aircrafts associated with Jandakot Airport.
- Industrial Noise – Existing Industry located on Prinsep Road.

The objectives of the study were to:

- Measure existing noise levels at the proposed development from vehicles travelling on Kwinana Freeway and Berrigan Drive.
- Measure existing noise levels at the proposed development from trains travelling on the Yangebup Freight Rail Line.
- Determine by noise modelling the noise levels that would be received at residences within the development from vehicles travelling on the future Kwinana Freeway, Berrigan Drive and Yangebup freight Rail Line and proposed passenger rail.
- Assess the predicted noise levels received at residence for compliance with the requirements of the WAPC State Planning Policy 5.4 "Road and Rail Noise" (SPP 5.4).
- If exceedances are predicted, comment on possible noise amelioration options for compliance with the appropriate criteria.
- Assess the predicted noise levels received at residence for compliance with the requirements of the WAPC State Planning Policy 5.3 "Land Use Planning in the Vicinity of Jandakot Airport" (SPP 5.3).
- Consider impacts of industrial noise associated with existing industry located on Prinsep Road, in accordance with the City of Cockburn's Local Planning Policy 1.12 (LPP 1.12).

This acoustic assessment is provided in support of the Structure Plan process, therefore provides high level acoustic advice for the proposed development to inform the development team and regulatory authorities of the potential noise issues and associated noise controls. It is noted that detailed design for these requirements can be applied at subdivision staging, once further information is available.

2.0 CRITERIA

2.1 NOISE INGRESS INTO DEVELOPMENT

The Western Australian Planning Commission (WAPC) released on 6th September 2019 State Planning Policy 5.4 *"Road and Rail Noise"*. The requirements of State Planning Policy 5.4 are outlined below.

POLICY APPLICATION (Section 4)

When and where it applies (Section 4.1)

SPP 5.4 applies to the preparation and assessment of planning instruments, including region and local planning schemes; planning strategies, structure plans; subdivision and development proposals in Western Australia, where there is proposed:

*a) noise-sensitive land-use within the policy's trigger distance of a transport corridor as specified in **Table 1**;*

*b) New or major upgrades of roads as specified in **Table 1** and maps **(Schedule 1,2 and 3);** or*

*c) New railways or major upgrades of railways as specified in maps (**Schedule 1, 2 and 3);** or any other works that increase capacity for rail vehicle storage or movement and will result in an increased level of noise.*

Policy trigger distances (Section 4.1.2)

***Table 1** identifies the State's transport corridors and the trigger distances to which the policy applies.*

*The designation of land within the trigger distances outlined in **Table 1** should not be interpreted to imply that land is affected by noise and/or that areas outside the trigger distances are un-affected by noise.*

*Where any part of the lot is within the specified trigger distance, an assessment against the policy is required to determine the likely level of transport noise and management/ mitigation required. An initial screening assessment (**guidelines: Table 2: noise exposure forecast**) will determine if the lot is affected and to what extent."*

TABLE 1: TRANSPORT CORRIDOR CLASSIFICATION AND TRIGGER DISTANCES

Transport corridor classification	*Trigger distance*	*Distance measured from*
Roads		
Strategic freight and major traffic routes *Roads as defined by Perth and Peel Planning Frameworks and/or roads with either 500 or more Class 7 to 12 Austroads vehicles per day, and/or 50,000 per day traffic volume*	*300 metres*	*Road carriageway edge*
Other significant freight/traffic routes *These are generally any State administered road and/or local government road identified as being a future State administered road (red road) and other roads that meet the criteria of either >=23,000 daily traffic count (averaged equivalent to 25,000 vehicles passenger car units under region schemes)*	*200 metres*	*Road carriageway edge*
Passenger railways		
	100 metres	*Centreline of the closest track*
Freight railways		
	200 metres	*Centreline of the closest track*

Proponents are advised to consult with the decision making authority as site specific conditions (significant differences in ground levels, extreme noise levels) may influence the noise mitigation measures required, that may extend beyond the trigger distance.

POLICY MEASURES (Section 6)

The policy applies a performance-based approach to the management and mitigation of transport noise. The policy measures and resultant noise mitigation will be influenced by the function of the transport corridor and the type and intensity of the land-use proposed. Where there is risk of future land-use conflict in close proximity to strategic freight routes, a precautionary approach should be applied. Planning should also consider other broader planning policies. This is to ensure a balanced approach takes into consideration reasonable and practical considerations.

Noise Targets (Section 6.1)

***Table 2** sets out noise targets that are to be achieved by proposals under which the policy applies. Where exceeded, an assessment is required to determine the likely level of transport noise and management/mitigation required.*

In the application of the noise targets the objective is to achieve:

- *indoor noise levels as specified in **Table 2** in noise sensitive areas (for example, bedrooms and living rooms of houses, and school classrooms); and*
- *a reasonable degree of acoustic amenity for outdoor living areas on each residential lot. For non-residential noise-sensitive developments, for example schools and child care centres the design of outdoor areas should take into consideration the noise target.*

It is recognised that in some instances, it may not be reasonable and/or practicable to meet the outdoor noise targets. Where transport noise is above the noise targets, measures are expected to be implemented that balance reasonable and practicable considerations with the need to achieve acceptable noise protection outcomes.

TABLE 2: NOISE TARGETS

Proposals	New/Upgrade	Noise Targets		
		Outdoor		Indoor
		Day (L_{Aeq}(Day) dB) (6 am-10 pm)	Night (L_{Aeq}(Night)dB) (10 pm-6 am)	(L_{Aeq} dB)
Noise-sensitive land-use and/or development	New noise sensitive land use and/or development within the trigger distance of an existing/proposed transport corridor	55	50	L_{Aeq} (Day) 40(Living and work areas) L_{Aeq} (Night) 35 (bedrooms)
Roads	New	55	50	N/A
	Upgrade	60	55	N/A
Railways	New	55	50	N/A
	Upgrade	60	55	N/A

Notes:

- *The noise target is to be measured at one metre from the most exposed, habitable façade of the proposed building, which has the greatest exposure to the noise-source. A habitable room has the same meaning as defined in State Planning Policy 3.1 Residential Design Codes.*
- *For all noise-sensitive land-use and/or development, indoor noise targets for other room usages may be reasonably drawn from Table 1 of Australian Standard/New Zealand Standard AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors (as amended) for each relevant time period.*
- *The 5dB difference in the criteria between new and upgrade infrastructure proposals acknowledges the challenges in achieving noise level reduction where existing infrastructure is surrounded by existing noise-sensitive development.*
- *Outdoor targets are to be met at all outdoor areas as far as is reasonable and practical to do so using the various noise mitigation measures outlined in the guidelines. For example, it is likely unreasonable for a transport infrastructure provider to achieve the outdoor targets at more than 1 or 2 floors of an adjacent development with direct line of sight to the traffic.*

Noise Exposure Forecast (Section 6.2)

*When it is determined that SPP 5.4 applies to a planning proposal as outlined in Section 4, proponents and/or decision makers are required to undertake a preliminary assessment using **Table 2**: noise exposure forecast in the guidelines. This will provide an estimate of the potential noise impacts on noise-sensitive land-use and/ or development within the trigger distance of a specified transport corridor. The outcomes of the initial assessment will determine whether:*

- *no further measures is required;*
- *noise-sensitive land-use and/or development is acceptable subject to deemed-to-comply mitigation measures; or*
- *noise-sensitive land-use and/or development is not recommended. Any noise-sensitive land-use and/ or development is subject to mitigation measures outlined in a noise management plan."*

2.2 STATE PLANNING POLICY 5.3 LAND USE IN THE VICINITY OF JANDAKOT AIRPORT

AS2021: Acoustics – Aircraft Noise Intrusion-Building Siting and Construction, provides guidelines for determines the type of building construction necessary to provide a given noise reduction, given that external windows and doors are closed.

Additionally, guidance has been sought from *State Planning Policy 5.3 Land use in the vicinity of Jandakot airport.*

2.2.1 Building Site Acceptability

AS2021:2015 lists the building types compared to the acceptable ANEF contour in Table 2.1 of AS2021:2015. The applicable building types are reproduced in Table 1 below.

TABLE 1 – ANEF ACCEPTABILITY FOR SITING AND CONSTRUCTION

Building Type	ANEF zone of Site		
	Acceptable	Conditionally Acceptable	Unacceptable
House, home unit, flat, caravan park	Less than 20 ANEF	20 to 25 ANEF	Greater than 25 ANEF

AS2021:2015 *"Acoustics – Aircraft Noise Intrusion-Building Siting and Construction"* provides guidelines for determining the type of building construction necessary to provide a given noise reduction, given that external windows and doors are closed.

Indoor design sound levels for determination of aircraft noise reductions are given as follows:

Sleeping areas	-	50 dB(A)
Other habitable spaces	-	55 dB(A)

For commercial buildings:

Private offices	-	55 dB(A)
Open offices	-	65 dB(A)
Shops, showrooms etc.	-	75 dB(A)
Industrial	-	75 dB(A)

We note that the above noise levels are maximum noise levels.

2.3 CITY OF COCKBURN LOCAL PLANNING POLICY 1.12 – NOISE ATTENUATION

An Acoustic Report must accompany a Structure Plan, variations to a Structure Plan that materially alter the Plans intent or a Local Development Plan. The Acoustic Report shall be prepared in accordance with the attached City of Cockburn Noise Attenuation Guidelines where:

1. Noise sensitive development is proposed in the vicinity of an existing or future major road, rail infrastructure or a freight handling facility as required by SPP 5.4;
2. The land is located within either the Core Area or Frame Area for Jandakot Airport as identified by SPP 5.3; or
3. Noise sensitive development and commercial, industrial or light industry land uses or essential infrastructure are proposed in close proximity.

2.3.1 NOISE INTRUSION (NOISE SENSITIVE DEVELOPMENT)

1. Noise sensitive developments are to be designed to achieve the following sound levels:

   (a) Leq 35 dB(A) in sleeping areas (bedrooms); and
   (b) Leq 40 dB(A) in living/work areas and other habitable rooms.

   IMPORTANT NOTE:
   The Leq level should not be unduly biased toward the lower frequencies of the octave band spectrum. If lower frequencies are dominant in sound levels taken during the sampling phase of reporting (below 200Hz or a 15-20dB difference between LA and LC levels), the Acoustic Consultant shall discuss the findings with the City in developing appropriate solutions to ensure that low frequency noise is appropriately attenuated, prior to the submission of the final Acoustic Report.

2. For all other developments, noise intrusion is to be controlled to achieve the indoor design sound levels for buildings as set out in Australian Standard AS/NZS2107: "Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors".
3. For noise sensitive developments in close proximity to road and rail infrastructure, the report must address the requirements of SPP 5.4, including the requirement for a reasonable degree of acoustic amenity in at least one outdoor living area.
4. For noise sensitive developments in close proximity to freight rail infrastructure or other sources of vibration, the Acoustic Report should also address ground borne vibration levels to ensure that occupants of the development are not exposed to an unacceptable level of vibration. The report should make reference to:
   (a) Australian Standard 2670.2-1990 "Evaluation of human exposure to whole-body vibration; Part 2: Continuous and shock induced vibration in buildings (1 to 80 Hz)"
   (b) ISO 2631-2:2003 "Evaluation of human exposure to whole-body vibration Part 2: Vibration in buildings (1 Hz to 80 Hz)";
   (c) British Standard BS6472-2008: "Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)".
5. Residential developments are to be constructed to meet the requirements of the National Construction Code (as amended) and the Building Code of Australia Part F5 (as amended).

2.3.2 NOISE SOURCE IDENTIFICATION

Acoustic reports must identify all noise sources relevant to a development, including those which may require detailed assessment at a later stage. Ambient environmental noise sources that are relevant within the City of Cockburn include the following:

1. Noise from Road, Rail and Freight Infrastructure
2. Breakout and Street Noise
3. Mechanical Plant and Equipment
4. Co-existing Land Uses
5. Noise Sensitive Developments in Proximity to Jandakot Airport

2.4 APPROPRIATE CRITERIA

Based on the above, the following criteria are proposed for this development:

ROAD TRAFFIC AND RAIL NOISE

External

Day	Maximum of 55 dB(A) L_{Aeq}
Night	Maximum of 50 dB(A) L_{Aeq}
Outdoor Living Areas*	Maximum of 50 dB(A) $L_{Aeq\ (night\ period)}$

*This is a suggested noise level; noise is to be reduced as far as practicably possible.

Internal

Sleeping Areas	35 dB(A) $L_{Aeq(night)}$
Living Areas	40 dB(A) $L_{Aeq(day)}$

AIRCRAFT NOISE

Internal

Sleeping areas	50 dB(A) L_{Amax}
Other habitable spaces	55 dB(A) L_{Amax}

3.0 NOISE MONITORING

Noise monitoring was undertaken as part of the study with the results used to calibrate the noise model.

In summary, the monitoring was undertaken over seven-day period commencing Monday 2nd December 2020. Monitoring was conducted at two locations, firstly at the northern end of the golf course, with the second location being in the south of the golf course

The results of this monitoring are summarised in Table 3.1.

TABLE 3.1 : SUMMARY OF MEASURED ROAD TRAFFIC NOISE LEVELS (dB(A))

Date	Day of week	North Monitor		South Monitor	
		$L_{Aeq,day}$ (6am to 10pm)	$L_{Aeq,night}$ (10pm to 6am)	$L_{Aeq,day}$ (6am to 10pm)	$L_{Aeq,night}$ (10pm to 6am)
2/12/2020	Wednesday	-	-	55.9	48.0
3/12/2020	Thursday	56.7	49.8	55.4	48.4
4/12/2020	Friday	57.4	48.0	57.3	48.6
5/12/2020	Saturday	56.8	49.1	55.2	49.3
6/12/2020	Sunday	55.1	50.2	53.6	47.4
7/12/2020	Monday	54.3	47.0	51.9	47.4
8/12/2020	Tuesday	54.6	48.1	52.5	45.7
Average (Weekdays)		**55.8**	**48.2**	**54.6**	**47.6**

Note: Based on the results of the noise monitoring the difference between the L_{Aeq} (Day) and L_{Aeq} (Night) is greater than 5 dB(A). Hence, achieving compliance with the day period criteria would also result in compliance with the night period criteria. Thus, the day period has been used for the assessment.

A third measurement location was included to calibrate noise levels for Berrigan Drive. The measurement was conducted on 14th September 2021. Short term (15 minute), noise levels were measured during peak traffic volumes, as referenced from the MRWA traffic count web site. The $L_{Aeq(15minute)}$ has been used as the overall L_{Aeq} day, based on current traffic volumes.

This method was used in place of continuous monitoring over 3 weekdays due to the potential change in traffic speeds etc and due to the construction of Jandakot Road, which was impacting Berrigan Drive in this area.

The short-term measurement of road traffic has been shown (previously) as being a conservative method when assessing noise levels for an existing roadway. This is due to the L_{Aeq} noise level measurement being based on peak traffic flows, hence is generally higher than the L_{Aeaday}, when measured over a 16-hour period.

This method provides information for the Structure Plan, which is used to inform the general acoustic requirements, and once Berrigan Drive returns to normal traffic conditions on the completion of the Jandakot Road works, then confirmation noise levels can be conducted.

The summarised results are contained in table 3.2.

TABLE 3.2 : SUMMARY OF MEASURED ROAD TRAFFIC NOISE LEVELS BERRIGAN DRIVE (dB(A))

Date	Day of week	L_{Aeq}	L_{A10}	L_{A90}
14/09/2021	Tuesday	68.8	72.5	56.7

For information, the results of the monitoring are shown graphically in Appendix E, with Figure 3.1 showing the location map, and Figure 3.2 showing the monitors in situ.

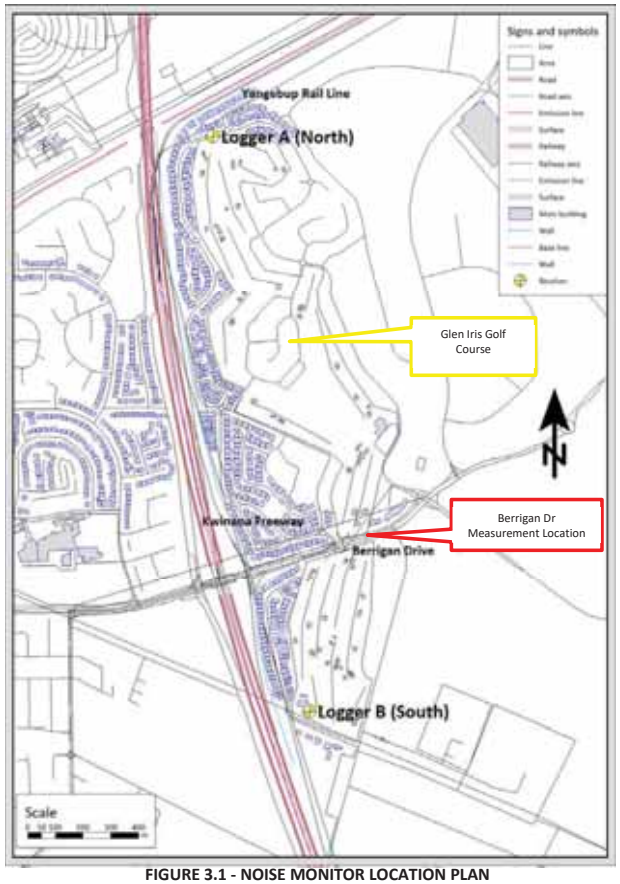


FIGURE 3.1 - NOISE MONITOR LOCATION PLAN

FIGURE 3.2 - NOISE MONITOR IN SITU

4.0 METHODOLOGY

4.1 ROAD TRAFFIC

The future road traffic volumes were based on information provided by the MRWA traffic modelling department. ROM24 2016 validation plots for 2016 and 2041 link volume plots were provided.

Predictive noise modelling has allowed for the following traffic data. It is noted that where available on the MRWA traffic maps site, current traffic counts were used to calibrate the measured noise levels.

Other information relevant to the calculations are shown below in Table 4.1.

TABLE 4.1 - NOISE MODELLING INPUT DATA

Parameter	Traffic Flow VPD Current	Traffic Flow VPD Future (2041)	Traffic Speed km/hr	Road Surface
Traffic flows VPD Kwinana Freeway South Bound	*48,368 (13%)	124,300 (11%)	100	Dense Graded Asphalt
Traffic flows VPD Kwinana Freeway North Bound	*55,082 (14%)	118,000 (11%)	100	Dense Graded Asphalt
Kwinana Freeway (South Bound) Berrigan Drive Offramp	9,000 (13%)	20,900 (11%)	60	Dense Graded Asphalt
Berrigan Drive to Kwinana Freeway (South Bound) Onramp	2,300 (17%)	7,700 (11%)	60	Dense Graded Asphalt
Berrigan Drive East of Kwinana Freeway (East Bound)	*27,780 (11%)*	20,000 (9%)	70	Dense Graded Asphalt
Berrigan Drive East of Kwinana Freeway (West Bound)		17,300 (11%)	70	Dense Graded Asphalt

* Based on current traffic counts (2018 to 2021)

Other input data for the model included:

- Traffic data from MRWA (https://mrapps.mainroads.wa.gov.au/TrafficMap/)
- Noise source heights for the three road source strings (Passenger Vehicles, Heavy Vehicles Engine and Heavy Vehicle Exhausts) are +0.5, +1.5 and +3.6m, with a noise correction of -0.8 and -8.0 applied to the heavy vehicles engine and exhaust noise sources.

- Topographical data, with the ground level within the development based on natural ground levels as surveys conducted.
- A +2.5 dB adjustment to allow for façade reflection.
- Development receiver heights at 1.4m above ground level.
- Calculations based on CoRTN algorithms.
- Other parameter listed in SPP 5.4 as to guidance for modelling road traffic noise / assessment.

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'.

The following scenario have been modelled:

- Current Traffic flows, with existing walls and surrounding residential housing.
- Future traffic flows, with existing walls and surrounding residential housing

Based on the above, the noise contours plot for day period for the above modelling scenario is attached in Appendix B.

4.2 RAIL TRAFFIC

4.2.1 FREIGHT RAIL

To determine the requirements of noise associated with the Yangebup freight Line, acoustic modelling was carried out using the computer program 'SoundPlan' using Nord2000 calculation methodology.

As the Freeway is the dominant noise source in the area, it is impacting the ability to measure current noise levels of train movements on the freight line and provide a basis for a statistical analysis. Additionally, the freight line is contained within a cutting for this section of track, as well as there being a noise wall and two storey residential buildings between the development and the rail line.

Reference was made to other monitoring conducted on the Cockburn freight line as to the validity of using an $L_{Aeq(1hour)}$ level for calibration of this assessment. Previous studies resulted in an $L_{Aeq(130seconds)}$ of 68.7 dB(A) for busier sections of the freight line. This was at a monitoring point 20m from the freight line. For information, calculating this noise level to the equivalent $L_{Aeq(1hour)}$ gives a resultant noise level of 54.3 dB(A).

Freight rail movements generally involved S class locomotives, with up to 150 wagons. Speeds were generally posted as 70km per hour.

Based on the calibrated freight rail line, the following scenarios were modelled:

1. Ultimate capacity volumes, i.e. 24 per 24 hours at 1 per hour, with existing walls and residential buildings between train line and proposed development.

Based on the above, the noise contours plots for day and night period for the above modelling scenarios are attached in Appendix C with the resultant level discussed further in the next section.

4.2.2 PROPOSED FUTURE FREIGHT / PASSENGER RAIL

Information was sought from the Metronet and the EPA as to the proposed design and impact of noise levels from the proposed future passenger rail and freight rail lines.

As there are existing residential premises located on the proposed rail line, development of the future rail line operations needs to consider these highly noise sensitive premises.

Review of the preliminary design noise levels, as provided in the *Thornnlie-Cockburn Link Noise and Vibration Assessment Report Number 675.10409.00100-R01* shows that noise levels to these existing residential premises will be designed such that the target noise levels (as per SPP 5.4) will be met.

As the Glen Iris development is set back behind these residential premises, noise levels would be less than those at the façade lots, hence compliance with the requirements of SPP 5.4 would be achieved. Therefore, noise modelling of the future proposed Freight / Passenger Rail would not be required for this development as the infrastructure provide will meet the requirements of SPP 5.4 for existing residential premises closer to the rail line.

It is noted that assessment of the freight rail has been undertaken and calibrated to existing noise levels. These noise levels have been increased for future rail freight movements of one per hour. This is based on the current built form, including the noise wall located along the existing residence boarding the rail line, and the two storey dwellings currently in place. If the proposed passenger rail development goes ahead, the noise mitigation requirements would incorporate the freight rail, hence noise levels would be less than those considered in this assessment. This provides as conservative acoustic assessment for the proposed development, where the future freight rail increases, and no further noise attenuation works are carried out.

5.0 RESULTS / ASSESSMENT

5.1 ROAD TRAFFIC

Under the WAPC State Planning Policy 5.4, for this development, the appropriate "Noise Targets" to be achieved under SPP 5.4, external to a residence are:

External	
Day	Maximum of 55 dB(A) L_{Aeq}
Night	Maximum of 50 dB(A) L_{Aeq}

The policy states that the "outdoor targets are to be met at all outdoor areas as far as reasonable and practical to do so using the various noise mitigation measures outlined in the guidelines". The Policy also states, under Section 6 – Policy Measures that "a reasonable degree of acoustic amenity for living areas on each residential lot". The policy recognises that "it may not be practicable to meet the outdoor noise targets".

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)

For this development, compliance with the requirements of SPP 5.4, noise modelling and assessment are based on the day period.

The results of the acoustic assessment indicate that noise received at the proposed residential development would generally comply with the "Noise Targets" as outlined in SPP 5.4 with the exception of three main areas. These are identified below in Figure 5.1 and are discussed further below.

FIGURE 5.1 – FUTURE ROAD TRAFFIC NOISE LEVELS

5.1.1 AREA A - NORTH

Based on the development plan, it is proposed that areas are to be constructed for the purpose of residential. As per Figure 5.2 the areas exceed the 55 dB(A) noise Target, however only marginally and likely at only the façade Lots. This is shown by the spread of noise through the existing dwellings located between the development and the Freeway.

Given the noise levels, the façade lots would require quiet house design in the form of Package A for ground floor locations. Appendix F contains the quiet house design requirements and an area plan outlining the effected Lots. It is noted that for upper levels, it is likely Package B would be applied, however specialist acoustic advice will be detailed at subdivision staging.

Additionally, as they are over the Target noise level, the lots in this area would require notification on titles of the Freeway noise impact.

FIGURE 5.2 – FUTURE ROAD TRAFFIC NOISE LEVELS, AREA A - NORTH

5.1.1 AREA B - CENTRAL

Based on the development plan, it is proposed that areas are to be constructed for the purpose of residential. As per Figure 5.3, the areas exceed the 55 dB(A) noise Target, however only marginally and likely at only the façade Lots. This is shown by the spread of noise through the existing dwellings located between the development and the Freeway.

Given the noise levels, the façade lots would require quiet house design in the form of Package A for ground floor locations. Appendix F contains the quiet house design requirements and an area plan outlining the effected Lots. It is noted that for upper levels, it is likely Package B would be applied, however specialist acoustic advice will be detailed at subdivision staging.

Additionally, as they are over the Target noise level, the lots in this area would require notification on titles of the Freeway noise impact.

FIGURE 5.3 – FUTURE ROAD TRAFFIC NOISE LEVELS, AREA B - CENTRAL

5.1.1 AREA C – BERRIGAN DRIVE AND SOUTH

Based on the development plan, it is proposed that areas are to be constructed for the purpose of residential south of Berrigan Drive, and Commercial for the section to the north of Berrigan Drive. As per Figure 5.4 the areas exceed the 55 dB(A) noise Target, however only marginally and likely at only the façade Lots.

Given the noise levels, the façade lots would require quiet house design in the form of Package A for ground floor locations. Appendix F contains the quiet house design requirements and an area plan outlining the effected Lots. It is noted that for upper levels, it is likely Package B would be applied, however specialist acoustic advice will be detailed at subdivision staging.

Additionally, as they are over the Target noise level, the lots in this area would require notification on titles of the Freeway and Berrigan Drive noise impact.

FIGURE 5.4 – FUTURE ROAD TRAFFIC NOISE LEVELS, AREA C - SOUTH

5.2 RAIL TRAFFIC

Under the WAPC State Planning Policy 5.4, for this development, the appropriate "Noise Targets" to be achieved under SPP 5.4, external to a residence are:

External

Day	Maximum of 55 dB(A) L_{Aeq}
Night	Maximum of 50 dB(A) L_{Aeq}

The policy states that the "outdoor targets are to be met at all outdoor areas as far as reasonable and practical to do so using the various noise mitigation measures outlined in the guidelines". The Policy also states, under Section 6 – Policy Measures that "a reasonable degree of acoustic amenity for living areas on each residential lot". The policy recognises that "it may not be practicable to meet the outdoor noise targets".
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)

For this development, compliance with the requirements of SPP 5.4, noise modelling and assessment are based on the night period.

The results of the acoustic assessment indicate that noise received at the proposed residential development would comply with the "Noise Targets" as outlined in SPP 5.4. The resultant noise level for the future night period, considering one train movement per hour is shown below in Figure 5.5.

FIGURE 5.5 – FUTURE FREIGHT RAIL NOISE LEVELS

It is noted that the existing freight rail as per Section 4.2.1, has been undertaken and calibrated to existing noise levels. These noise levels have been increased for future rail freight movements of one per hour. This is based on the current built form, including the noise wall located along the existing residence boarding the rail line. If the proposed passenger rail development goes ahead, the noise mitigation requirements would incorporate the freight rail, hence noise levels would be less than those considered in this assessment. This provides as conservative acoustic assessment for the proposed development, where the future freight rail increases, and no further noise attenuation works are carried out.

5.3 AIRCRAFT NOISE

Based on guidance from SPP 5.3, the majority of the northern section of the proposed development site is acceptable for residential development, as indicated in Figure 5.6.

The blue area (ANEF 20 to 25) is also acceptable for residential development, although it requires conditions. These conditions are such that the internal noise level (for aircraft noise events) is to meet the criteria contained in AS2021. The affected lots within this development are those within the blue contour as noted in Figure 5.6.

Whilst at this stage of the development the lot configuration and layout are not known, a preliminary "deemed to satisfy construction" has been provided below for development within the ANEF 20-25 contour. This can form the basis of future concept designs and can be refined at subdivision staging.

Glazing:

Bedrooms:

- Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10mm single or 6mm-12mm-10mm double insulated glazing (R_w+C_{tr} 28 dB). Sealed awning or casement windows may use 6 mm glazing instead.
- Up to 60% floor area: as per above but must be sealed awning or casement type windows (R_w+C_{tr} 31dB).

Indoor living and work areas:

- Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulated glazing (R_w+C_{tr} 25dB).
- Up to 60% floor area: As per Bedrooms at up to 40% area (R_w+C_{tr} 28 dB).
- Up to 80% floor area: As per Bedrooms at up to 60% area (R_w+C_{tr} 31dB).

Walls:

Bedroom and indoor living and work areas to R_w+C_{tr} 45dB:

- One row of 92mm studs at 600mm centres with:
  - Resilient steel channels fixed to the outside of the studs; and
  - 9.5mm hardboard or 9mm fibre cement sheeting or 11mm fibre cement weatherboards or one layer of 19mm board cladding fixed to the outside of the channels; and
  - 75mm glass wool (11kg/m3) or 75mm polyester (14kg/m3) insulation, positioned between the studs; and
  - Two layers of 16mm fire-protective grade plasterboard fixed to the inside face of the studs.
  - Single leaf of 150mm brick masonry with 13mm cement render on each face.
  - Double brick: two leaves of 90mm clay brick masonry with a 20mm cavity between leaves.

Roof and Ceiling:

Tiled or colorbond roof with sarking and 10mm plasterboard ceiling R_w+C_{tr} 35.

Additional to the above there is a requirement where the lots within the ANEF 20 noise contour require notifications on titles for aircraft noise. The wording for the notification on title is as follows:

Notification:

"This lot is situated in the vicinity of Jandakot Airport, and is currently affected, or may in the future, be affected by aircraft noise. Noise exposure levels are likely to increase in the future as a result of increases in numbers of aircraft using the airport, changes in aircraft type or other operational changes. Further information about aircraft noise, including development restrictions and noise insulation requirements for noise-affected properties, are available on request from the relevant local government offices."

Further to the criteria contained in SPP 5.3, the City of Cockburn LPP 1.12 contains advice as follows:

> *Consideration should be given to noise attenuation for noise sensitive premises within the Frame area corresponding to the requirements of Western Australian Planning Commission publication "Aircraft Noise Insulation for Residential Development in the Vicinity of Perth Airport" 2004 (such as the installation of 6.38mm laminated glazing), in order to ensure that residential amenity is adequately protected within noise sensitive developments.*

Therefore, development outside of the ANEF 20-25 contour, but within the Frame Area would require upgraded glazing in the form of 6.38 laminate.

FIGURE 5.6 – JANDAKOT AIRPORT FRAME AREA NOISE CONSIDERATIONS

5.4 INDUSTRY NOISE

Based on the City of Cockburn Intramaps, there is industrial zoned land use to the south of the proposed residential development, as shown in Figure 5.7.

As there are existing residential premises located on Imlah Court, located at a closer distance to the industrial premises than the proposed development, expectations are that compliance with Regulatory criterial contained in the *Environmental Protection (Noise) Regulations 1997* would be achieved for the existing situation at these locations. However, consideration of the potential for noise impact from this area has been undertaken for the proposed residential development.

Three forms of noise amelioration have been considered for the future residence located on the southern end of the Glen Iris development, with these being as follows:

1. Noise Wall

   A solid, masonry barrier has been allowed for on the eastern boundary of the development, bounding Prinsep Road. The height of the wall has been set at 1.8m. As the proposed Lots are to back onto Prinsep Road, this will provide protection od outdoor living areas for noise associated with surrounding land use.

2. Upgrade Building Design

   As the proposed Lots for the southern section of the development lay within the Frame Area / ANEF 20/25 for Jandakot Airport, these residential dwellings will be required to meet the upgrade design as per SPP 5.4 / LPP 1.12. This will provide attenuation for other noise sources, such as industrial noise within the surrounding area.

3. Setback

As per the development plan attached in Appendix A, there is a 50m setback of lots from the southern boundary of the development. This will provide further amelioration in the form of distance attenuation.

FIGURE 5.7 – PLANNING LAND USE MAP

6.0 CONCLUSION

ROAD NOISE

Based on the development plan, it is proposed that areas are to be constructed for the purpose of residential with some commercial usage for the section to the north of Berrigan Drive. Noise levels for the future road traffic are such, that at some of the lot façades, the noise could exceed the 55 dB(A) noise Target. Therefore, amelioration in the form of Quiet House Design is required. These areas have been identified and general "deemed to satisfy packages" as per the SPP 5.4 guidelines applied. Detailed design for these requirements can be applied at subdivision staging once further information is available.

Given the noise levels, the lot façades would require Quiet House Design in the form of Package A. Appendix F contains the deemed to satisfy packages or Quiet House Design requirements and an area plan outlining the effected Lots.

Additionally, as they are over the "Target" noise level, the lots in this area would require notification on titles of the Freeway and Berrigan Drive noise impact.

RAIL NOISE

For train noise associated with the Yangebup Freight Line, due to the topography (line being in a cutting) and the noise wall and residential housing between the rail line and the development, the noise levels for the worst-case future scenario of one train per hour have been assessed as being below the night time noise Target criteria at the façade lots of the development boundary, hence there are no acoustic requirements.

Information was sought from the Metronet and the EPA as to the proposed design and impact of noise levels from the proposed future passenger rail and freight rail lines.

As there are existing residential premises located on the proposed rail line, development of the future rail line operations needs to consider these highly noise sensitive premises.

Review of the preliminary design noise levels, as provided in the *Thornnlie-Cockburn Link Noise and Vibration Assessment Report Number 675.10409.00100-R01* shows that noise levels to these existing residential premises will be designed such that the target noise levels (as per SPP 5.4) will be met.

As the Glen Iris development is set back behind these residential premises, noise levels would be less than those at the lot façades, hence compliance with the requirements of SPP 5.4 would be achieved. Therefore, noise modelling of the future proposed Freight / Passenger Rail would not be required for this development as the infrastructure provide will meet the requirements of SPP 5.4 for existing residential premises closer to the rail line.

Notwithstanding the above, confirmation assessment of the freight rail has been undertaken and calibrated to existing noise levels. These noise levels have been increased for future rail freight movements of one per hour. This is based on the current built form, including the noise wall located along the existing residence boarding the rail line. When the proposed passenger rail development is constructed, the noise mitigation requirements would incorporate the freight rail, hence noise levels would be less than those considered in this assessment. This provides a conservative acoustic assessment for the proposed development, where the future freight rail increases, and no further noise attenuation works are carried out.

AIRCRAFT NOISE

Based on guidance from SPP 5.3, the majority of the northern section of the proposed development site is acceptable for residential development, as indicated in Figure 5.3.

The blue area (ANEF 20 to 25) is also acceptable for residential development, although it requires conditions. These conditions are such that the internal noise level (for aircraft noise events) are to meet the criteria contained in AS2021. The affected lots within this development are those within the blue contour as noted in Figure 5.3.

Further to the criteria contained in SPP 5.3, the City of Cockburn LPP 1.12 contains advice as follows:

> *Consideration should be given to noise attenuation for noise sensitive premises within the Frame area corresponding to the requirements of Western Australian Planning Commission publication "Aircraft Noise Insulation for Residential Development in the Vicinity of Perth Airport" 2004 (such as the installation of 6.38mm laminated glazing), in order to ensure that residential amenity is adequately protected within noise sensitive developments.*

Therefore, whilst at this stage of the development the lot configuration and layout are not known, a preliminary "deemed to satisfy construction" has been provided within this report for areas within the ANEF 20-25 noise contour. This can form the basis of future concept designs and can be refined at subdivision staging. For area outside the ANEF 20 but contained within the Frame Area upgraded glazing would be required (as per LPP 1.12).

INDUSTRY NOISE

Based on the City of Cockburn Intramaps, there is industrial zoned land use to the south of the proposed residential development, as shown in Figure 5.4.

As there are existing residential premises located on Imlah Court, located at a closer distance to the industrial premises than the proposed development, expectations are that compliance with Regulatory criterial contained in the *Environmental Protection (Noise) Regulations 1997* would be achieved for the existing situation at these locations. However, consideration of the potential for noise impact from this area has been undertaken for the proposed residential development.

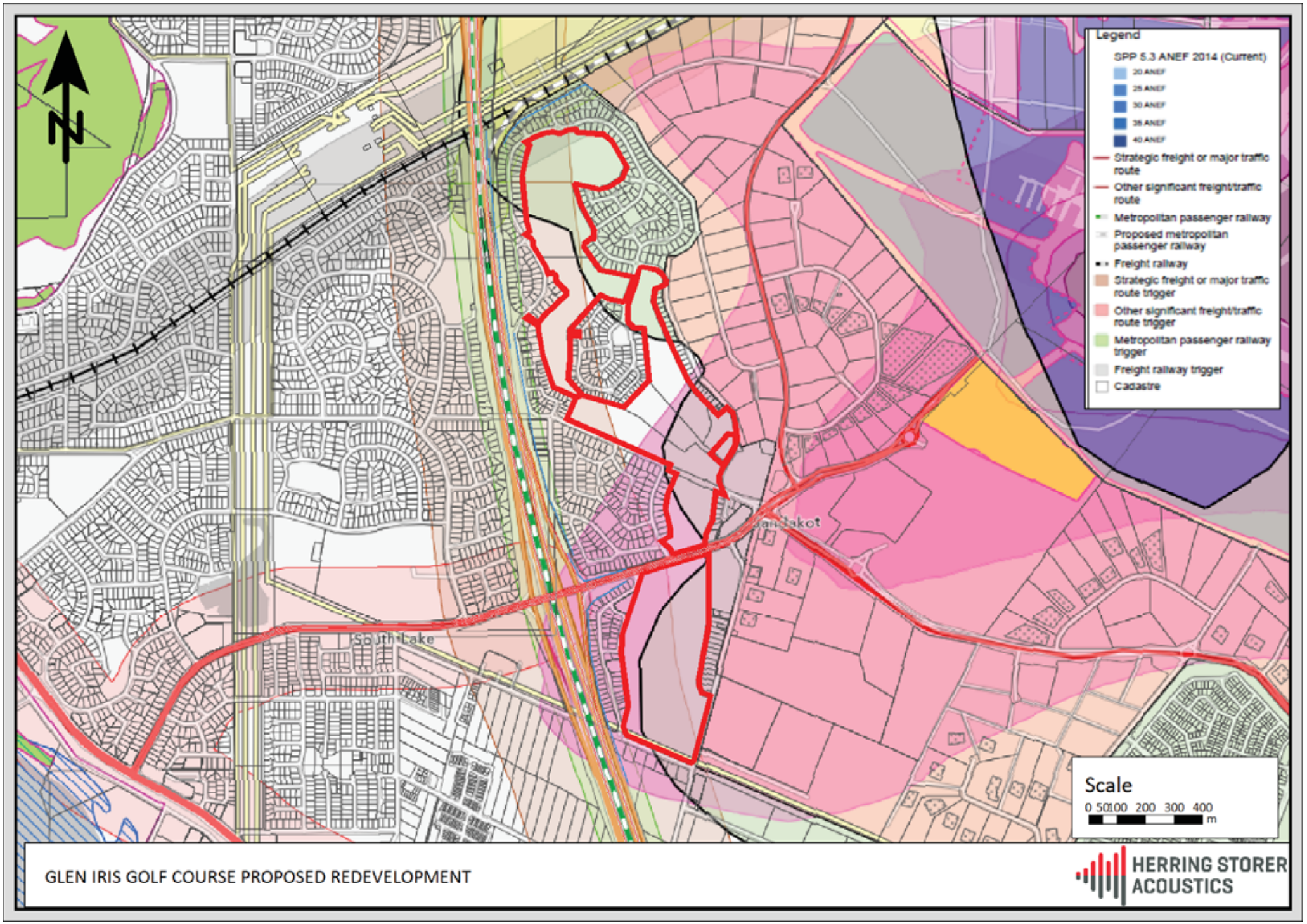
Three forms of noise amelioration have been considered for the future residence located on the southern end of the Glen Iris development, with these being as follows:

1. Noise Wall (Prinsep Road)
2. Upgrade Building Design (As per SPP 5.3)
3. Setback

Given the implementation of the above, noise levels can be managed, regardless of compliance with the regulatory criteria.

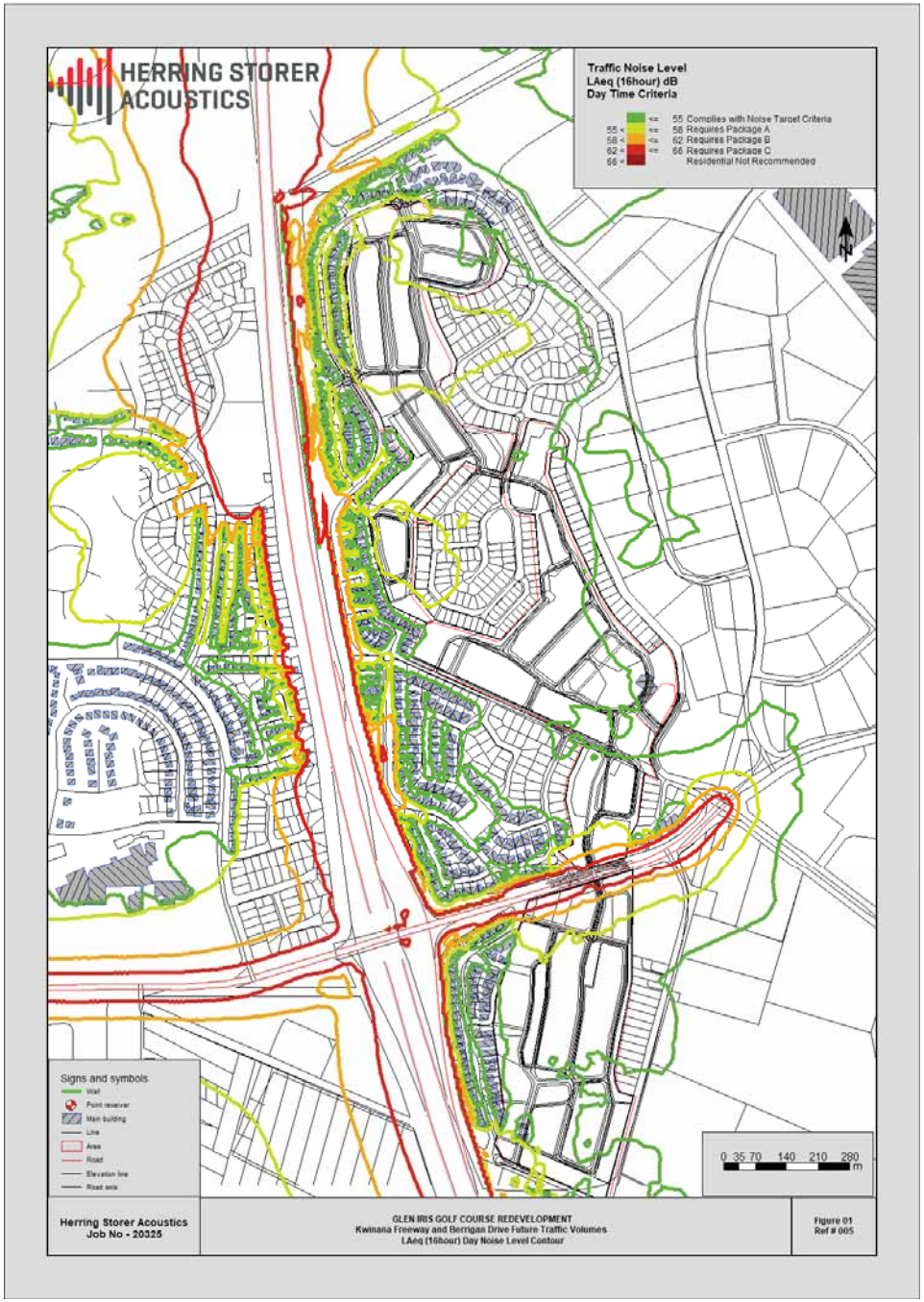
APPENDIX A

Area Plan


N
Legend
SPP 5.3 ANEF 2014 (Current)
20 ANEF
25 ANEF
30 ANEF
35 ANEF
40 ANEF
Strategic freight or major traffic route
Other significant freight/traffic route
Metropolitan passenger railway
Proposed metropolitan passenger railway
Freight railway
Strategic freight or major traffic route trigger
Other significant freight/traffic route trigger
Metropolitan passenger railway trigger
Freight railway trigger
Cadastre
South Lake
Scale
0 50 100 200 300 400
m
GLEN IRIS GOLF COURSE PROPOSED REDEVELOPMENT
HERRING STORER ACOUSTICS

APPENDIX B

$L_{Aeq(16hr)}$ DAY
NOISE CONTOURS FOR FUTURE KWINANA FREEWAY and BERRIGAN DRIVE



APPENDIX C

$L_{Aeq(8hr)}$ NIGHT
NOISE CONTOURS FOR FUTURE YANGEBUP FREIGHT LINE

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HERRING STORER ACOUSTICS
Services WA
Training Pl
Training Pl
Training Pl
Turtle Point Cove
Glen Iris Dr
Glen Iris Dr
Glen Iris Dr
Glen Iris Dr
Glen Iris Dr
Lakes Way
Lakes Way
Kwinana Fr
0 10 20 40 60 80 m
Freight Rail Noise Level
LAeq (8hour) dB
Night Time Criteria
<= 50 Complies with Noise Target Criteria
50 < <= 53 Requires Package A+
53 < <= 57 Requires Package B+
57 < <= 61 Requires Package C+
61 < Residential Not Recommended
N
Signs and symbols
Wall
Point receiver
Main building
Line
Area
Road
Elevation line
Herring Storer Acoustics
Job No - 20325
GLEN IRIS GOLF COURSE
Future Traffic Volumes - Yangebup Freight Rail Line
LAeq (8hour) Night Noise Level Contour
Figure C2
Ref # 009

APPENDIX D

TRAFFIC FLOW VOLUMES – KWINANA FREEWAY and BERRIGAN DRIVE

mainroads WESTERN AUSTRALIA

SITE 8437

Hourly Volume

Kwinana Fwy (H015)

2017/18
Monday to Friday

SB At Bridge Under Berrigan Dr (SLK 16.90)

All Vehicles

	SB
00:00	[illegible]
01:00	[illegible]
02:00	[illegible]
03:00	[illegible]
04:00	[illegible]
05:00	[illegible]
06:00	[illegible]
07:00	[illegible]
08:00	[illegible]
09:00	[illegible]
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12:00	[illegible]
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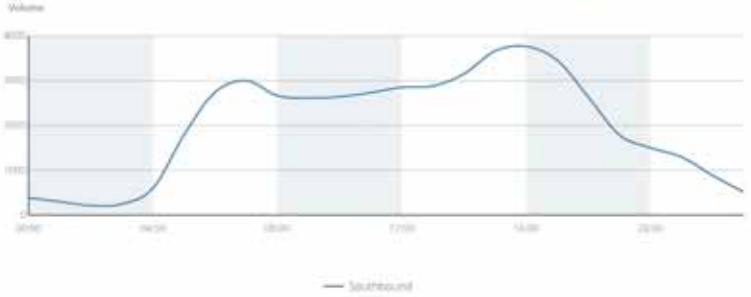
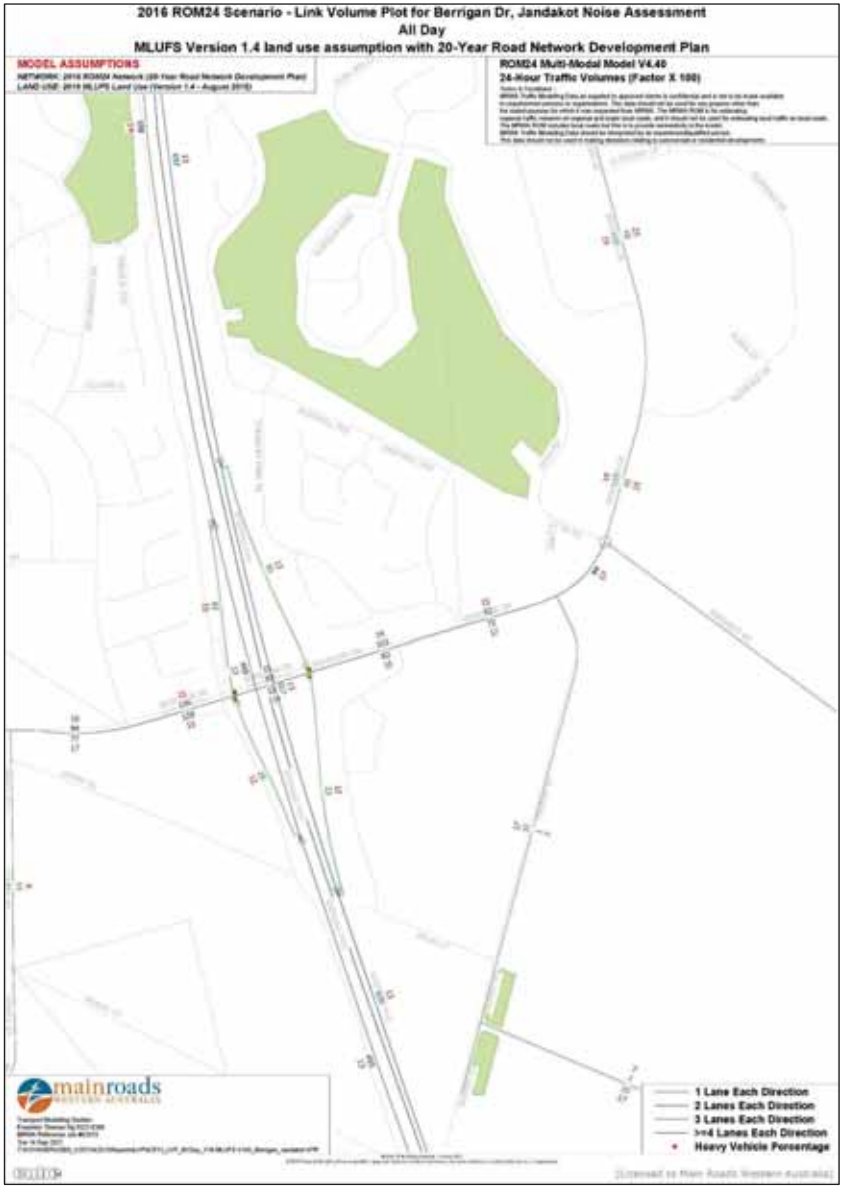
15:00	[illegible]
16:00	[illegible]
17:00	[illegible]
18:00	[illegible]
19:00	[illegible]
20:00	[illegible]
21:00	[illegible]
22:00	[illegible]
23:00	[illegible]
TOTAL	[illegible]

Peak Statistics

AM	TIME	[illegible]
	VOL	[illegible]
PM	TIME	[illegible]
	VOL	[illegible]

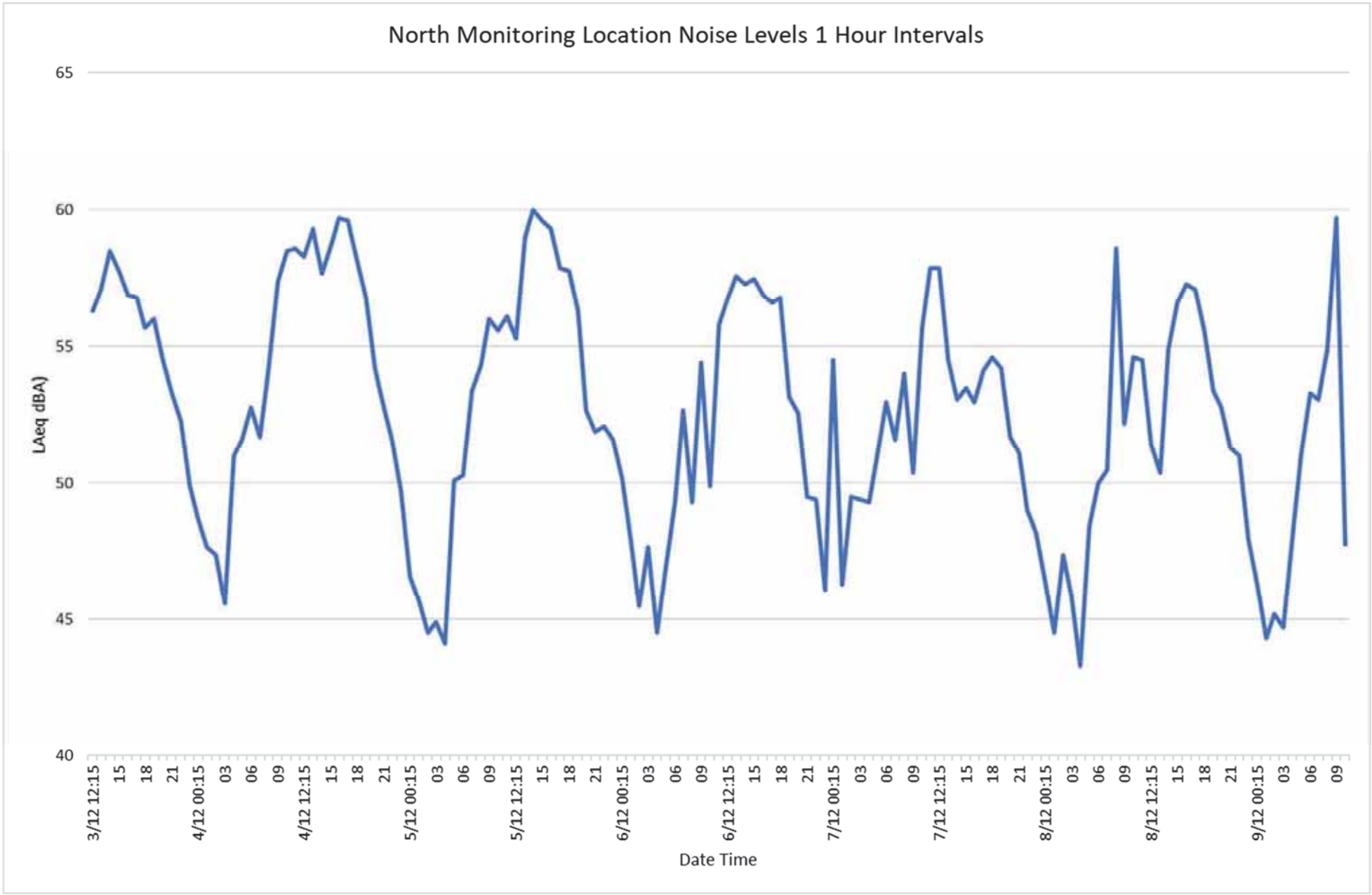
Information Not Available





APPENDIX E

MONITORING DATA


North Monitoring Location Noise Levels 1 Hour Intervals
LAeq dBA)
65
60
55
50
45
40
3/12 12:15
15
18
21
4/12 00:15
03
06
09
4/12 12:15
15
18
21
5/12 00:15
03
06
09
5/12 12:15
15
18
21
6/12 00:15
03
06
09
6/12 12:15
15
18
21
7/12 00:15
03
06
09
7/12 12:15
15
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06
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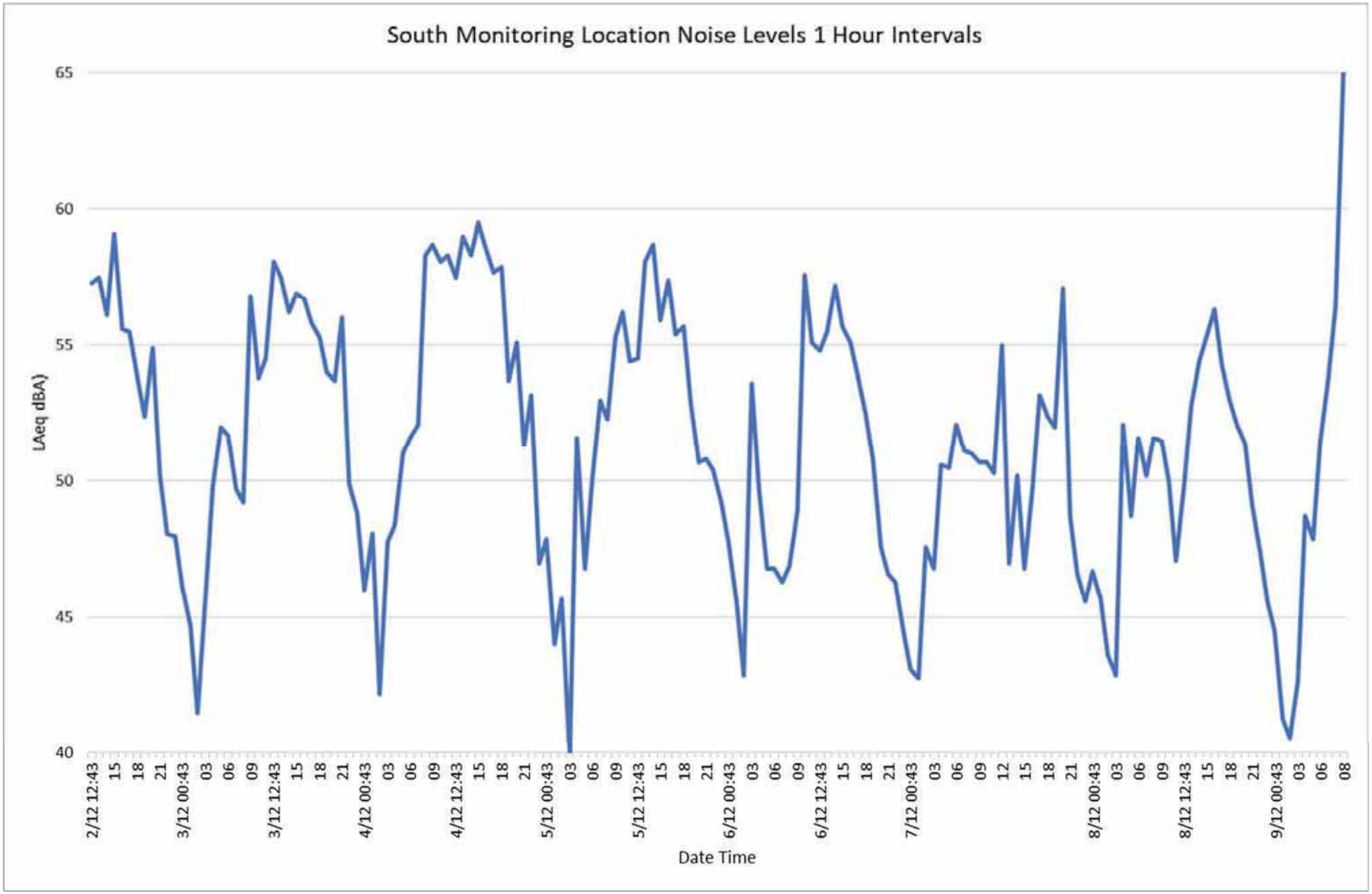
8/12 12:15
15
18
21
9/12 00:15
03
06
09
Date Time


South Monitoring Location Noise Levels 1 Hour Intervals
LAeq dBA)
65
60
55
50
45
40
2/12 12:43
15
18
21
3/12 00:43
03
06
09
3/12 12:43
15
18
21
4/12 00:43
03
06
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21
8/12 00:43
03
06
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8/12 12:43
15
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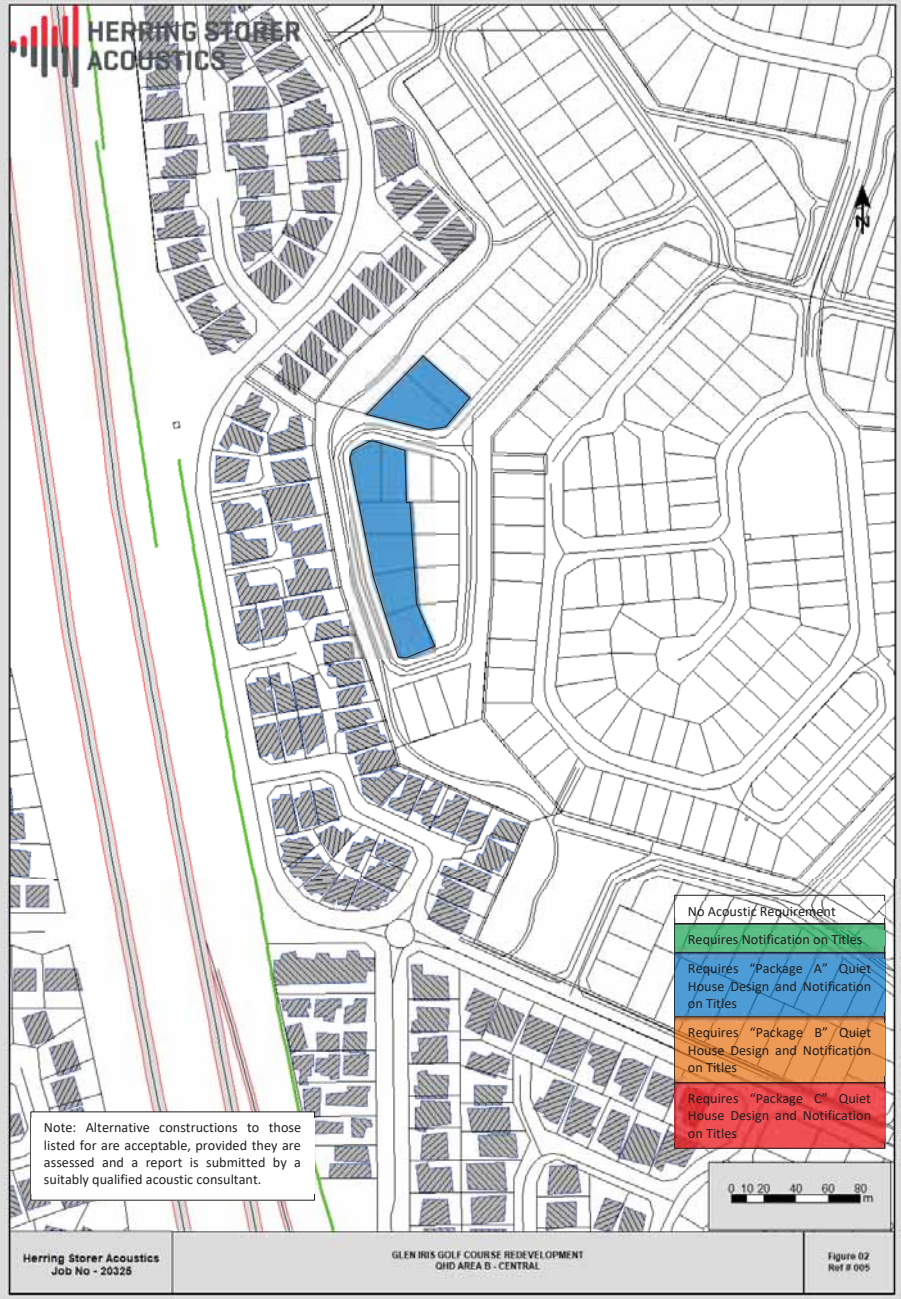
21
9/12 00:43
03
06
08
Date Time

APPENDIX F

QUIET HOUSE DESIGN REQUIREMENTS


HERRING STORER ACOUSTICS
N
No Acoustic Requirement
Requires Notification on Titles
Requires "Package A" Quiet House Design and Notification on Titles
Requires "Package B" Quiet House Design and Notification on Titles
Requires "Package C" Quiet House Design and Notification on Titles
Note: Alternative constructions to those listed for are acceptable, provided they are assessed and a report is submitted by a suitably qualified acoustic consultant.
0 10 20 40 60 80 m
Herring Storer Acoustics
Job No - 20325
GLEN IRIS GOLF COURSE REDEVELOPMENT
QHD AREA B - CENTRAL
Figure 02
Ref # 005

HERRING STORER ACOUSTICS
N
No Acoustic Requirement
Requires Notification on Titles
Requires "Package A" Quiet House Design and Notification on Titles
Requires "Package B" Quiet House Design and Notification on Titles
Requires "Package C" Quiet House Design and Notification on Titles
Note: Alternative constructions to those listed for are acceptable, provided they are assessed and a report is submitted by a suitably qualified acoustic consultant.
0 10 20 40 60 80 m
Herring Storer Acoustics
Job No - 20325
GLEN IRIS GOLF COURSE REDEVELOPMENT
QHD AREA C - SOUTH
Figure 03
Ref # 005

Road Traffic and Passenger Rail
Quiet House Requirements
(*Based on Table 3 of State Planning Policy 5.4 2019*)

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					Mechanical ventilation/air conditioning considerations
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	
A **Quiet House A**	**Facing**	**Bedroom and Indoor Living and work areas to Rw + Ctr 45dB** **Stud Frame Walls** ➢ One row of 92mm studs at 60mm centres with: ➢ Resilient steel channels fixed to the outside of the studs; and ➢ 9.5mm hardboard or 9mm fibre cement weatherboards or one layer of 19mm board cladding fixed to the outside of the channels; and ➢ 75mm glass wool (11kg/m3) or 75mm polyester (14kg/m3) insulation, positioned between the studs; and ➢ -Two layers of 16mm fire-protective grade plasterboard fixed to the inside face of the studs. **Brick Walls** ➢ Single leaf of 150mm brick masonry with 13mm cement render on each face: **OR** ➢ Double brick: two leaves of 90 mm clay brick masonry with a 20mm cavity between leaves.	**Bedrooms**: ➢ Fully glazed hinged door with certified **R_w+C_{tr} 28dB** rated door and frame including seals and 6mm glass **Indoor Living and work areas:** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals: **OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10 mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 28 dB**). Sealed awning or casement windows may use 6 mm glazing instead**: OR** ➢ Up to 60% floor area: as per above but must be sealed awning or casement type windows (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 25dB**)**: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr28 dB : OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 31 dB**).	**To R_w+C_{tr} 35dB** ➢ Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard ceiling	➢ At least one outdoor living area located on the opposite side of the building from the transport corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum **2 metres** height above ground level	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of **Rw 40dB** into sensitive spaces ➢ Evaporative systems require attenuated ceiling air vents to allow closed windows ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable
	Side On		As per "Facing" above, except R_w+C_{tr} values may be 3dB less, e.g. glazed sliding door with 10 mm glass and weather seals for bedrooms	As above, except R_w+C_{tr} values may be 3dB less, or max % area increased by 20%			
	Opposite		No specific requirements	No specific requirements			

Freight Rail
Quiet House Requirements
(*Based on Table 3 of State Planning Policy 5.4 2019*)

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					Mechanical ventilation/air conditioning considerations
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	
A+ **Quiet House A+**	**All Facades**	**Brick Walls Only** ➢ Double brick: two leaves of 90 mm clay brick masonry with a 20mm cavity between leaves.	**Bedrooms**: ➢ No external doors for bedrooms with entry facing rail corridor and for other facades, fully glazed hinged door with certified **R_w+C_{tr} 28dB** rated door and frame including seals and 6mm glass **Indoor Living and work areas:** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ All windows comprise minimum 6mm thick laminated or toughened glass in sealed awning or casement type frames. Polymer (e.g. uPVC) window framing should be used (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 25dB**). **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr28 dB**) **: OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 31 dB**).	**To R_w+C_{tr} 35dB** ➢ Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard ceiling	➢ At least one outdoor living area located on the opposite side of the building from the transport corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum **2 metres** height above ground level	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of **Rw 40dB** into sensitive spaces ➢ Evaporative systems not recommended ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable

Road Traffic and Passenger Rail
Quiet House Requirements
(*Based on Table 3 of State Planning Policy 5.4 2019*)

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					Mechanical ventilation/air conditioning considerations
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	
B **Quiet House B**	**Facing**	**Bedroom and indoor living and work areas to R_w+C_{tr} 50dB** **Single leaf of 90 mm clay brick masonry with:** ➢ A row of 70 mm x 35 mm timber studs or 64 mm steel studs at 600 mm centres; ➢ A cavity of 25 mm between leaves; ➢ 50 mm glass wool or polyester cavity insulation (R2.0+) insulation between studs; and ➢ One layer of 10mm plasterboard fixed to the inside face ➢ Single leaf of 220mm brick masonry with 13mm cement render on each face ➢ 150mm thick unlined concrete panel or 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face **Double brick: two leaves of 90mm clay brick masonry with:** ➢ A 50mm cavity between leaves ➢ 50mm glass wool or polyester cavity insulation (R2.0+) ➢ Resilient ties where required to connect leaves **Double brick: two leaves of 110mm clay brick masonry with** ➢ 50mm cavity between leaves and R2.0+ cavity insulation	**Bedrooms** ➢ Fully glazed hinged door with certified **R_w+C_{tr} 31dB** rated door and frame including seals and 10mm glass **Indoor Living and work areas** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor areas: Fixed sash, awning or casement with minimum 6mm single or 6mm-12mm-6mm double insulted glazing (**Rw+Ctr 31dB**). ➢ Up to 60% floor area: as per above but must be minimum10mm single or 6mm-12mm-10mm double insulated glazing (**Rw+Ctr 34dB**) **Indoor Living and work areas** ➢ Up to 40% floor area; Sliding or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (R_w+C_{tr} 28dB). Sealed awning or casement windows may use 6mm glazing instead. **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**R_w+C_{tr} 31dB**). **: OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 34dB).**	**To R_w+C_{tr} 35dB** ➢ Concrete or terracotta tile sarking and at least 10mm plasterboard ceiling, R3.0+ insulation **OR** ➢ Metal sheet roof, sarking and at least 10mm plasterboard ceiling, R3.0+ insulation	➢ At least one outdoor living area located on the opposite side of the building from the corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum **2.4 metres** height above ground level	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of **Rw 40dB** into sensitive spaces ➢ Evaporative systems require attenuated ceiling air vents to allow closed windows ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable
	Side-On		**Bedrooms**: ➢ Fully glazed hinged door with certified **R_w+C_{tr} 28dB** rated door and frame including seals and 6mm glass **Indoor Living and work areas:** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10 mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 28 dB**). Sealed awning or casement windows may use 6 mm glazing instead. **: OR** ➢ Up to 60% floor area: as per above but must be sealed awning or casement type windows (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 25dB**). **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr28 dB**) **: OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 31 dB**).			
	Opposite		As above, except R_w+C_{tr} values may be 3dB less, or max % area increased by 20%	As above, except R_w+C_{tr} values may be 3dB less, or max % area increased by 20%			

Freight Rail
Quiet House Requirements

(*Based on Table 3 of State Planning Policy 5.4 2019*)							
Exposure Category	**Orientation to corridor**	**Acoustic rating and example constructions**					**Mechanical ventilation/air conditioning considerations**
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	
B+ **Quiet House B**	**All Facades**	**Double brick: two leaves of 90mm clay brick masonry with:** ➢ A 50mm cavity between leaves ➢ 50mm glass wool or polyester cavity insulation (R2.0+) ➢ Resilient ties where required to connect leaves **Double brick: two leaves of 110mm clay brick masonry with** ➢ 50mm cavity between leaves and R2.0+ cavity insulation	**Bedrooms** **Bedrooms**: ➢ No external doors for bedrooms with entry facing or side on to rail corridor and for other facades, fully glazed hinged door with certified **R_w+C_{tr} 31dB** rated door and frame including seals and 10mm glass **Indoor Living and work areas** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals	**Bedrooms**: ➢ All windows comprise minimum 6mm thick laminated or toughened glass in sealed awning or casement type frames. Polymer (e.g. uPVC) window framing should be used (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 28dB**) **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr31 dB**) **: OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 34 dB**).	**To R_w+C_{tr} 40dB** ➢ To all bedrooms, 2 layers of 10mm plasterboard, or one layer 13mm high density sealed plasterboard (minimum surface density of 12.5 kg/m2), affixed using steel furring channels beneath ceiling rafters/supports**: and** ➢ R3.0+ insulation batts laid in cavity**: and** ➢ Concrete or terracotta tile roof with sarking, or metal sheet roof with foil backed R2.0+ fibre insulation between steel sheeting and roof battens	➢ At least one outdoor living area located on the opposite side of the building from the corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum **2.4 metres** height above ground level	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of **Rw 40dB** into sensitive spaces ➢ Evaporative systems not recommended ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable

Road Traffic and Passenger Rail
Quiet House Requirements
(*Based on Table 3 of State Planning Policy 5.4 2019*)

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	**Mechanical ventilation/air conditioning considerations**
C **Quiet House C**	**Facing**	**Bedroom and indoor living and work areas to R_w+C_{tr} 50dB** **Single leaf of 90 mm clay brick masonry with:** ➢ A row of 70 mm x 35 mm timber studs or 64 mm steel studs at 600 mm centres; ➢ A cavity of 25 mm between leaves; ➢ 50 mm glass wool or polyester cavity insulation (R2.0+) insulation between studs; and ➢ One layer of 10mm plasterboard fixed to the inside face ➢ Single leaf of 220mm brick masonry with 13mm cement render on each face ➢ 150mm thick unlined concrete panel or 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face **Double brick: two leaves of 90mm clay brick masonry with:** ➢ A 50mm cavity between leaves ➢ 50mm glass wool or polyester cavity insulation (R2.0+) ➢ Resilient ties where required to connect leaves **Double brick: two leaves of 110mm clay brick masonry with** ➢ 50mm cavity between leaves and R2.0+ cavity insulation	**Bedrooms** ➢ External doors to bedrooms facing the corridor are not recommended. **Indoor Living and work areas** ➢ Fully glazed hinged door with certified **Rw+Ctr 31dB** rated door and frame including seals and 10mm glass**: OR** 40mm solid core timber frame and door (without glass or with glass inserts not less than 6mm), side hinged with certified **Rw 32dB** acoustically rated door and frame system including seals	**Bedrooms**: ➢ Total external door and window system area up to 20% of room floor area: Fixed sash, awning or casement with minimum 6mm single or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 31dB): OR** ➢ Up to 40% floor area; as per above but must be minimum 10mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 34dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulated glazing (**R_w+C_{tr} 31dB**). Sealed awning or casement windows may use 6mm glazing instead**: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr 34dB)**	**To R_w+C_{tr} 40dB** ➢ To al bedrooms, 2 layers of 10mm plasterboard, or one layer 13mm high density sealed plasterboard (minimum surface density of 12.5 kg/m2), affixed using steel furring channels beneath ceiling rafters/supports**: and** ➢ R3.0+ insulation batts laid in cavity **: and** ➢ Concrete or terracotta tile roof with sarking, or metal sheet roof with foil backed R2.0+ fibre insulation between steel sheeting and roof battens	➢ At least one outdoor living area located on the opposite side of the building from the corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum **2.4 metres** height above ground level	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of Rw 40dB into sensitive spaces. ➢ Evaporative systems require attenuated ceiling air cents to allow closed windows. ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, close or relocated to building sides facing away from the corridor where practicable.
	Side-on	**Bedrooms** ➢ Fully glazed hinged door with certified **R_w+C_{tr} 31dB** rated door and frame including seals and 10mm glass **Indoor Living and work areas** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals					
	Opposite	**Bedrooms**: ➢ Fully glazed hinged door with certified **R_w+C_{tr} 28dB** rated door and frame including seals and 6mm glass **Indoor Living and work areas:** ➢ 35mm solid core timber hinged door and frame system certified to **Rw 28dB** including seals**: OR** ➢ Glazed sliding door with 10 mm glass and weather seals		**Bedrooms**: ➢ Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10 mm single or 6mm-12mm-10mm double insulted glazing (**R_w+C_{tr} 28 dB**). Sealed awning or casement windows may use 6 mm glazing instead**: OR** ➢ Up to 60% floor area: as per above but must be sealed awning or casement type windows (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 25dB): OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr28 dB : OR** ➢ Up to 80% floor area: As per Bedrooms at up to 60% area (**R_w+C_{tr} 31 dB**).			

Freight Rail
Quiet House Requirements

(*Based on Table 3 of State Planning Policy 5.4 2019*)							
Exposure Category	**Orientation to corridor**	**Acoustic rating and example constructions**					
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor Living areas**	**Mechanical ventilation/air conditioning considerations**
C+ **Quiet House C+**	**All Facades**	**Double brick: two leaves of 90mm clay brick masonry with:** ➢ A 50mm cavity between leaves ➢ 50mm glass wool or polyester cavity insulation (R2.0+) ➢ Resilient ties where required to connect leaves **Double brick: two leaves of 110mm clay brick masonry with** ➢ 50mm cavity between leaves and R2.0+ cavity insulation	**Bedrooms** ➢ External doors to bedrooms facing or side onto the corridor are not recommended. **Indoor Living and work areas** ➢ Fully glazed hinged door with certified **Rw+Ctr 31dB** rated door and frame including seals and 10mm glass**: OR** ➢ 40mm solid core timber frame and door (without glass or with glass inserts not less than 6mm), side hinged with certified **Rw 32dB** acoustically rated door and frame system including seals	**Bedrooms**: ➢ All windows comprise minimum 6mm thick laminated or toughened glass in sealed awning or casement type frames. Polymer (e.g. uPVC) window framing should be used (**R_w+C_{tr} 31dB**). **Indoor Living and work areas** ➢ Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulted glazing (**R_w+C_{tr} 31dB**) **: OR** ➢ Up to 60% floor area: As per Bedrooms at up to 40% area (**Rw+Ctr34 dB**)	**To R_w+C_{tr} 45dB** ➢ To al bedrooms, 2 layers of 10mm plasterboard, affixed using steel furring channels beneath ceiling rafters/supports**: and** ➢ R3.0+ insulation batts laid in cavity **: and** ➢ Concrete or terracotta tile roof with sarking, (No metal sheet roofing)	➢ At least one outdoor living area located on the opposite side of the building from the corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum **2.4 metres** height above ground level	➢ Acoustically rated openings and ductwork to provide a minimum sound reduction performance of Rw 40dB into sensitive spaces. ➢ Evaporative systems require attenuated ceiling air cents to allow closed windows. ➢ Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements ➢ Openings such as eaves, vents and air inlets must be acoustically treated, close or relocated to building sides facing away from the corridor where practicable.

GLEN IRIS ESTATE

APPENDIX 7
LANDSCAPE AND PUBLIC OPEN SPACE STRATEGY

Glen Iris Estate

Landscape Strategy for Local Structure Plan
Eastcourt

December 2023

emerge ASSOCIATES

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REVISION	DATE	ISSUE OR AMENDMENT	BY	REVIEWED
A	June 2021	Issued for approval	CN	CN
B	Sept 2021	Issued for approval	CN	CN
C	March 2022	Issued for Text Update to page19	CN	CN
D	April 2022	Issued for Text Update to page 5	CN	CN
E	July 2023	Structure Plan Modifications	XZ	SM

1.1 General

The proposed redevelopment of the former Glen Iris golf course has created the need for a planning design to create residential housing including the provision of considerable areas of landscaped open space in a generally somewhat constrained space. The redevelopment includes planning for between 550 and 600 residential dwellings of varying densities in areas between the existing residential uses adjoining and surrounding the site. The use of landscaped open space is critical in providing for the needs of new and providing additional amenity to all existing residents. The project broadly consists of north, central and southern residential precincts.

It was noted during the extensive community consultation phase of the design process that the opportunity exists for a more diversified and broader accessible open space network than the previous fenced and single use golf course. The planning layout and landscape design have worked together to maximise the access and usability of the open space areas as a broader green link network with the aim of connecting precincts both within the new development and with the existing development surrounding the site.

1.2 Landscape Approach

The nature of the project as an infill redevelopment offers the opportunity to both create new existing open space precincts in its own contemporary style and also to be complimentary and mindful of the retention and expression of the sites existing older character. The overall intent of the landscaped open space design is encompassed below:

- To reflect and respond to the key existing landscape elements and character of the site in order to maintain visual continuity between existing and new precincts wherever reasonably possible. This includes built form and landscape treatments within streetscapes and open space.
- To provide safe external environment for the quiet enjoyment of the residents, guests and the general public.
- To best cater for the lifestyle needs and aesthetic desires of the existing residential community within the bounds of the capacity of the development to do so.
- To best cater for the lifestyle needs and expected desires of the new future residential community in reference to their anticipated demographics.
- To provide integrated public access that links with the existing residential, street and path network with a strong sense of movement opportunity, options and legibility as part of a broader open space green link strategy.
- To retain mature trees where ever reasonable and practical to do so within the bounds of the projects delivery and approval requirements.
- To provide a more environmentally sustainable outcome than the prior land use as a golf course, inclusive of the use of sustainable design practices as applied to new works.
- To consider habitat retention and creation in various methods including vegetation retention and replanting.

- To clearly define various landscape design typologies as applicable to all areas of open space to assist in the provision of facilities and legibility.
- To manage fire risk in a creative and aesthetic manner while meeting required standards and obligations.
- To respond to the local colour palette with either matching or complimentary colours and textures with the aim of visually minimizing visual impacts and blending where possible.

1.3 Private Realm Strategy

The project's private realm consists of landscaped open space within private residential lots in both front and rear yards. In the case of higher density strata development areas, the open space consists of common areas for access and the use of those strata residents as well as private open space to balconies and courtyards in accordance with R-Code requirements.

It is envisaged that landscape guidelines will be provided to residents as part of their purchase process to assist them in making informed landscape choices around design, aesthetics, sustainability and maintenance. In all cases the private realm will be under the care and control of the individual resident or the strata body.

1.4 Public Realm Strategy

Generally the public realm includes primarily the landscaped open space and path network within the proposed development and its linkages to the existing adjacent and surrounding open spaces networks and streetscapes. The landscape design aims to:

- Provide clear, direct, safe and compliant access around and through the proposed development
- Positioned to ensure the retention of a significant number of existing mature trees in new parks and linear interface buffers adjoining existing residences.
- Be designed and installed to integrate and manage fire risk to the required areas of the landscape treatment
- Provide open usable informal grass recreation space for new and existing residents visitors and the general public.
- Provide shaded seating as a point of refuge on the pedestrian and cycle networks
- Provide suitably sized central play facility befitting the character and history of the site.
- Provide small informal play area for general public use.
- Provide shady endemic native and exotic trees for respite.
- Provide signage elements for clarity of pedestrian and cycle movement.
- To cater for a range of demographics, user groups and skill levels.

Braithwaite Park, Emerge Associates

Newhaven, Emerge Associates

Secret Harbour, Emerge Associates

1.5 Changing Demographics

The demographics of the existing Glen Iris locality is generally characterized as a mature suburb with a large proportion of long standing residents. There is a lower than average number of children or adolescents and young people living in the locality. It is understood that grandchildren are somewhat present when visiting the existing residents. The anticipated demographics of new residents is younger than the existing Glen Iris age cohort. New residents will bring a range of children ranging in ages from school age children to older teens as part of a general second and third home buyer profile. It is not currently expected that first home buyers will be significantly present within the new development based on proximity, lot size and anticipated pricing structures.

1.6 Open Space Distribution

The proposed open space typologies are arranged to provide a range of experiences and also a range of facilities within both vehicular and walking proximity to all new and existing residents of Glen Iris and Jandakot generally. The landscape plans attached identify the open space distribution and strategy.

1.7 Open Space Typologies

Broadly the open space areas within the project consist of set landscape and use typologies. These typologies are determined by a number of factors including size of the open space, grade / levels and grade within the open space, the amount and location of gravity surface runoff, tree retention ability, habitat retention and creation, usable and safe walkable linkages.

The four open space typologies include:

1. Focal open space

The proposed design consists of four distributed larger open space areas suitable for community gathering and active informal recreation. These four parks are distributed reasonably evenly throughout the proposed redevelopment. These parks cater for a range of informal active recreation uses and a mix of passive recreation uses. These larger areas of open space have the ability to cater for tree retention and larger areas of surface runoff drainage storage and management.

2. Access open space

The proposed design consists of a series of access open space areas. These open space areas are characterized by providing a strong open space link between other open space typologies. In so doing, these open spaces provide a critical role in creation of a continuous green link option for pedestrian and cycle movement around the redevelopment. The linear nature of these open space links allows for the retention of vegetation, while the width of these open spaces enables the inclusion of series of public facilities accessible for existing and new residents.

3. Pocket park open space

The proposed design locates a number of smaller open space areas set within the residential zone. These smaller open space areas are located to provide a range of localized incidental benefits including visual softening among the residential zone, walkability rest and respite via shade and seating, and in some cases specific associated needs such as low point drainage management and existing landmark specimen tree retention.

4. Buffer and linking open space

The proposal consists of a series of linear open space links. The nature of these open space areas ranges from road reserves with a widened verge to one side, to narrow buffers suitable to cater for a linking path and low planting between existing and new residences. The internal function of these spaces is to act as an access link.

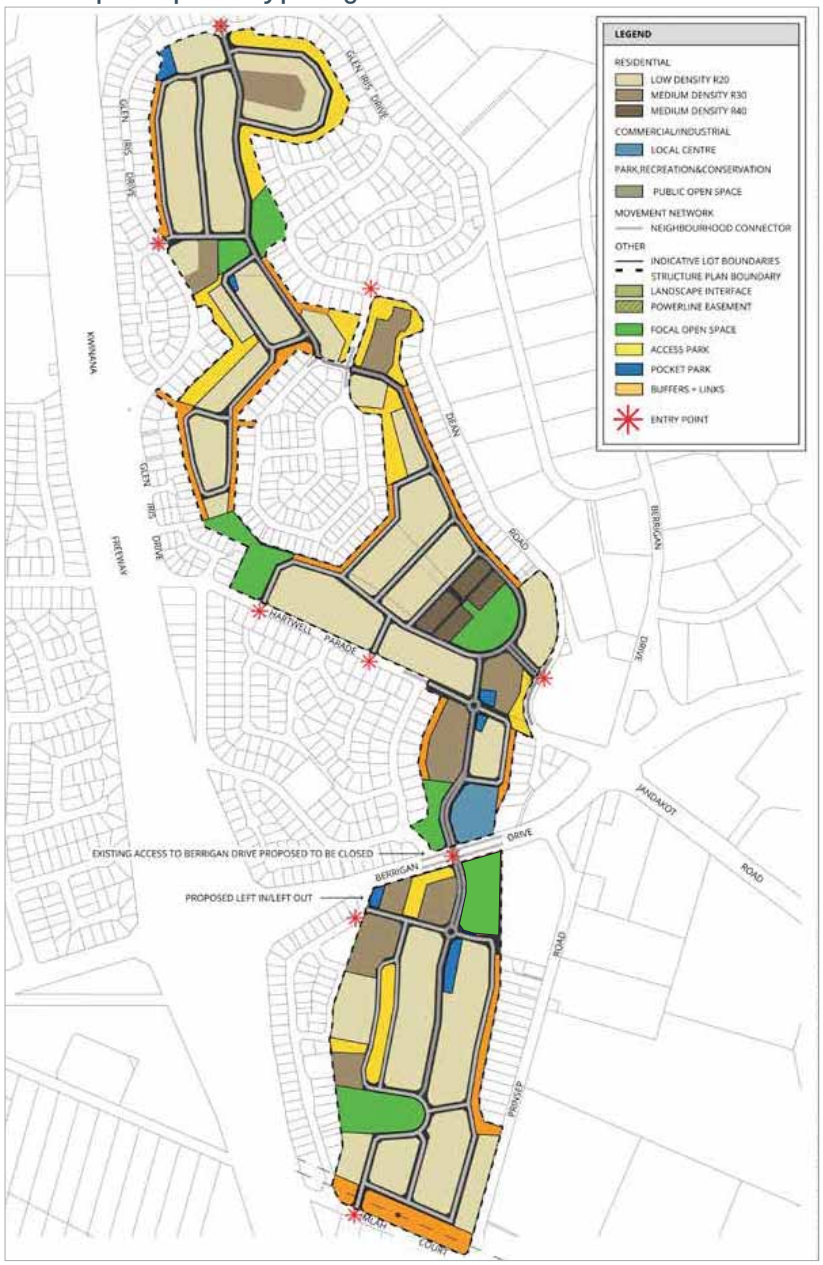
Bibra Lake Regional Playground, Emerge Associates

Bibra Lake Regional Playground, Emerge Associates

Braithwaite Park, Emerge Associates

Evermore Heights, Emerge Associates

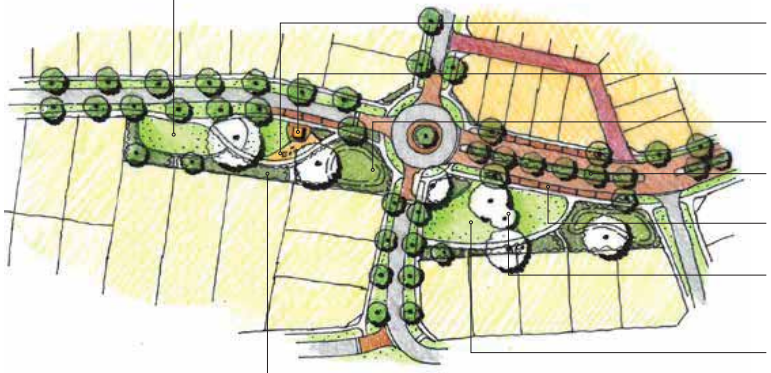
1.8 Open Space Typologies Visual



FOCAL OPEN SPACE CONCEPT DESIGN EXAMPLE

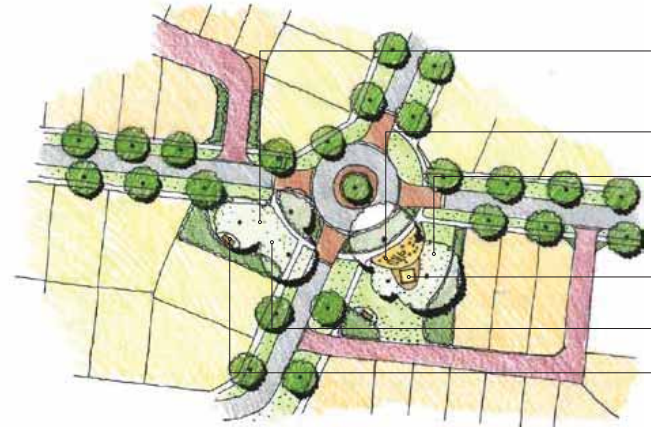
- HABITAT PLANTING TO QUIETER ZONE
- MIXTURE OF PLAY ELEMENTS & NATURE PLAY ELEMENTS SET AMONGST EXISTING TREES. PLAY AREA SET ON AXIS VIEW
- PLANTED DRAINAGE BASIN
- FEATURE SHELTER SET ON AXIS VIEW
- 50m X 30m OPEN LEVEL GRASS KICKABOUT AREA
- CAPARKING ADJACENT PARK
- RETAIN & PROTECT SIGNIFICANT EXISTING TREES
- 50m X 40m OPEN LEVEL GRASS KICKABOUT AREA

ACCESS PARK CONCEPT DESIGN EXAMPLE



- 30m X 10m INFORMAL GRASS AREA
- NATURE PLAY TRAIL
- FEATURE SHELTER
- PLANTED DRAINAGE BASIN
- PLANTED BOULEVARD
- CAPARKING
- RETAIN & PROTECT SIGNIFICANT EXISTING TREES
- 50m X 15m GRASS KICKABOUT AREA
- HABITAT PLANTING TO QUIETER ZONE

POCKET PARK CONCEPT DESIGN EXAMPLE



RETAIN & PROTECT SIGNIFICANT EXISTING TREES

NATURE PLAY TRAIL

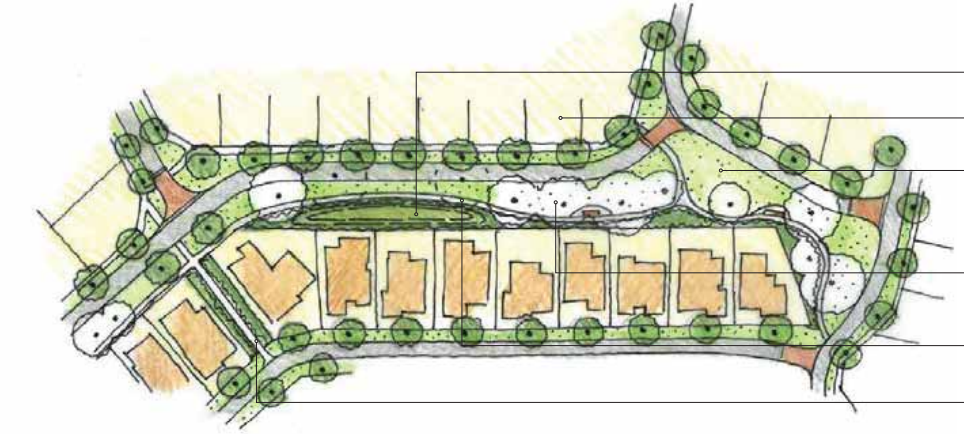
INFORMAL GRASS AREA

FEATURE SHELTER

SHADY GRASS AREA

BENCH SEAT

LANDSCAPE BUFFER WITH ROAD FRONTAGE CONCEPT DESIGN EXAMPLE



PLANTED DRAINAGE BASIN

NEW RESIDENCES

OPEN GRASS AREA

RETAIN & PROTECT SIGNIFICANT EXISTING TREES

PEDESTRIAN FOOTPATH

RIGHT OF WAY PEDESTRIAN CONNECTION

LANDSCAPE BUFFER WITHOUT ROAD FRONTAGE CONCEPT DESIGN EXAMPLE

NEW RESIDENCES

ACTIVE OPEN SPACE

PEDESTRIAN FOOTPATH SET AMONGST LOW SHRUB PLANTNG & GRASS

LIGHTING SET AT LOW PHYSICAL LEVEL

SHADY TREES AT REGULAR INTERVALS

EXISTING RESIDENCES

Glen Iris Estate

1.9 Landscape Masterplan

KWINANA FREEWAY
GLEN IRIS DRIVE
PARADE
KOORALBYN VALLEY CRESCENT
FAIRWAY PARK
DEAN ROAD
CAPRICORN PARK
GLEN IRIS DRIVE
LAKES WAY

Glen Iris Estate

1.10 Functional Layout Masterplan

KWINANA FREEWAY
GLEN IRIS DRIVE
PARADE
KOORALBYN
VALLEY
FAIRWAY PARK
CRESCENT
GLEN
IRIS
DRIVE
CAPRICORN PARK
DEAN ROAD
LAKES WAY

1.11 Public Facilities

The development proposes to build upon existing public facilities whilst catering for new residents via a range of new publicly accessible facilities. The extensive community consultation process and discussions with the City of Cockburn technical staff have identified a number of desirable public facilities including:

1. Informal larger play areas disbursed through the focal parks to cater for informal recreation activities eg: informal touch football, ball games, unstructured training, frisbee, kite flying, dog exercise and the like.
2. Defined personal training areas. It is envisaged that areas set aside for small gatherings of residents and visitors to allow for use/hiring for personal training and bootcamp type events. This is intended to cater for a variety of local age groups and skill levels. The landscape design can provide definition to these areas via small level changes and path and wall layouts.
3. 3. Playground facilities – it is noted that the need for a major regional facility is already catered for externally to the development area. It is proposed that a mid order play facility is located within the development to cater for the expected increase in local use and change in demographics. The aim is to design play elements that complement the existing retained play elements within Glen Iris rather than copy them, this will better provide a range of user experiences.
4. 4. Smaller play elements generally associated with nature play items located in discrete locations along the green links as part of a broader play trail running through the proposed development. This caters for smaller residential local precincts and also acts as a combined whole with each nature play area having a different type of play offering to those retained play elements currently in the Glen Iris.
5. Shelter structures with picnic settings to select locations where residents are encouraged to stop and stay for a while. These are generally associated with play elements and view axis lines from adjacent roads.
6. Electric BBQs are proposed to a couple of select locations as part of a social gathering and mixing initiative catering for smaller family groups and family scaled events.
7. Fitness elements are proposed as part of the broader green link design approach. This is in response to community feedback gained from the community consultation process.
8. Walking trails are proposed to occur through the green link network and are to be denoted via signage and colour coded elements to identify trails of various lengths and difficulty to suit a variety of users (eg: 1km, 3km, 5km, 7km). It is envisaged these trails will form a key tool in encouraging greater social interaction between existing and new residents.
9. Cycle trails are proposed to meander through the proposed development primarily on a path system with suitable signage and in some locations this may also occur partly onto the road system where low vehicle flow is to occur.
10. Dog walking trails and facilities are proposed to be included generally in alignment with the walking trails. These may include rest points in shade, taps and fixed dog bowls and discrete areas containing dog agility elements as part of a broader walking network.
11. A hard surface ball court is proposed to provide an active focus for teens. The final location of these facilities will be subject to detail design to mitigate noise impacts to adjacent residents but also to maintain clear and open view lines for passive surveillance.
12. Embayment carparking is proposed adjacent to the larger areas of open space and along certain streets. The car bays will cater for local visitors and a variety of social events and informal activities.
13. Street furniture is proposed to occur to defined set locations for the comfort of open space users. This will be inclusive of seating, table settings, drink fountains, select bollards and the like.
14. Public art is proposed to occur either as a larger landmark element on key view lines or as smaller discrete art elements to be discovered as part of the green link approach perhaps set into paving or on to low walls and the like.
15. A 3 phase power outlet is proposed for the larger open community gathering grass space to cater for possible periodic larger scaled community events.

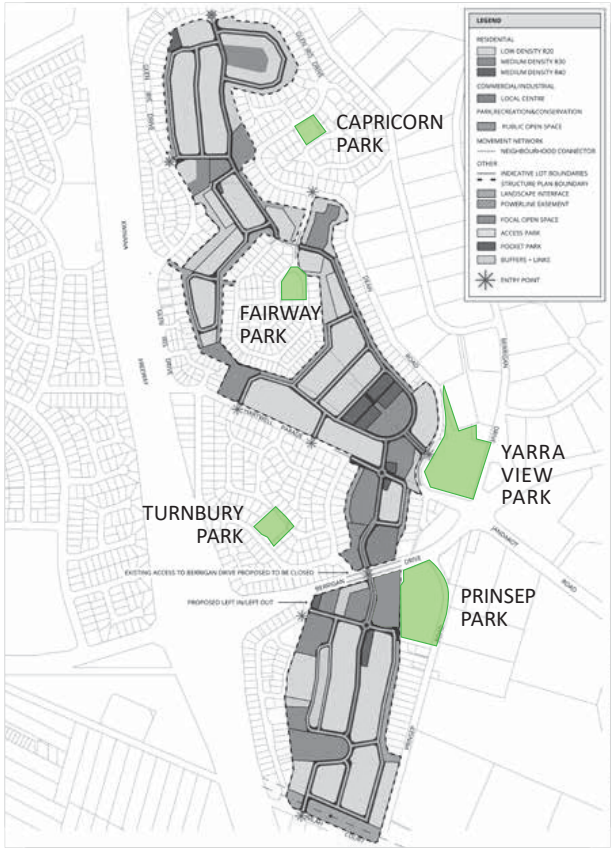
Dalyellup Beach, Emerge Associates

Evermore Heights, Emerge Associates

Osprey Waters, Emerge Associates

1.12 Existing Open Space Facilities

Glen Iris has 5 existing parks that form part of the current local urban layout that are well used and loved by the local community. Each has differing sizes and facilities catering for the local population and visiting public as summarised below. It is not proposed that any reduction in the existing public open space areas is to occur. The new open space network aims to be complimentary to the existing parks and their facilities.



A. Prinsep Park

This is a large neighbourhood scale park with minimal facilities. There is a large open grass kickabout area centrally located to the park bounded by clumps of taller native trees and stands of native bushland shrub vegetation forming bushland. The park appears to be well maintained but somewhat underutilised for its scale with limited public facilities. A simple path system and a shelter and table setting front onto the central grass area. Access into the park is currently difficult as it occurs mainly off major roads and intersections bounding the park.

It is noted that officers from the City of Cockburn have indicated there is the current need for a formal oval playing surface somewhere in the Glen Iris area as part of a broader growing need within Jandakot and Treeby. One possible option suggested by the City is its inclusion by reimagining the existing Prinsep Park on the corner of Berrigan Drive and Prinsep Road given the parks size can cater for an oval. Should the City wish to pursue this option it will be subject to a separate application process led by the City and is not part of the proponents proposal.

B. Yarra View Park

This is a large neighbourhood scale park with numerous facilities including a dedicated carpark for approx 20 cars. Existing native mature trees are located internally within the park with mature exotic street trees located to street edges. There is a large grass kick about area that doubles as a drainage overflow basin. There are 2 off lead fenced dog agility areas that exist with gate access and a variety of dog agility elements that cater for local and visiting dog walkers.

An existing off the shelf plastic playground is set in a sand base which caters for a variety of play and user ages from 4 to 10. Individual standalone small play elements exist in grass outside of the main play area for 2 – 4 year old users. Bench seating is set into the park near existing path system and there is a picnic shelter and table setting overlooking the usable grass area. There is a partly fenced basketball court in a raised area within the park that caters for teens.

C. Turnbury Park

This is a local scale park that is well maintained with central open grass kickabout area and numerous exotic shade trees set in grass. A central off the shelf plastic playground currently caters for 2-10 years of age and includes an off the shelf climbing wall and swings. A small basketball half court caters for teens as active semi formal play. There is a BBQ located in the park but no table setting. There is bench seating located under trees overlooking the grass area.

A large feature brick arbor at the main entry point adds formality and shade but has no particular usability or shaded seating. Hedge planting along the road edge limits some views from Turnbury Park Drive. The park has its own bore. Residents directly side onto the park and view over park inclusive of areas of detailed exotic shrub planting in a domestic character and scale.

D. Fairway Park

Generally the park consists of a central open grass kickabout area bounded by a variety of shrubs and hedges interspersed with a variety of mature native and exotic nature trees. A children's play area caters for toddlers and young children in a fairy garden character inclusive of off the shelf play items and with a small amount of specialised themed equipment for imagination play with a seesaw all set in a white picket fence. The park contains a bore and is well maintained and is overlooked by adjacent residences and bounded in part by a residential scaled road system.

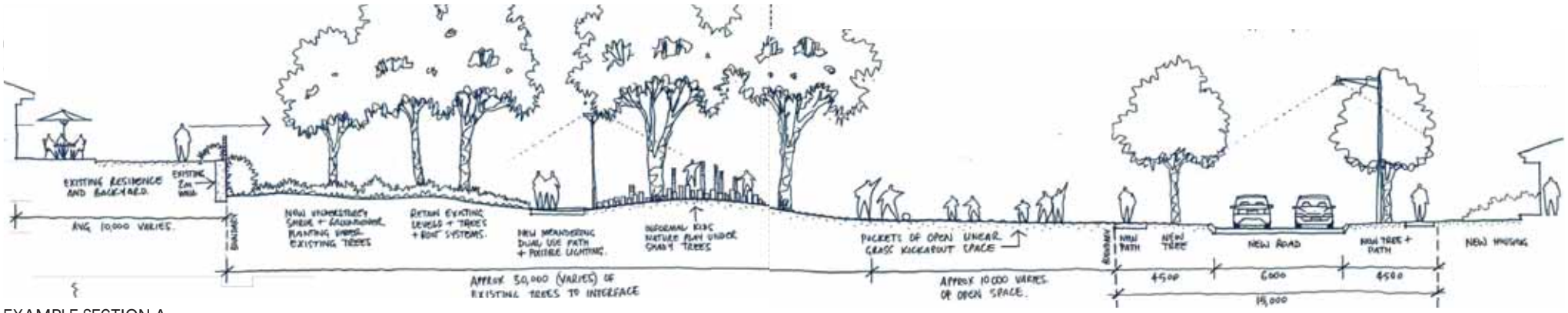
E. Capricorn Park

The park is located on a hilltop location with views to the surrounding area. Pockets of retained mature native vegetation inclusive of mature native trees exist with mature exotic trees located along adjacent street edges. A meandering concrete path is set into pockets of sloped grass set among native planting beds. An off the shelf playground set in a sand surface is nestled into bushland adjacent to residents side boundary fence with a single solar light located nearby. The playground appears well maintained and caters for children 2 - 10yrs and generally the park is in good condition. The park has low passive surveillance and is not particularly safe with limited street visibility. No seating is evident within the park.

Glen Iris Estate

Sunrise, Emerge Associates

Brighton, Emerge Associates



EXAMPLE SECTION A

Braithwaite Park, Emerge Associates

Spire, Emerge Associates

Braithwaite Park, Emerge Associates

Allara, Emerge Associates

1.13 Interface to Existing Residences

The former golf course was directly backed onto by existing one and two storey residential housing. Some of the adjoining existing residential land is elevated above the subject site. In all instances, private rear fences along the boundary interface generated the safety and security necessary for the respective residence. Under the proposed development approvch the edge treatment between the existing residences and the new development will be managed in a variety of ways including:

- Upgrading to the existing rear wall and fencing where suitable and necessary subject to need, levels and impact with the work to be managed by the developer at 50/50 shared expense in consultation with individual affected adjoining landowners.
- The creation of new walling and/or fencing where suitable and necessary subject to levels and the impact of any alterations proposed by the development.

The design of the interface may be managed in a variety of ways including but not limited to:

- The backing of new housing directly onto the rear of the existing residence creating a typical residential rear boundary interface.
- The creation of a road and streetscape to the rear boundary of the existing residence.
- The creation of open space to the rear boundary of the existing residence.
- The creation of an access and buffer strip to the rear boundary of the existing residence.

1.14 CPTED & Passive Surveillance Approach

The landscape design of open space and streetscapes will take into consideration various crime prevention through environmental design (CPTED) principles. Noting the extent of open space and the connected nature of the path system, passive surveillance over the open space areas is a key part of the developments safety and security approach. The design of the open space landscape treatments combined with orientation of the open space to roads, paths and new and existing residences enables passive surveillance over parks.

The height of rear boundary fencing and possible semi permeable detailing enables interaction. In addition the use of level changes where required allows for some overlooking of open space areas. The location of trees, furnishings, and play elements will be arranged to not impede views to smaller open space areas.

Shrub planting will typically be lower shrubs and groundcovers to minimize the ability for hiding. The location of key facilities will be set ion key view lines from adjacent streets inclusive of car headlights illuminating various elements. The use of lighting has been described elsewhere within this document.

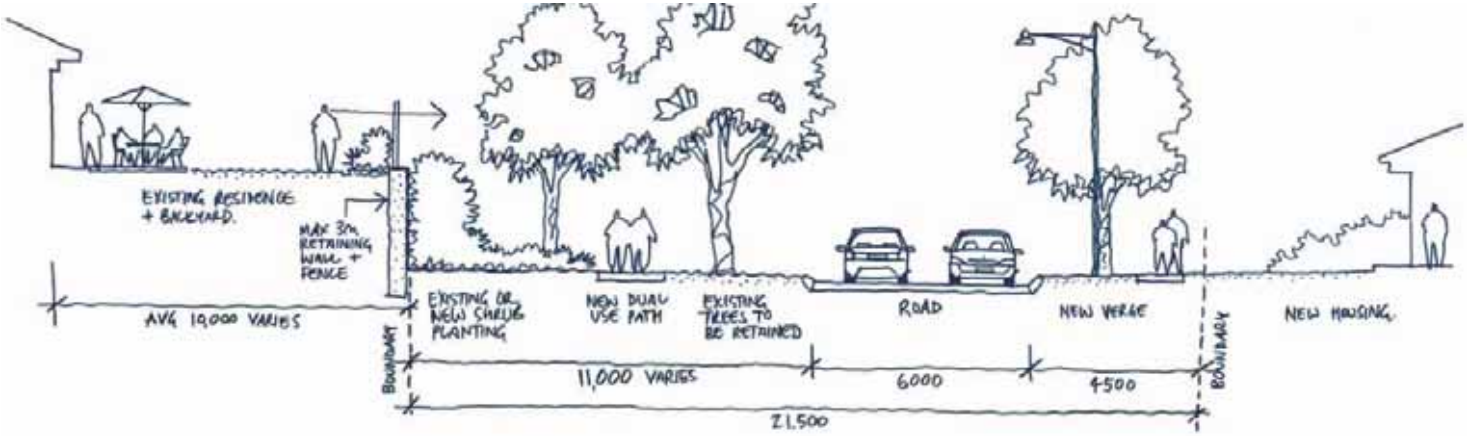
1.15 Existing Adjacent Public Open Space Upgrades

The Glen Iris precinct has a number of existing parks throughout the existing residential areas that are well used and loved by the local community. It is not proposed that any reduction in the existing public open space areas is to occur.

Osprey Waters, Emerge Associates

The Sanctuary, Emerge Associates

The Sanctuary, Emerge Associates

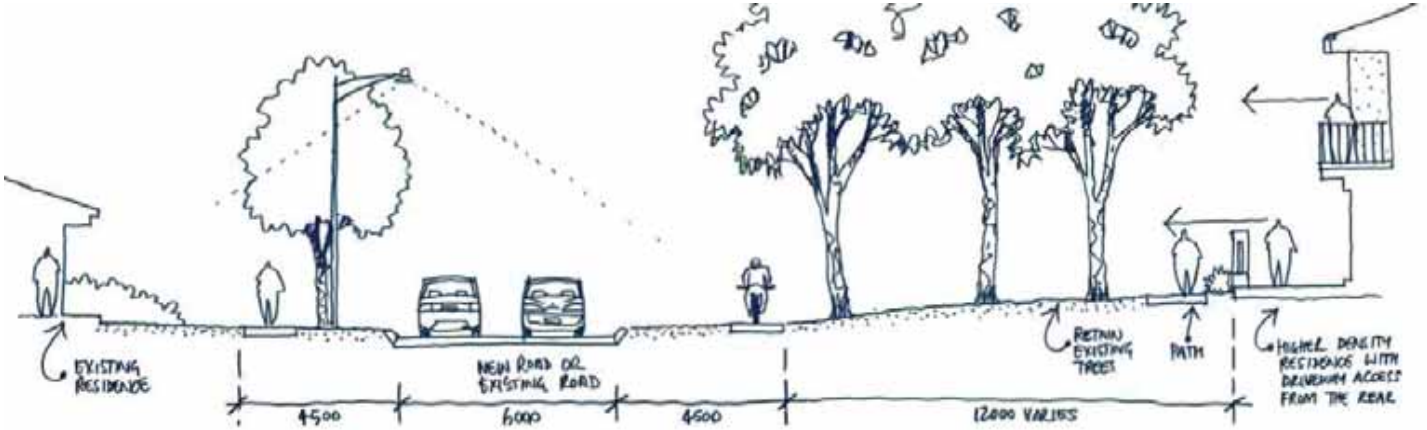


EXAMPLE SECTION B

The Sanctuary, Emerge Associates

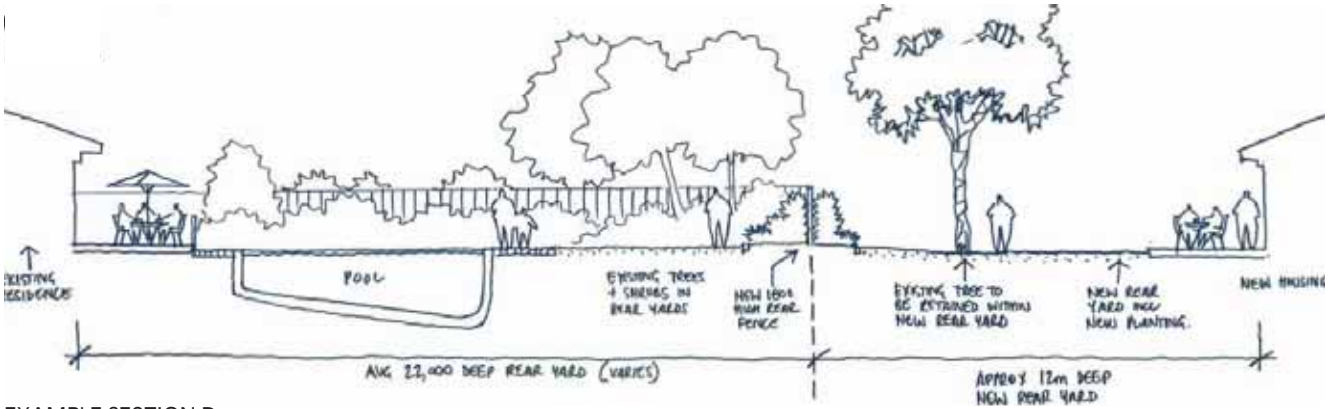
Heritage Park, Emerge Associates

Shoreline, Emerge Associates



EXAMPLE SECTION C

Lakeway, Claremont



EXAMPLE SECTION D

Lakeway, Claremont

1.16 Streetscapes

Road Hierarchy

The proposed road network will consist of a variety of typologies to better define planning legibility to the user, including:

- A series of entry points into the proposed development that will aim to define the edge of the new works without being completely divorced from the character, colour and finish of the existing Glen Iris residential area.
- Collector roads. These will distribute traffic into and out of the proposed development, these will have defined larger future tree stock to recreate the meandering shady drive as the most travelled roads. The opportunity for drainage management exists based on the generally wider road verges.
- Residential streets landscape type 1: These streets are generally longer and more direct in their layout and will have a series of tree species befitting this street type.
- Residential streets landscape type 2: These are smaller shorter residential streets which act as much more localized road element in some cases as cul-de-sacs.

In all cases the provision of shade and canopy cover is paramount and in keeping with urban green canopy coverage aims and the reduction of the urban heat island effect wherever possible.

Existing Streets

The existing streetscapes in Glen Iris are one of its key defining character and landscape features. The intention is to retain the existing streetscapes as is, and to aim to replicate elements of this avenue approach in the proposed streets where possible. It is proposed that in the order of 500 existing mature trees will be retained within the proposed open space areas, and more than 1,000 new trees will be planted across the new development in open space and streetscape areas. This is in addition to the trees to be retained within existing streetscapes in and around the surrounds of the site.

Widened Road Reserves

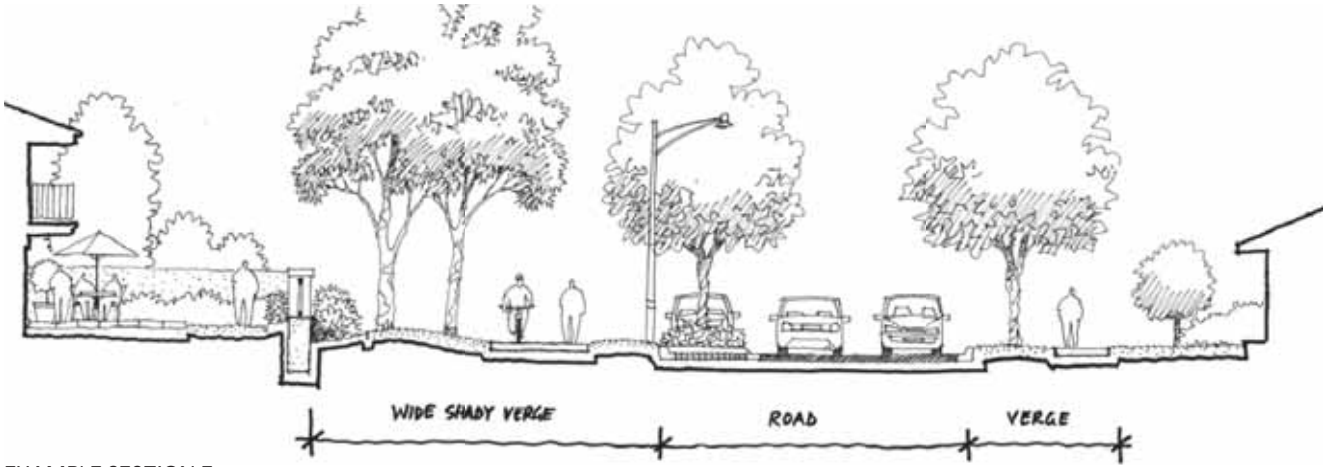
Select streets are proposed to have an offset road carriageway and a widened verge to cater for a widened 2.5m dual use footpath and a shady double tree avenue either side of the path, which will act as a key part of the broader safe and secure green link movement network through the proposed development. This enables access to occur off street and can cater for visitors carparking in select locations in addition to flush kerbing and drainage swales in select locations - subject to future detail design.

New Roads

New road design will cater for street tree planting and the broader safe and secure green link network. Street tree planting will be selective and will be variable to bring a variable character to different streets.

Traffic Calming

In locations of longer lengths of straight residential roads the inclusion of traffic calming may be employed to assist in slowing traffic speeds and allowing crossing points are suitable locations and allow for additional landscape softening. Locations of traffic calming will need to pay due regard to driveways and lot access and footpath road crossings.



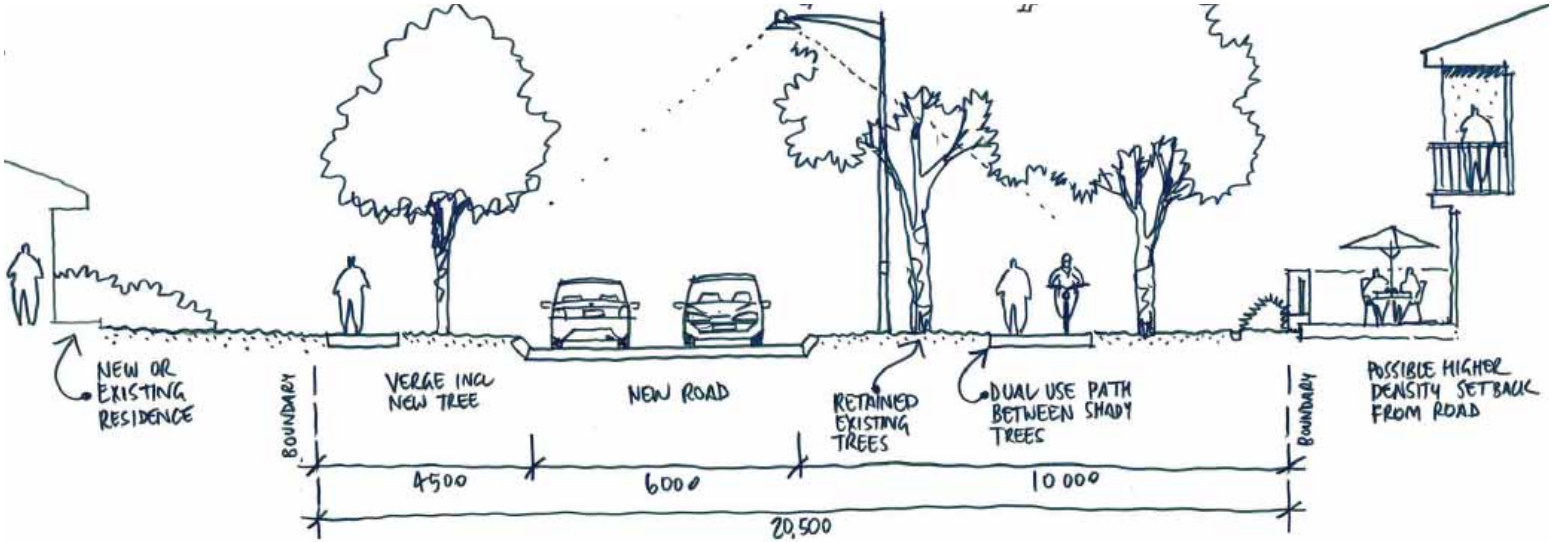
EXAMPLE SECTION E

Jacob's Ridge, Queensland

Lakeway, Claremont

Newhaven, Emerge Associates

Baldivis Town Centre, Emerge Associates

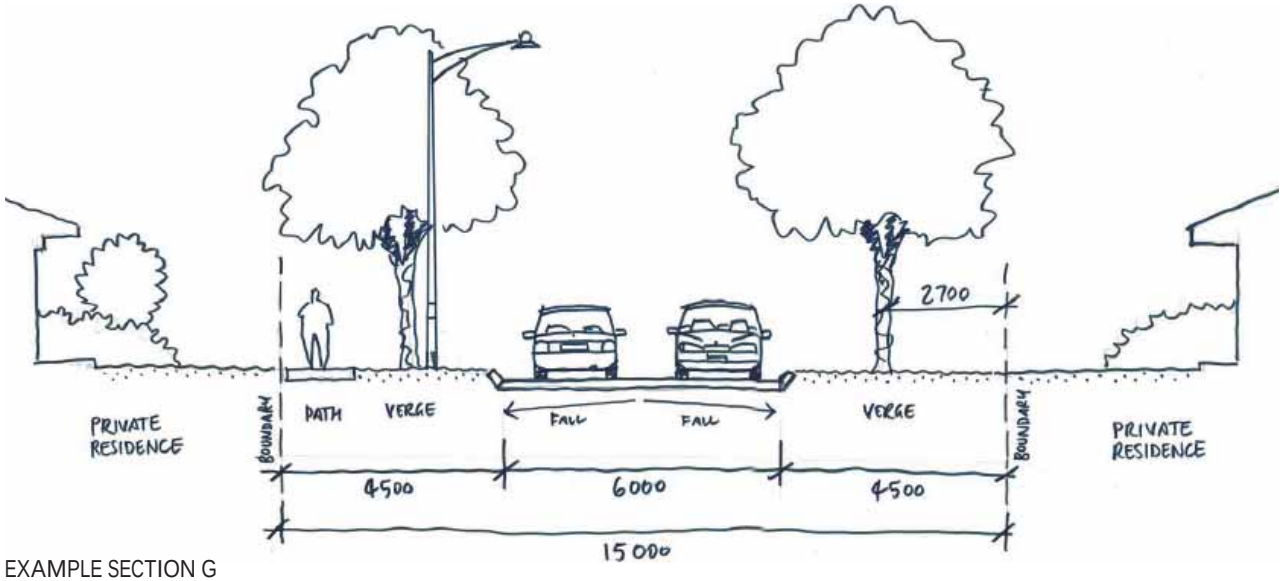


EXAMPLE SECTION F

Baldivis Town Centre, Emerge Associates

Vale, Emerge Associates

Bushmead



EXAMPLE SECTION G

Honeywood, Emerge Associates

Lakeway, Claremont

1.17 Tree and Plant Species

An indicative plant list and select imagery has been included within the attached drawings in support of the proposal. While the list is subject to refinement in consultation with the City of Cockburn, it clearly defines the plant species approach and intent. Planting will consist of a mix of mature stock for specific uses and high profile location purposes, and smaller nursery hardened off stock for mass planting purposes.

The planting strategy consists of the following three principal approaches:

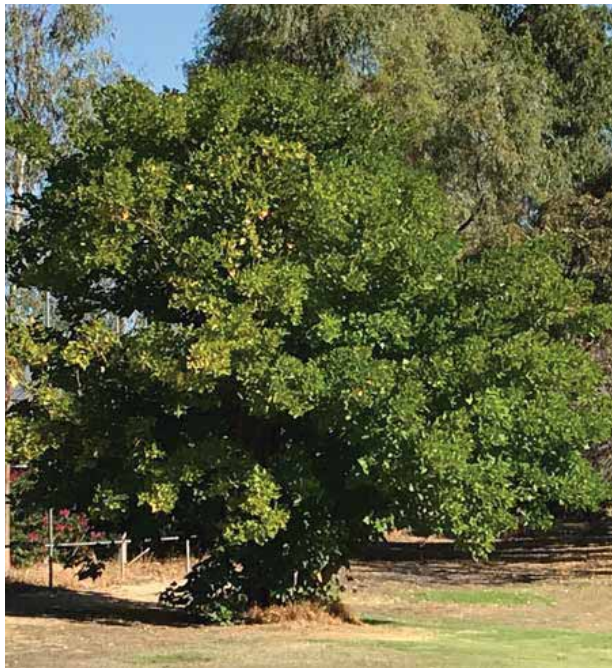
a. Retained trees. The retention of existing trees from the golf course rough areas in between the various former fairways is proposed. This creates instant visual effect, retains shade and habitat and maintains an element of the site's former use.

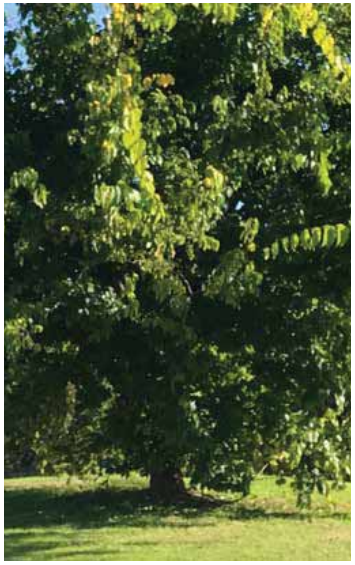
b. Transplanted trees. The preparation and transplanting of existing trees is possible based on the diversity of species currently located on the site. Existing transplantable trees include but are not limited to: Norfolk Island Pines, Plane trees, Palms of various species, Cape lilacs (subject to approval), WA Peppermints, Liquidambers, casuarinas, ficus species, melaleuca species and grass trees.

c. New tree planting. The proposed development intends on undertaking a new tree planting regime for streetscapes and parkland areas. The final extent and species mix will be subject to approvals and availability. In addition to planting in public areas, the planting of trees is also encouraged in the private realm noting the generally larger sized residential lots proposed for this development.

The new planting selections are aimed at achieving the below criteria:

- Being of local character.
- Preferably being endemic and native to the site area.
- Not being invasive by habit and not containing any declared weed species.
- Being hardy to local soils, wind and salt tolerant and with lower water needs.
- Where required and suitable, being of low fire fuel creation and load as a key part of fire management to the margins of the development.
- Promoting the local ecosystem as habitat for a range of endemic fauna.
- Being of a series of attractive and contrasting foliage, colour and form to enable design based planting and displaying the diversity of the local environment.
- Having a selection of species that ideally enable some to be seasonally flowering at all times of the year.
- Being of suitable form and habit to promote shade where suitable and to either open or screen select views.
- Being of species that are readily commercially accessible and available for future replenishment.





Verge Planting

Scaevola ‘Purple Fanfare’

Melaleuca incana ‘Nana’

Adenanthos cuneatus ‘Coral Carpet’

Hemiandra pungens

Grevillea obtusifolia prostrate

Westringia mundi

Eremophila glabra

Myoporum parvifolium purpurea

Lomandra tanika

Feature Planting

Grevillea obtusifolia prostrate

Beaufortia squarrosa orange

Westringia fruticosa ‘Smokey’

Scaevola ‘Purple Fanfare’

Hemiandra pungens purpurea

Lomandra tanika

Broad Planting

Adenanthos sericea

Pimelia ferruginea

Eremophila nivea ‘Spring Mist’

Grevillea olivacea

Grevilea olivacea

Dampiera linearis

Acacia lasiocarpa

Acacia saligna ‘Green Mulch’

Acacia pulchella

Hemiandra pungens purpurea

Chamelaucium unicnatum

Calothamnus quadrifidus

Hypocalymma angustifolium

Thryptomene baeckeacea

Grevillea thelemanniana

Beaufortia squarrosa orange

Westringia fruticosa ‘Jervis Gem’

Adenanthos cuneatus

Ricinocarpus ‘Bridal Star’

Callistemon phoeniceus

1.18 Habitat Approach

The former fenced golf course created the opportunity for native fauna to use the area as part of a broader habitat area with access to shelter, shade, food and water and some degree of protection. The conclusion of the golf course use may alter aspects of this until such time as the new open space can be created and established. The City has indicated its support for the creation of a series of smaller habitat zones within the proposals open space areas that encourage the survival and retention of native fauna in the area. The final locations will be determined based on existing vegetation, suitable seclusion from humans.

Avian fauna will be able to access the site and use its existing retained trees as it always has done, albeit noting that works may see some degree of disturbance. Ultimately new tree planting will rise to provide generational change to the existing tree stock currently providing habitat. The retention of trees individually, in clumps and in avenues, encourages the retention of existing fauna.

Ground dwelling native fauna will have access to the site noting that construction will occur in stages allowing fauna to adjust to newly created open space areas as the environment transitions over time. As the landscaped areas are installed and mature over time, it is envisaged that native fauna will return to the site from adjacent bushland areas. The proposed retention of two smaller areas of existing banksia bushland provides some continuity for habitat and cover for native fauna.

The landscape design aims to provide areas suitable for fauna to reside and move through the development over time. This will be accomplished by planting types and densities, continuous cover, pockets of refuge for example logs and rocks to lesser used areas of open space, planted drainage basins with infrequent domestic animal and human use. Education of the local existing and new community around risks to native fauna and what individuals can do to promote preservation. An item possibly worthy of examination as part of future detail design is the creation of defined native fauna refuge zones with controlled suitably sized access that limits domestic animal access.

1.19 Sustainability Approach

The landscape approach will have embedded within it a series of sustainable initiatives to be further refined at the detail design stage. These include, but are not limited to:

- Tree retention above and beyond that typical for greenfield development within parks and streetscapes.
- Transplanting of existing mature tree stock saving from destruction and retaining habitat and creating instant shade.
- Larger percentage of open space (22.9% total proposed green space) beyond that typical for greenfield development.
- A variety of storm water management initiative, techniques and inclusions to provide at source recharge including possible subsurface storage tanks.
- Planted detention basins inclusive of nutrient stripping capability in place of sumps.
- A major reduction in the existing long term groundwater draw and licensing needs for public open space maintenance, and significant reduction in the use of fertilizers and herbicides and pesticides.
- Removal of existing lined lakes and their groundwater top up resulting from evaporation and use by the former golf course for irrigation purposes.
- Relocation of native fauna (as may either be temporary or permanent)
- A variety of water wise initiatives applied to the public and private realm inclusive of a new, more efficient irrigation system.
- Retention of two small pockets of existing Banksia woodland.
- Reuse of timber removed from the site as both nature play elements and in mulch and possible select public art elements.
- Preference for use of low embodied energy materials where possible and suitable.
- Use of select LED /and solar lighting where possible and suitable.
- Creation of possible fauna habitat opportunities within open space and retention of trees suitable for avian fauna.
- A maintenance minimisation in design approach to limit cost and time impacts.
- A series of maintenance initiatives to reduce pesticides, herbicides and chemical use generally.
- The aim of creating a continuous tree canopy coverage to limit urban heat island effect and maximise green canopy coverage.
- Use of predominantly native shrub and groundcover vegetation endemic to the Swan coastal plain.

1.20 Wayfinding & Signage Approach

Wayfinding

The design of the development is proposed to be undertaken to encourage intuitive orientation and movement through the development. This is to be undertaken through the use of materials and colours to define particular movement routes, visibility to key features and elements, open viewsheds to desirable destinations and screened viewsheds to assist in directing users and promote privacy where necessary. The design of the path system is aimed at promoting connectivity through the development in an expanded, safe and efficient manner.

Signage

Signage to the development will be unified in its materials and form. Signage is proposed to be located at key decision points including points of arrival, intersections of roads and paths and at reinforcement locations along longer paths.

Signage is proposed to consist of:

- Directional signage to facilitate efficient movement within the precinct.
- Educational signage relating to the local area its habitat, features and history.
- Orientation signage pertaining to direction and distances to local places of interest inclusive of information pertaining to users' fitness and outdoor activities.

1.21 Landscape Materials & Furnishings

Landscape materials will be common to the proposed development area to bring design and character unity to the precinct while also marking quality of the new development area. External landscape materials will be generally selected to be complimentary to the local character in texture, colour and style. The attraction of the local area is intended to be reflected in the materials used. In all instances materials will be robust and fit for purpose with consideration on durability, longevity and maintenance minimization over the longer term inclusive of minimized replacement, local availability and all relevant warranties and guarantees.

Furnishings will all be off the shelf proprietary elements available locally inclusive of parts, replacements, and all suitable guarantees and warranties.

The proposed range of landscape includes:

- Stone paving finish to select higher use and feature areas and to select dry stacked look limestone feature walls befitting of a more handcrafted finish.
- A mix of exposed aggregate and plain concrete finishes to select areas.
- A mix of fencing materials fit for purpose.
- Off form concrete to select feature walls and stairs.
- Metal frames decking and structures with a variety of materials panels and finishes.
- Stabilised gravel paving to select lower use paths.
- Galvanised metal finish to select landscape elements.
- Natural loose gravel paths to select private access points.
- Natural treated timber materials for nature play elements.
- Red asphalt for select paths and higher use road areas.
- A combination of large stone, concrete and steel and/or plastic garden edging.
- Minimal timber to reduce maintenance and extend longevity.
- Low fuel mulches including sand, gravels, select organic mulches to defined areas.

1.22 Landscape Lighting Strategy

Lighting to the landscaped areas will be kept to the minimum necessary to enable safe access to select key routes and areas. The intention is that lighting is subtle but effective, directed rather than broad. There is proposed to be minimal light overspill and light pollution generated by the development.

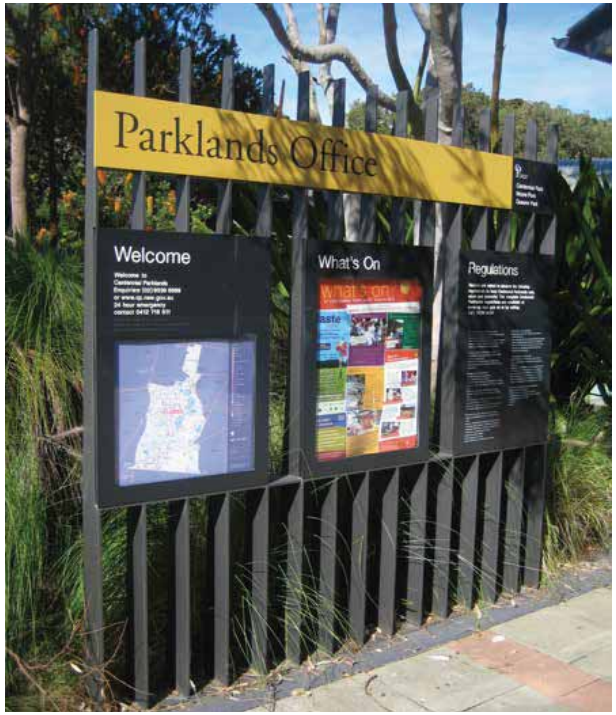
In the main, landscape lighting will be solar and/or LED or similar low electricity use equivalent and will typically be lower directed lighting to signage, doorways, roads and key paths and access routes as opposed to lighting to all access routes. Street lighting will be managed by the civil design package.

1.23 Bushfire Risk Management Landscape Response

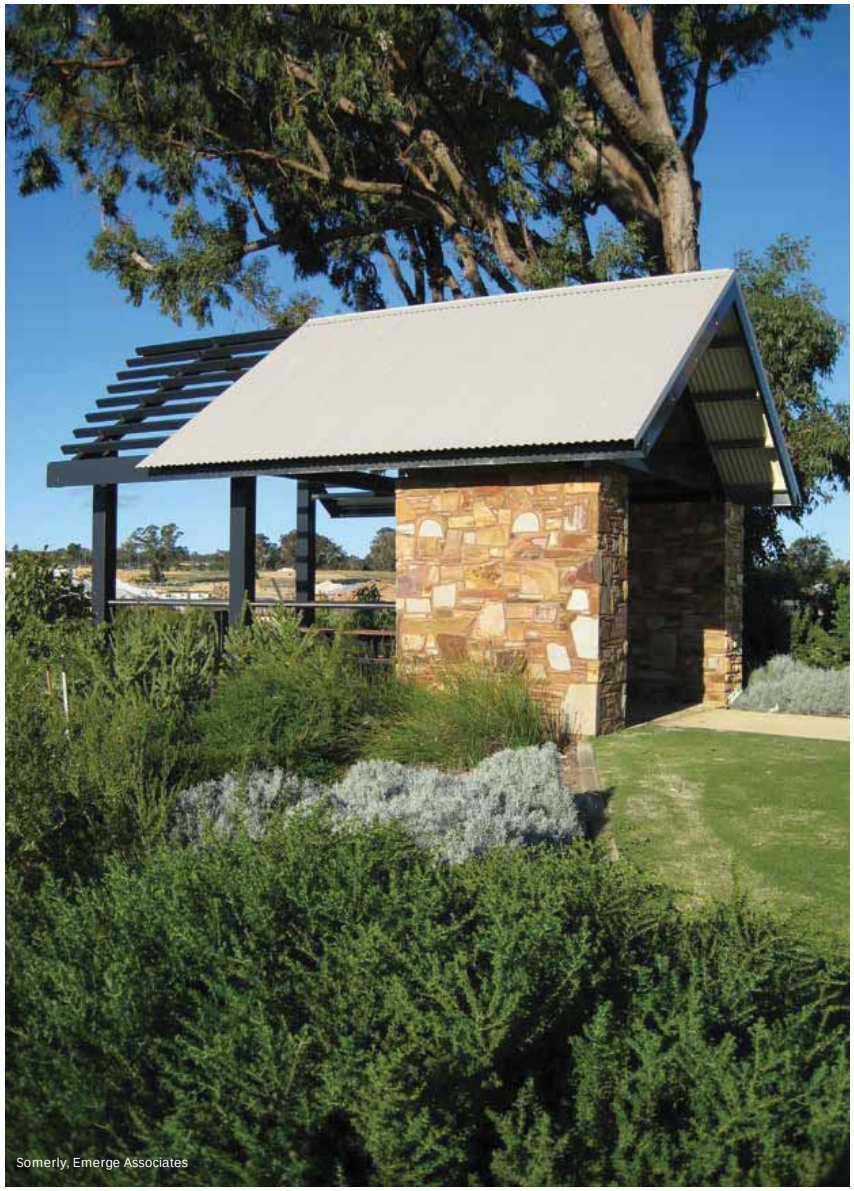
The fire setback zone occurs around most of the margins of the development where they abut a bushland fire threat. Two small areas of existing banksia bushland are proposed to be retained within the design. The resulting landscape design will respond to the projects BAL line in these two smaller defined locations and will employ the use of compliant fire management techniques to meet fire management obligations.

The landscape response will include, but not be limited to, the below in all selected effected fire management zone areas:

- Use of endemic plants and native species identified by the Department of Fire and Emergency Services (DFES) as being low fire fuel species.
- Selection, arrangement and spacing of shrub planting to meet low fire risk principles and requirements.
- Selection, arrangement and spacing of trees to meet low fire risk principles and requirements.
- Use of noncombustible and low combustible landscape materials within the fire setback zone including hard paving, gravels as paths and mulches in select areas, limited organic material, rocks and boulders.
- Provision of access for fire and emergency vehicles.
- Incorporation of a fire setback zone management and maintenance approach inclusive of removal of necessary vegetative fuel and debris at standard required intervals.



The Sanctuary, Emerge Associates


Somerly, Emerge Associates

- Proposed inclusion of irrigation to fire zones for use in advance of fire emergency. Should fire management may require fire mitigation measures in addition to setbacks, the installation of irrigation sprays to defined locations can assist in the suppression of fire prone material and flames within the fire buffer zone.

1.24 Irrigation Strategy

The former golf course has a large irrigation allocation suitable for the preparation and maintenance of healthy greens and fairways over a larger area than that proposed for the new development. This irrigation allocation remains in place.

With the removal of the golf course it is anticipated that the use of ground water will significantly decline. Initial expectations are in the vicinity of up to a 70% reduction in water usage which may be on-sold, traded and / or returned to the groundwater aquifer.

The exiting irrigation system will be removed and replaced with a new integrated irrigation system designed and installed to meet the standards of the City of Cockburn. This may include a system of sprays, drippers and bubblers to suit various circumstances and planting regimes. The existing bores are expected to be reviewed and reworked to maximise water extraction efficiency and to meet new standards. Additional bores may also be considered/ required to better distribute extraction and more efficiently cater for water distribution. Ultimately the groundwater licence and infrastructure required for the new parks will be transferred to the City.

The irrigation water source is proposed to be from the existing (or new) bore system and will be separately metered. The irrigation system will have a range of inbuilt sustainable measures including, but not limited to, rain gauges, water use monitoring, partial drip systems and hydro zoning as part of the design process, inclusive of manual override to respond to periods of excessive rain or lengthy dry periods. Conscious of continuing staged house and road construction, there is also the opportunity to consider a mainline loop system with reverse flow or to be linked to a variety of bores in order to maintain water flow irrespective of any possible future break.

Individual residences may apply for a domestic bore or uitilise mains scheme water as suitable and will be separately metered accordingly. The individual on lot and verge irrigation system will be under the care and control of the resident. In the main, the planting species palette will be local endemic species / native species requiring less water than existing system.

1.25 Landscape Surface Drainage Strategy

Generally the site has a good drainage infiltration rates and good soil permeability reducing the need for extensive drainage and water storage infrastructure. Where possible, the development will opt for at source drainage solutions to distribute drainage throughout. Landscape zones will include planted basins at key low point locations within the development and also will utilize the existing drainage basins where possible. Overflow onto adjacent grass areas may occur to cater for defined irregular larger storm events.

The residential lots and the medium density sites will seek to manage their drainage and infiltration within their lot or strata area. Where open space areas are somewhat limited in space to cater for surface drainage management, underground storage solutions are proposed in accordance with relevant standards and subject to detail design, to ensure maximum open space areas are available for the community.

Roads and paths will be generally graded to sheet drain inclusive of a mix of infiltration basins, raingardens in select locations and swales where suitable. Final drainage design will be subject to detail engineering design. The streetscapes will seek to have flush kerbing in select locations adjacent to grass swales or planted swales inclusive of defined rain gardens to select locations.

Harvest Lakes, Emerge Associates

Vivente, Emerge Associates

1.26 Maintenance Strategy

In all cases, a maintenance regime will be in place inclusive of general maintenance minimization through design practices and will aim to use sustainable maintenance practices. This includes, but is not limited to, defined edges and borders, minimal and preferably alternate approaches to pesticides, controlled and minimized fertilizer use.

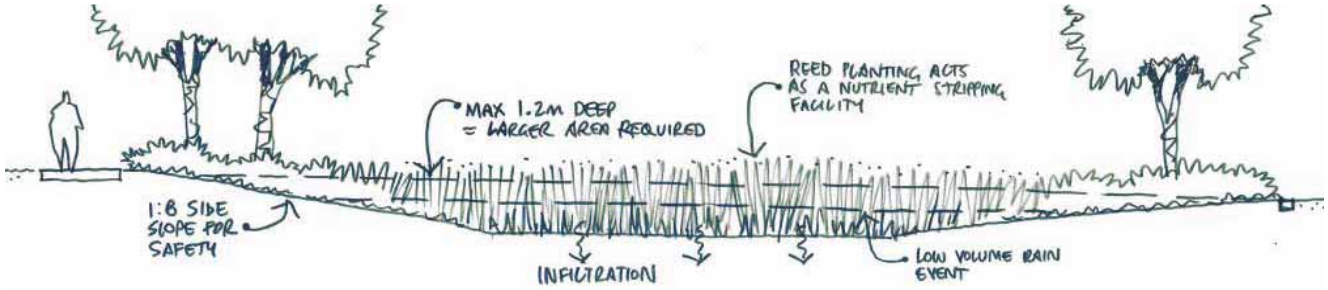
Planted revegetation areas and managed vegetation zones will include a maintenance regime as part of its bushfire management obligations. This will include but is not limited to required periodic removal of natural fuel, review of planting densities to ensure continued compliance with fire regulations and checking and testing of irrigation sprays.

Maintenance will be undertaken via general access to all public accessible areas. Light maintenance vehicles can access all public areas and can adjoin all private areas within the development. This will occur initially via the road system and then by careful access over landscaped grass areas and select areas of the pedestrian path system. Use of removable bollards will limit and control unauthorize access to link areas between roads.

Maintenance will be managed by the development for the first 2 years minimum. The 2 year maintenance timeframe may be extended in certain locations at the developers discretion in liaison with the City.

The increased volume of open space will see additional expenditure occur as necessary in order to maintain the increase in area of open space. This additional cost is somewhat offset by the content of the additional open space (which will mainly be linear widened streetscape areas)

The Sanctuary, Emerge Associates



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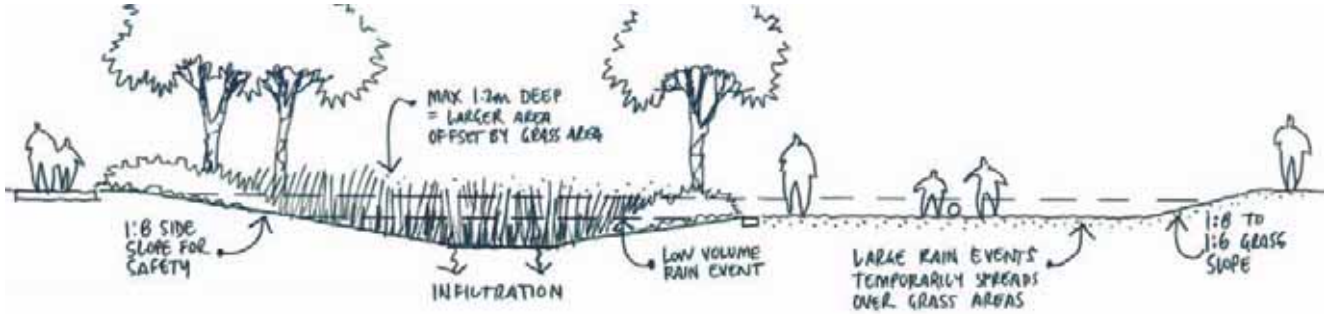

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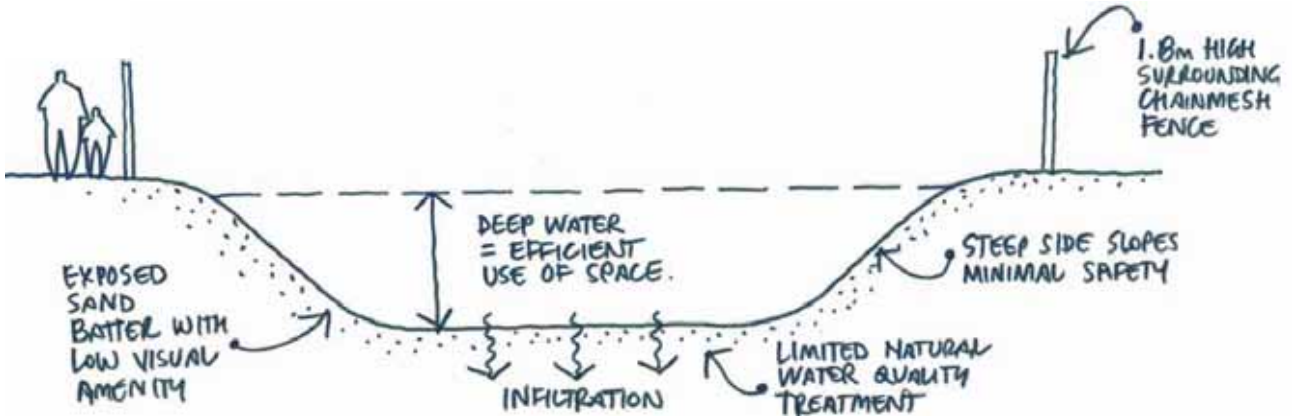


EXAMPLE SECTION J

which will not generally be complex in layout, detail design or material selection thus minimising maintenance costs.

The proponent has been advised by the City that the City's current typical maintenance rate is approximately $2.00/m2. Preliminary calculations indicates that the likely maintenance cost for the proposed design is approximately $2.50/m2 average.

The additional maintenance required to deliver the proposed design may be met by either:

a. The City agreeing to undertake additional maintenance based on the larger volume of open space in response to the existing residents requests and concerns as identified through the community consultation process and the resulting proposed masterplan.

b. The City agreeing to a special area rate to be applied to the new residential lots in addition to their usual rates in order to meet the additional costs over and above Council typical expenditure. This arrangement would be disclosed to the purchasers of new lots at the time of sale and written into the sale contract annexures. This arrangement requires confirmation that the City's expenditure of these funds occurs within the Glen Iris precinct.

Providence, Emerge Associates

GLEN IRIS ESTATE

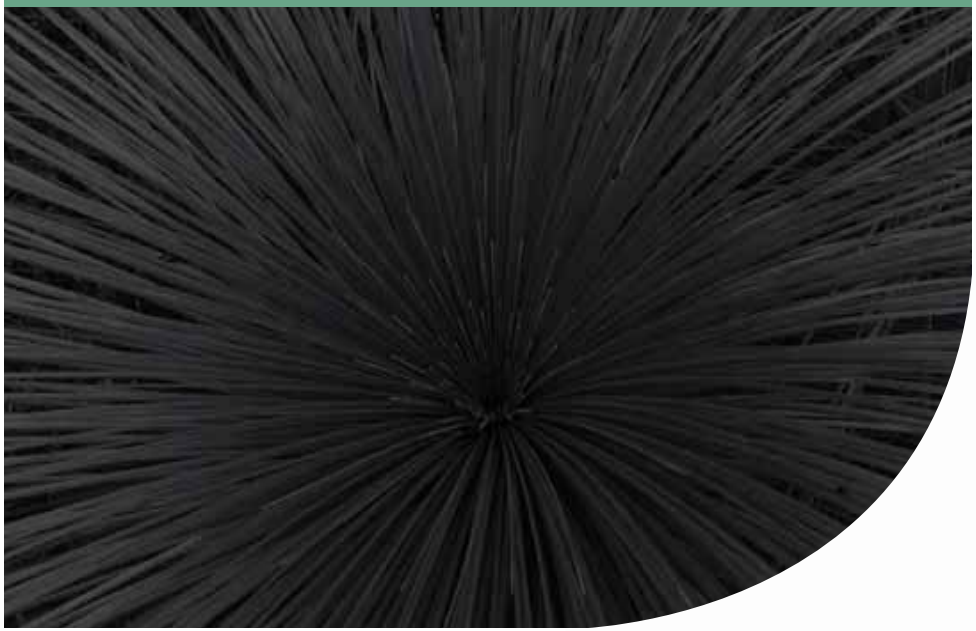
APPENDIX 8
PRINSEP PARK FLORA AND VEGETATION ASSESSMENT

Detailed Flora and Vegetation Assessment

Former Glen Iris Golf Course

Project No: EP20-009(03)

Prepared for ECP Acquisitions 6 Pty Ltd
October 2021



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Executive Summary

Emerge Associates (Emerge) were engaged by ECP Acquisitions 6 Pty Ltd to conduct a 'detailed' and 'targeted' level assessment within the former Glen Iris Golf Course (referred to herein as the 'site') to provide information on the flora and vegetation values.

As part of the assessment a desktop review of relevant background information was completed, and site surveys were undertaken on 11 March 2020, 19 August, 9 September, 7 and 28 October 2021. Outcomes of the flora and vegetation assessment include the following:

- A total of 80 native and 51 non-native (weed) species were recorded in the site.
- Four plant communities were recorded within the site:
  - Plant community EmB extends over 1.9 ha (4% of the site) and comprises remnant native vegetation in 'very good', 'good' and 'degraded' condition. This vegetation occurs as scattered patches and is considered likely to represent floristic community type (FCT) 23a 'Central *Banksia attenuata – B. menziesii* woodlands'.
  - Plant community TdSt extends over 0.2 ha (<1% of the site) and comprises riparian vegetation that is likely planted or a combination of planted and naturally regenerated and was mapped as being in 'good – degraded' condition.
  - Plant community planted trees and shrubs extends over 13.6 ha (25% of the site) and comprises predominantly scattered non-native species in 'completely degraded' condition.
  - Plant community turf and bare ground extends over 35.7 ha (66% of the site) and comprises the previous golf fairway and bare ground in 'completely degraded' condition.
- The remainder of the site comprises artificial lakes, buildings and hardstand which extend over 2.3 ha (4% of the site) and were not assigned to a vegetation condition category.
- No threatened or priority flora species were recorded within the site and none are considered likely to occur.
- No threatened or priority ecological communities occur within the site and none are considered likely to occur.

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Former Glen Iris Golf Course

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Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
EPA	Environmental Protection Authority
DBCA	Department of Biodiversity, Conservation and Attractions
DoW	Department of Water (now DWER)
DWER	Department of Water and Environmental Regulation
WALGA	Western Australia Local Government Association

Table A2: Abbreviations – General terms

General terms	
ESA	Environmentally sensitive area
FCT	Floristic community type
IBRA	Interim Biogeographic Regionalisation of Australia
MUW	Multiple use wetland
NVIS	National Vegetation Inventory System (ESCAVI 2003)
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
P5	Priority 5
PEC	Priority ecological community
T	Threatened
TEC	Threatened ecological community
UFI	Unique feature identifier

Table A3: Abbreviations –Legislation

Legislation	
BAM Act	*Biosecurity and Agriculture Management Act 2007*
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
BC Act	*Biodiversity Conservation Act 2016*
BC Regs	*Biodiversity Conservation Regulations 2018*

Table A4: Abbreviations – planning

Planning terms	
MRS	Metropolitan region scheme

Table A5: Abbreviations – units of measurement

Units of measurement	
cm	Centimetre
ha	Hectare
m	Metre
m AHD	m in relation to the Australian height datum
mm	Millimetre

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1 Introduction

1.1 Project background

ECP Acquisitions 6 Pty Ltd intends to develop the former privately run Glen Iris Golf Course into a residential estate. The former Glen Iris Golf Course comprises Lots 6 and 7 Glen Iris Drive, Lots 3, 509 and 512 Dean Road and Lot 139 Imlah Court in Jandakot (referred to herein as the 'site').

The site is located approximately 16 kilometres (km) south of the Perth Central Business District within the City of Cockburn and is zoned 'urban' under the *Metropolitan Region Scheme* (MRS) and 'development contribution area 13 special use 1', 'development contribution area 13 special use 6', 'development contribution area 13 residential-R40' under the City of Cockburn *Town Planning Scheme No. 3*.

The site is approximately 53.7 hectares (ha) in size and is surrounded by residential subdivision, with a railway to the north and Kwinana Freeway to the west. The site comprises two areas separated by Berrigan Drive. The location and extent of the site is shown in Figure 1.

1.2 Purpose and scope of work

Emerge Associates (Emerge) were engaged by Acumen Development Solutions, on behalf of ECP Acquisitions 6 Pty Ltd, to provide environmental consultancy services to support the planning process for the site. The purpose of this survey is to provide sufficient information on the flora and vegetation values within the site to inform this process.

The scope of work was specifically to undertake a flora and vegetation assessment to the standard required of a detailed and a targeted survey with reference to the Environmental Protection Authority's (EPA's) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016).

As part of this scope of work, the following tasks were undertaken:

- Desktop review of relevant background information pertaining to the site and surrounds, including database searches for threatened flora species and ecological communities.
- Compilation of a comprehensive list of flora species recorded as part of the field survey.
- Mapping of conservation significant flora and vegetation, plant communities and vegetation condition.
- Identification of potential habitat for conservation significant flora and vegetation and likelihood of occurrence.
- Targeted searches for conservation significant flora within areas of suitable habitat.
- Documentation of the desktop assessment, survey methodology and results into a report.

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2 Environmental Context

2.1 Climate

Climate has a strong influence on the types of vegetation that grow in a region and the life cycles of the flora present. It is therefore critical for a flora and vegetation survey to respond appropriately to climatic conditions to ensure that surveys are conducted during times when flora species are easiest to detect and identify.

The south-west of Western Australia experiences a Mediterranean climate of hot dry summers and cool wet winters. In Mediterranean type climates some flora species will typically spend part of their lifecycle as either underground storage organs or as seed. This is an adaptation to unfavourable environmental conditions such as excessive heat and drought that occur over the summer period. These species, known as 'geophytes' or 'annuals', tend to re-emerge during winter when favourable conditions return and are most visible during spring, which is the flowering period for a majority of plant species. Therefore, spring is the optimal time to complete flora and vegetation surveys in the south-west of WA.

An average of 719.6 millimetres (mm) of rainfall is recorded annually from the Jandakot Aero weather station, which is the closest weather station, located approximately 2 km east of the site. The majority of this rainfall is received between the months of May and September. Mean maximum temperatures at the Jandakot Aero weather station range from 18.0ºC in July to 31.6ºC in February, while mean minimum temperatures range from 6.9ºC in July to 17.2ºC in February (BoM 2020).

A total of 600.6 mm of rain was recorded between May and August 2021 prior to the surveys which is higher than the combined long-term average of 558.5 mm for the same months (BOM 2021). This high rainfall was considered to have been sufficient to promote the flowering and emergence of native flora.

2.2 Geomorphology and soils

Landform and soils influence vegetation types at regional and local scales. The site occurs on the Swan Coastal Plain, which is the geomorphic unit that characterises much of the Perth metropolitan area.

The Swan Coastal Plain is approximately 500 km long and 20 to 30 km wide and is roughly bound by the Indian Ocean to the west and the Darling Scarp to the east. Broadly the Swan Coastal Plain consists of two sedimentary belts of different origin. Its eastern side has formed from the deposition of alluvial material washed down from the Darling Scarp, while its western side is comprised of three dune systems that run roughly parallel to the Indian Ocean coastline (Seddon 2004). These dune systems, referred to as Quindalup, Spearwood and Bassendean associations, represent a succession of coastal deposition that has occurred since the late Quaternary period (approximately two million years ago) (Kendrick *et al.* 1991) and, as a result, they contain soils at different stages of leaching and formation.

Examination of broad scale soil mapping places the site within the Bassendean soil association (Churchward and McArthur 1980). The Bassendean association comprises sand plains with low dunes and occasional swamps, iron or humus podzols and areas of complex steep dunes.

Finer scale mapping by (Gozzard 2011) also places the site in Bassendean sand (S8) which was later confirmed during the field survey. The Bassendean sands typically very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of eolian origin (Purdie *et al.* 2004).

The site is not known to contain any restricted landforms or unique geological features.

2.3 Topography

The elevation of the site ranges from 25 m in relation to the Australian height datum (mAHD) in the southern portion to 40 mAHD in the northern portion of the site (DoW 2008) (Figure 2).

2.4 Hydrology and wetlands

Wetlands include "areas of seasonally, intermittently or permanently waterlogged soils or inundated land, whether natural or otherwise, fresh and saline, e.g. waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries" (Wetlands Advisory Committee 1977). Wetlands can further be recognised by the presence of vegetation associated with waterlogging or the presence of hydric soils such as peat, peaty sand or carbonate mud (Hill *et al.* 1996).

Wetlands of national or international significance may be afforded special protection under Commonwealth or international agreements. The following lists of important wetlands were checked as part of this assessment:

- *Ramsar List of Wetlands of International Importance* (DBCA 2017b)
- *A Directory of Important Wetlands in Australia* (DBCA 2018).

No Ramsar or listed 'important wetlands' are located within or near the site.

Examination of the Department of Water and Environmental Regulation (DWER) hydrography dataset (DWER 2018) shows that no wetland or water related features are mapped within the site.

On the Swan Coastal Plain DBCA (2017a) have used the geomorphic wetland classification system developed by Semeniuk (1987) and Semeniuk and Semeniuk (1995) to classify wetlands based on the landform shape and water permanence (hydro-period). The Department of Biodiversity, Conservation and Attractions (DBCA) maintains the *Geomorphic Wetlands of the Swan Coastal Plain* dataset (DBCA 2020a), which further categorises geomorphic wetland features into specific management categories to guide land use and conservation. Note that as this dataset was drafted at a regional scale the boundaries of mapped wetland features are often inconsistent with physical wetland boundaries.

A review of the *Geomorphic Wetlands, Swan Coastal Plain* dataset (DBCA 2020a) indicated that no wetland features are mapped within the site. Two 'multiple use' category wetland features (UFIs 6654 and 6655) occur adjacent to the south-western portion of the site.

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The locations of the geomorphic wetlands surrounding the site are shown in Figure 2.

2.5 Regional vegetation

Native vegetation is described and mapped at different scales in order to illustrate patterns in its distribution. At a continental scale the *Interim Biogeographic Regionalisation of Australia* (IBRA) divides the Swan Coastal Plain into two floristic subregions (Environment Australia 2000). The site is contained within the 'SWA02' or Perth subregion, which is characterised as mainly containing *Banksia* low woodland on leached sands with *Melaleuca* swamps where ill-drained; and woodland of *Eucalyptus gomphocephala* (tuart), *E. marginata* (jarrah) and *Corymbia calophylla* (marri) on less leached soils (Beard 1990). This subregion is recognised as a biodiversity hotspot and contains a wide variety of endemic flora and vegetation types.

Variations in native vegetation within the site can be further classified based on regional vegetation associations. Heddle *et al.* (1980) mapping shows the majority of the site as comprising the 'Bassendean central and south' complex, which is described as vegetation ranging from woodland of *Eucalyptus marginata - Allocasuarina fraseriana - Banksia* spp. to low woodland of *Melaleuca* spp. and sedgelands on the moister sites. This complex was determined to have 26.87% remaining in 2019, of which 2.15% is under formal protection (Government of Western Australia 2019).

2.6 Historic land use

Review of historical images available from 1953 (WALIA 2020) onwards shows that the northern and southern portions of the site, separated by Berrigan Drive, have been subject to vegetation clearing at different times.

The northern portion of the site supported native vegetation until construction of the central part of the Glen Iris Golf Course commenced, which is first visible in imagery from 1965. The remainder of the northern portion of the site was cleared of native vegetation by 1995 for further golf course construction. Scattered remnant native trees appear to have been retained between the golf course fairway but the majority of the vegetation was cleared during construction of the golf course.

The southern portion of the site supported native vegetation until construction of the golf course commenced, which is first visible in imagery from 1995. The entirety of the southern portion of the site, except two areas near the southern boundary, were completely cleared of native vegetation for the golf course.

The Glen Iris Golf Course was formally closed by the previous owners in March 2020 and has been in caretaker and maintenance ever since.

2.7 Significant flora and vegetation

2.7.1 Threatened and priority flora

Certain flora taxa that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth level, flora taxa may be listed as 'threatened' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threatened flora species listed under the EPBC Act are assigned a conservation status according to attributes such as population size and geographic distribution. Any action likely to have a significant impact on a taxon listed under the EPBC Act requires Ministerial approval.

In Western Australia flora species may also be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act). Similarly, it is an offence to 'take' or 'disturb' threatened flora listed under the BC Act without Ministerial approval.

Flora species that do not currently meet the criteria for listing as threatened but are potentially rare or threatened may be added to the DBCA's *Priority Flora List*. These species are classified into 'priority' levels based on threat. Whilst priority species are not under direct statutory protection, they are considered during State approval processes. Further information on threatened and priority species and their categories is provided in Appendix A.

2.7.2 Threatened and priority ecological communities

An ecological community is a naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat. An ecological community's structure, composition and distribution are influenced by environmental factors such as soil type, position in the landscape, altitude, climate and water availability (DoEE 2019b). 'Threatened ecological communities' (TECs) are ecological communities that are recognised as rare or under threat and therefore warrant special protection.

Selected TECs are afforded statutory protection at a Commonwealth level under the EPBC Act. Similar to flora species, TECs listed under the EPBC Act are assigned a conservation status. Any action likely to have a significant impact on a community listed under the EPBC Act requires Ministerial approval.

TECs are also listed within Western Australia under the BC Act and the BC Regulations. Their significance is also acknowledged through other state environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

A plant community that is under consideration for listing as a TEC in Western Australia, but does not yet meet survey criteria or has not been adequately defined, may be listed as a 'priority ecological community' (PEC). Listing as a PEC is similarly considered during State approval processes. Further information on categories of TECs and PECs is provided in Appendix A.

2.7.3 Local and regional significance

Flora species and ecological communities may be significant for a number of reasons irrespective of whether they have special protection under policy or legislation.

Two reasons that vegetation within the site may be significant are listed below:

- The vegetation within the site has potential value as habitat for threatened or priority fauna species including, in particular, Carnaby's black cockatoo and the forest red-tailed black cockatoo, which are listed as 'vulnerable' under the EPBC Act and 'endangered' under the BC Act.

- The vegetation supports flora species Listed in *Bush Forever* 'significant flora' list for the Bassendean dunes (Government of WA 2000).

2.7.4 Weeds

The term 'weed' can refer to any plant that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. Many non-native flora species and some native species are considered to be weeds.

A particularly invasive or detrimental weed species may be listed as a 'declared pest' pursuant to Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread. At a National level, the Australian government has compiled a list of 32 *Weeds of National Significance* (WoNS) (DoEE 2019c). Whilst the WoNS list is non-statuatory, many WoNS are also listed under the BAM Act. Further information on categories of declared pests is provided in Appendix A.

Due to historical disturbance weed species are expected to be present at the site.

2.8 Bush Forever

The Government of Western Australia's *Bush Forever* policy is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of *Bush Forever* is to protect comprehensive representations of all original ecological communities by targeting a minimum of 10% of each vegetation complex for protection (Government of WA 2000). *Bush Forever* sites are representative of regional ecosystems and habitat and have a key role in the conservation of Perth's biodiversity.

No *Bush Forever* sites occur within the site. Multiple *Bush Forever* sites occur to the east and west of the site.

2.9 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. This exchange of genetic material between vegetation remnants improves the viability of those remnants by allowing greater access to breeding partners and food sources, refuge from disturbances such as fire and maintenance of genetic diversity of plant communities and populations. Ecological linkages are ideally continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998).

The Perth Biodiversity Project, supported by the Western Australia Local Government Association (WALGA), have identified and mapped regional ecological linkages within the Perth Metropolitan Region (WALGA and PBP 2004).

There are no mapped ecological linkages within the site. One biodiversity ecological linkage (no. 48) is located approximately 800 m to the north of the site and extends to the west and east.

2.10 Previous surveys

No previous flora and vegetation surveys are known to have been undertaken within the site.

3 Methods

3.1 Desktop assessment

3.1.1 Database searches

A search was conducted for threatened and priority flora that may occur or have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2020a) and *NatureMap* (DBCA 2020).

A search was also conducted for TECs and PECs that may occur or have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2020a) and the *Weed and Native Flora Dataset* (Keighery *et al.* 2012).

Prior to undertaking the field survey, information on the habitat preferences of threatened and priority flora species and communities identified from database searches was reviewed. This was compared to existing environmental information available for the site, such as geomorphology, soils, regional vegetation and historic land use, to identify species and communities for which habitat may occur in the site.

3.2 Field survey

An ecologist from Emerge visited the site on 11 March 2020, 19 August, 9 September, 7 and 28 October 2021 to conduct the flora and vegetation field surveys.

3.2.1 Flora and vegetation

The site was traversed on foot and the composition and condition of vegetation was recorded.

Detailed sampling of the vegetation was undertaken using non-permanent relevés. Each relevé was completed over an approximately 10 x 10 m area. A total of three relevés were sampled and the position of each sample location was recorded with a hand-held GPS unit, as shown in Figure 3. The data recorded within each relevé included:

- site details (site name, site number, observers, date, location)
- environmental information (slope, aspect, bare-ground, rock outcropping soil type and colour class, litter layer, topographical position, time since last fire event)
- biological information (vegetation structure and condition, degree of disturbance and species present).

Additional plant taxa not observed within samples were recorded opportunistically as the ecologist traversed the site. Photographs were taken throughout the field visit to show particular site conditions.

The suitability of habitat within the site for conservation significant species identified in the desktop assessment was assessed (refer Section 3.1). Areas of suitable habitat were searched for conservation significant species as required.

All plant specimens collected during the field survey were dried, pressed and then named in accordance with requirements of the Western Australian Herbarium. Identification of specimens occurred through comparison with named material and through the use of taxonomic keys. Flora species not native to Western Australia are denoted by an asterisk ('*') in text and raw data.

Vegetation condition was assigned at each sample and changes in vegetation condition were also noted and mapped across the site. The condition of the vegetation was assessed using methods from Keighery (1994). For vegetation in the site containing *Banksia* spp., the condition scale provided in the conservation advice for the 'banksia Woodlands of the Swan Coastal Plain TEC' (TSSC 2016) was applied in addition to the Keighery scale (as shown in Table 1).

Table 1: Vegetation condition scale applied during the field assessment

Condition category	Definition (Keighery 1994)	Indicator (TSSC 2016)	
		Typical native vegetation composition	Typical weed cover
Pristine	Pristine or nearly so, no obvious signs of disturbance.	Native plant species diversity fully retained or almost so	Zero or close to
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.	High native plant species diversity	Less than 10%
Very good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing	Moderate native plant species diversity	5-20%
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.	Low native plant species diversity	5-50%
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	Very low native plant species diversity	20-70%
Completely degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.	Very low to no native species diversity	Greater than 70%

3.3 Mapping and data analysis

3.3.1 Likelihood of occurrence of conservation significant flora and vegetation

Information on the habitat preferences of threatened and priority flora species and communities identified from database searches was reviewed. Based on existing conditions such as plant community, vegetation condition, land use and disturbance, an assessment of the likelihood of occurrence of threatened and priority flora species and communities within the site was undertaken using the categories outlined in Table 2.

Table 2: Likelihood of occurrence assessment categories and definitions

Likelihood	Definition
Recorded	The species was recorded during the current field survey.
Likely	The site contains suitable habitat for the species and it is likely the species may occur based on presence of a recent historical record within or close to the site.
Possible	The site contains suitable habitat for the species but there is no other information to suggest that the species may occur within or close to the site.
Unlikely	The site does not contain suitable habitat for the species or the site contains suitable habitat for the species within which thorough targeted searches were completed and conclusion has been made that the species is unlikely to be present.

3.3.2 Plant community identification and description

The local plant communities within the site were identified from the sample data collected during the field survey. The vegetation was described according to the dominant species present using the structural formation descriptions of the *National Vegetation Inventory System* (NVIS) (ESCAVI 2003). The identified plant communities were mapped on aerial photography from the sample locations and boundaries were interpreted from aerial photography and notes taken in the field. Vegetation condition was mapped on aerial photography based on the locations and notes recorded during the field survey to define areas with differing condition.

3.3.3 Floristic community type assignment

Where possible, each plant community was assigned a 'floristic community type' (FCT), as defined by Gibson *et al.* (1994). This was determined by comparing the flora species recorded within each sample to those in the regional datasets *A floristic survey of the southern Swan Coastal Plain* Gibson *et al.* (Gibson *et al.* 1994) and *Weed and Native Flora Data for the Swan Coastal Plain* (Keighery *et al.* 2012). No statistical FCT analysis was undertaken due to the high level of disturbance across most of the site and small size of vegetation patches in better quality.

Ultimately the flora species present and contextual information relating to the soils, landforms and known locations of FCTs within the region were used to determine the appropriate FCT for vegetation within the site.

3.3.4 Threatened and priority ecological communities

Areas of native vegetation potentially representing a TEC were assessed against key diagnostic characteristics and, if available, size and/or vegetation condition thresholds provided in the following document:

- *Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community (TSSC 2016).*

3.4 Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in the EPA document *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) is provided in Table 3.

Table 3: Evaluation of survey methodology against standard constraints outlined in EPA (2016)

Constraint	Degree of limitation	Details
Availability of contextual information	No limitation	The broad scale contextual information described in Section 2 is adequate to place the site and vegetation in context.
		No previous relevant surveys are known to have been undertaken within the site.
	No limitation	Regarding assignment of FCTs, the authoritative Gibson *et al.* (1994) dataset was derived from a necessarily limited sample of vegetation from largely publicly owned land which is now more than 20 years out of date. Consequently, it is unknown to what degree official FCTs are appropriate reference to biodiverse vegetation across the Swan Coastal Plain. In lieu of an alternative and as recommended by DBCA, the Gibson *et al.* (1994) dataset was used to assign an FCT where possible. Comparison of species in the patches of vegetation in better condition with the Gibson *et al.* (1994) dataset, in combination with soils, landforms and known locations of FCTs within the region, was sufficient to assign an FCT.
Experience level of personnel	No limitation	This flora and vegetation assessment was undertaken by qualified botanists with 6-11 years of botanical experience in Western Australia. Technical review was undertaken by a senior environmental consultant with 18 years' experience in environmental science in Western Australia.
Suitability of timing	No limitation	The survey was conducted in March 2020 and August, September and October 2021 and thus within the main flowering season. High rainfall was recorded from May to August 2021 in the months preceding the site visits. Therefore, it is likely that most plant species would have been in flower and/or visible at the time of survey. The degraded nature of most of the site limits the potential habitat for native geophytic plants such as orchids and the majority of threatened and priority flora species with potential to occur are perennial species. Nevertheless, some orchid species were recorded and able to be identified to species level. No unidentified specimens were collected. The survey timing was considered adequate to allow the detection of all species for which seasonal timing is critical.
Temporal coverage	No limitation	Comprehensive flora and vegetation assessments can require multiple visits, at different times of year, and over a period of multiple, to enable observation of all species present. The portions of the site containing native vegetation were visited five times over two years and three seasons.

Table 3: Evaluation of survey methodology against standard constraints outlined in EPA (2016) (continued)

Constraint	Degree of limitation	Details
Spatial coverage and access	No limitation	Site coverage was comprehensive (track logged).
	No limitation	All parts of the site could be accessed as required.
Sampling intensity	No limitation	A total of 131 species were recorded, comprising 80 native and 51 non-native species. These species were recorded from three sample locations and opportunistic observations across the site. Considering the high level of disturbance within the majority of the site and the small size of the areas of remnant native vegetation, the number of native species recorded was considered sufficient to classify the vegetation for the purposes of this assessment.
Influence of disturbance	Minor limitation	Time since fire is greater than 60 years as interpreted form aerial imagery and therefore species reliant on fire to emerge may not have been visible. However, this was not considered a limitation in regards to determining the presence of threatened or priority flora species.
	No limitation	Historical ground disturbance was evident in the majority of the site. The disturbance history of the site was considered when undertaking field sampling.
Adequacy of resources	No limitation	All resources required to perform the survey were available.

4 Results

4.1 General site conditions

The site is gently undulating and comprises sandy white-grey soils. The site was recently used as a golf course and the fairways and lakes were irrigated at the time of the survey.

The site has been highly modified for its use as a golf course and is dominated by non-native vegetation and unvegetated areas. Small areas of remnant native vegetation occur as scattered patches of varying quality.

4.2 Flora

4.2.1 Desktop assessment

The database search results identified a total of 16 threatened and 34 priority flora species occurring or potentially occurring within a 10 km radius of the site. Information on these species including their habitat preferences is provided in Appendix B.

Based on background information available for the site, two threatened flora species and five priority flora species were identified as having potential to occur within the site as shown in Table 4.

Table 4: Conservation significant flora species considered to have potential to occur in the site based on known habitat preferences

Species	Level of significance		Life strategy	Habitat	Flowering period
	State	EPBC Act			
Caladenia huegelii	CR	E	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov
Macarthuria keigheryi	E	E	P	Low-lying winter-wet damp grey/white sands in open patches.	Sep-Dec, Feb-Mar
Stenanthemum sublineare	P2	-	P	White sand on coastal plains.	Oct-Dec
Thelymitra variegata	P2	-	PG	Sandy clay, sand, laterite.	Jun-Sep
Phlebocarya pilosissima subsp. *pilosissima*	P3	-	P	White or grey sand, lateritic gravel.	Aug-Oct
Styphelia filifolia	P3	-	P	Brown over pale yellow sand.	Feb-Apr
Jacksonia sericea	P4	-	P	Calcareous and sandy soils on Swan Coastal Plain	Dec-Feb

4.2.2 Species inventory

A total of 80 native and 51 non-native (weed) species were recorded within the site during the field survey, representing 45 families and 103 genera. The dominant families containing native taxa were

Myrtaceae (15 native taxa and 13 weed taxa) and Fabaceae (12 native taxa and four weed taxa). A complete species list is provided in Appendix C.

4.2.3 Threatened and priority flora

No occurrences of threatened or priority flora species were recorded within the site.

The EmB vegetation described in Section 4.3.2 comprises suitable habitat for the threatened and priority flora species identified in Table 4. Targeted searches were undertaken for these species during the optimal survey period and they were not recorded. Therefore, no threatened or priority flora species are considered likely to occur in the site.

The likelihood of occurrence assessment is provided in Appendix B.

4.2.4 Locally and regionally significant flora

No locally or regionally significant flora species were recorded within the site.

4.2.5 Declared pests

No species listed as declared pests pursuant to the BAM Act or weeds of national significance (WoNS) were recorded in the site.

4.3 Vegetation

4.3.1 Desktop assessment

The database search results identified four TECs and three PECs occurring or potentially occurring within a 10 km radius of the site. Information on these communities is provided in Appendix D.

Based geomorphology, soils and regional vegetation patterns, the following one TEC and three PECs were considered to have potential to occur in the site:

- 'Banksia woodlands of the Swan Coastal Plain' TEC which is listed as 'endangered' under EPBC Act.
- 'Banksia woodlands of the Swan Coastal Plain' PEC (P3)
- '*Banksia ilicifolia* woodlands, southern Swan Coastal Plain' PEC (P3)
- 'Northern Spearwood shrublands and woodlands' PEC (P3).

4.3.2 Plant communities

Four plant communities were identified within the site. Plant community EmB exists as scattered patches in the northern, central and south-western portions of the site. Plant community TdSt exists as multiple small patches on the edges of artificial lakes and is considered to be likely planted or a combination of planted and naturally generated vegetation. Plant communities planted trees and shrubs and turf and bare ground exist across the site and were likely previously installed for the sites' historic use as a golf course.

The remainder of the site supports multiple artificial lakes, buildings and hardstand (2.3 ha).

A description and the area of each plant community is provided in Table 5, representative photographs of each are provided in Plate 1 to Plate 4 and raw sample data is provided in Appendix E. The location of each plant community is shown in Figure 3.

Table 5: Description and extent of plant communities identified within the site

Plant community	Description	Area (ha)
EmB	Woodland to open woodland *Eucalyptus marginata* subsp. *marginata*, *Banksia attenuata* and *Banksia menziesii* over mixed shrubland *Xanthorrhoea preissii*, *Allocasuarina humilis* and *Hibbertia hypericoides* over open sedgeland *Mesomelaena pseudostygia* over non-native grassland **Ehrharta calycina* (Plate 1).	1.9
TdSt	Closed sedgeland *Typha domingensis*, *Schoenoplectus tabernaemontani*, **Cortaderia selloana* and *Baumea* sp. (Plate 2).	0.2
Planted trees and shrubs	Predominantly scattered non-native planted trees and shrubs such as **Corymbia* spp., **Eucalyptus* spp., *Melaleuca* spp. and *Grevillea* spp. with occasional native plants (Plate 3).	13.6
Turf and bare ground	Closed non-native grassland (turf) and bare ground (Plate 4).	35.7

Plate 1: Plant community EmB in 'very good' condition

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Plate 2: Plant community TdSt in 'good – degraded' condition

Plate 3: Planted trees and shrubs in 'completely degraded' condition

Plate 4: Turf and bare ground in 'completely degraded' condition

4.3.3 Vegetation condition

Plant community EmB comprises the most intact native vegetation within the site. Some of the EmB vegetation was mapped as being in 'very good' condition as they supported the general structure expected of a banksia woodland community and had moderate native species diversity. The remainder of the EmB vegetation was mapped as being in 'good' and 'degraded' condition where it was more disturbed with an altered structure, lower native species diversity and higher weed cover.

Plant community TdSt was mapped as being in 'good – degraded' condition as it comprises a combination of native and non-native species that only exist in the site due to the presence of the artificial lakes created for the previous golf course.

The planted trees and shrubs and the turf and bare ground communities were mapped as being in 'completely degraded' condition as they are dominated by non-native species or comprise unvegetated areas. The remainder of the site, which comprises artificial lakes, buildings and hardstand, were not assigned a condition category (2.3 ha).

The extent of vegetation by condition category is detailed in Table 6 and shown in Figure 4.

Table 6: Extent of vegetation condition categories within the site

Condition category (Keighery 1994)	Size (ha)
Pristine	0
Excellent	0
Very good	0.43
Good	0.69
Good – degraded	0.22
Degraded	0.80
Completely degraded	49.25

4.3.4 Floristic community types

Plant community EmB was determined to likely represent FCT 23a 'Central *Banksia attenuata – B. menziesii* woodlands'. This FCT is listed as 'well reserved' and 'low risk' by Gibson *et al.* (1994).

The other plant communities in the site were considered too degraded to assign to an FCT.

4.3.5 Threatened and priority ecological communities

The structure and composition of plant community EmB indicates that it has the potential to represent the Commonwealth listed TEC 'banksia woodlands of the Swan Coastal Plain' and the State listed PEC of the same name (P3).

The above TEC, herein referred to as the 'banksia woodland TEC', is listed as 'endangered' under the EPBC Act. Whether a patch of vegetation is considered to represent the banksia woodland TEC depends on a number of diagnostic criteria including geographic location, soils, landform, structure, composition, condition and patch size (DoEE 2016).

As outlined in Table 7, the EmB vegetation does not satisfy the criteria to be considered a patch of the 'banksia woodland TEC' due to the small size of the patches.

Table 7: Criteria for determining presence of Banksia Woodlands of the Swan Coastal Plain TEC adapted from (TSSC 2016)

Criteria	Requirements for meeting criteria	Site implications
1. Must meet key diagnostic characteristics	A variety of factors relating to: • Location • Soils • Structure • Composition	• Site meets location and soils criteria. • The EmB vegetation includes the key diagnostic feature of a tree layer of *Banksia attenuata*, *Banksia menziesii* and *Banksia ilicifolia*. • The EmB vegetation within site also meets structure and composition criterion. It is likely to represent FCT 23a which is identified as one of the FCTs comprising the banksia woodland TEC.
2. Must meet condition thresholds	• A patch should at least meet the 'good' condition category (see Table 1)	• The EmB vegetation is present in 'very good', 'good' and 'degraded' condition, which meets this criterion. The conservation advice indicates that a single patch may include areas of variable condition, meaning the 'degraded' condition may still be considered the TEC. • The patches of EmB vegetation that are adjacent to each other would be considered part of the same patch. Therefore, six 'patches' of EmB vegetation exist within the site.
3. Must meet minimum patch size	Minimum size of patch: • Pristine=no minimum size • Excellent=0.5 ha • Very Good=1 ha • Good=2 ha	• The six patches of EmB vegetation are each less than 1 ha in size and do not meet this criterion.
4. Must incorporate surrounding context	• Breaks (e.g. tracks) < 30 m do not separate vegetation into separate patches • Buffer zones may apply (20-50 m recommended from patch edge) • The site should be thoroughly sampled (2 surveys in same spring). • Survey timing should be appropriate. • Surrounding environment should be considered (e.g. connectivity, conservation values, fauna habitat)	• The patches of EmB vegetation are isolated from other banksia woodland and no relevant surrounding context considerations apply.
Result	The site does not support any vegetation that represents the banksia woodland TEC.	

DBCA's *Priority Ecological Community* list indicates that the description, area and condition thresholds that apply to the Commonwealth-listed TEC of the same name also apply to the 'banksia woodlands of the Swan Coastal Plain' PEC (DBCA 2020b). Since the EmB vegetation does not represent the banksia woodland TEC it also does not represent the PEC.

No other TECs or PECs occur within the site.

4.3.6 Locally and regionally significant vegetation

Plant communities EmB and planted trees and shrubs contain multiple foraging species for threatened species of black cockatoo. In addition, a small number of mature *Corymbia calophylla*, *Eucalyptus marginata* and **Eucalyptus* sp. trees with a diameter at breast height larger than 500 mm are also present within plant communities EmB and planted trees and shrubs. Due to their size these

trees have the potential to provide some value as foraging, roosting and breeding habitat values for black cockatoos, along with other ecological services.

5 Discussion

The site has been highly modified and approximately 92% supports vegetation in 'completely degraded' condition. Native vegetation exists as scattered patches that extend over approximately 4% of the site. The remaining 4% of the site comprises artificial lakes, buildings and hardstand. The highest quality vegetation exists within plant community EmB.

5.1 Threatened and priority flora

Based on the desktop assessment, it was considered that two threatened and five priority flora species had potential to occur within the site. If these species were to occur it was most likely that they would have been found within the EmB vegetation, which, while disturbed, is the most intact remnant vegetation in the site.

Intensive targeted searches were undertaken in August, September and October 2021 across the EmB vegetation and none of the identified threatened or priority flora species were recorded. The absence of the larger perennial species such as *Jacksonia gracillima*, *Verticordia lindleyi* subsp. *lindleyi* and *Andersonia gracilis* was relatively easy to confirm. However, due to their size and seasonal lifeform, smaller annual or geophytic species such as *Drakaea elastica*, *Thelymitra variegata* and *Caladenia huegelii* can be more difficult to detect. Intensive targeted searches were carried out in August, September and October 2021 to search for *Drakaea elastica*, *Thelymitra variegata* and *Caladenia huegelii*. The searches were conducted during the main growing and flowering period for these species and so they would have been visible, if present. Since these species were not recorded the surveys are considered sufficient to conclude that they do not occur in the site.

5.2 Vegetation condition

A vegetation condition score has the greatest implications when the condition of vegetation is close the boundary between 'good' and 'degraded'. This is because good condition is typically accepted as the threshold for conservation significance, while 'degraded' condition implies a low conservation requirement. Separating these two condition categories is further complicated by the fact that good condition is more correctly understood to mean 'average' condition. Applying the Keighery (1994) condition scale good condition vegetation can be expected to be significantly altered, with very obvious disturbance and the presence of aggressive weeds at high density. Therefore, good does not literally mean "good" as the label implies.

The method applied to assess vegetation condition was robust, as it combined the standard qualitative, categorical scheme of Keighery (1994), with the additional indicators for diversity and weed cover outlined in DoEE (2016).

Compound condition categories were applied where the patch of vegetation supported a mosaic of small areas in differing condition and at fine-scale unsuitable for mapping.

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Former Glen Iris Golf Course

5.3 Floristic community type assignment

Although no statistical FCT analysis was undertaken, the flora species within the EmB vegetation are similar to those recorded within Gibson *et al.* (1994) sites that represent FCT 23a. A total of 15 Gibson *et al.* (1994) and Keighery *et al.* (2012) samples that represent FCT 23a occur within approximately four kilometres of the site and the soils and landform within the site also align with that described for FCT 23a.

5.4 Threatened and priority ecological communities

Arriving at the conclusion that the EmB vegetation does not represent the banksia woodland TEC/PEC was straightforward as the small patches of this vegetation do not meet defined size thresholds.

5.5 Wetlands

The two mapped multiple use wetlands located adjacent to the south-western portion of the site comprise residential lots and extend over portions of the Kwinana Freeway (UFI 6655) and Berrigan Drive (UFI 6654) (Figure 2). Neither of these mapped wetlands contain any native wetland vegetation in proximity to the site.

5.6 Local and regional significance

Suitable habitat for threatened species of black cockatoo were opportunistically recorded within the site. A separate fauna assessment has been undertaken to determine the fauna habitat within the site and whether other fauna species of conservation significance are likely to occur (Emerge Associates 2021).

6 Conclusions

Over 95% of the site has been highly disturbed and modified from its remnant state, with approximately 2.3 ha supporting artificial lakes, buildings and hardstand and 49.2 ha supporting non-native vegetation (planted trees and shrubs and turf and bare ground) in 'completely degraded' condition. The remainder of the site supports remnant native vegetation (1.9 ha) and riparian vegetation that is likely planted or a combination of planted and naturally regenerated (0.2 ha).

No threatened or priority flora species were recorded within the site and none are considered likely to occur.

No TECs or PECs occur within the site and none are considered likely to occur.

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Detailed Flora and Vegetation Assessment
Former Glen Iris Golf Course

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Figures

Figure 1: Site Location

Figure 2: Environmental Features

Figure 3: Plant Communities

Figure 4: Vegetation Condition

Figure 1: Site Location

Project: Detailed Flora and Vegetation Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(03)--F02
Drawn: RAW
Date: 18/05/2020
Checked: RAW
Approved: TAA
Date: 16/06/2020

0 100 200
Metres
Scale: 1:10,000@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used

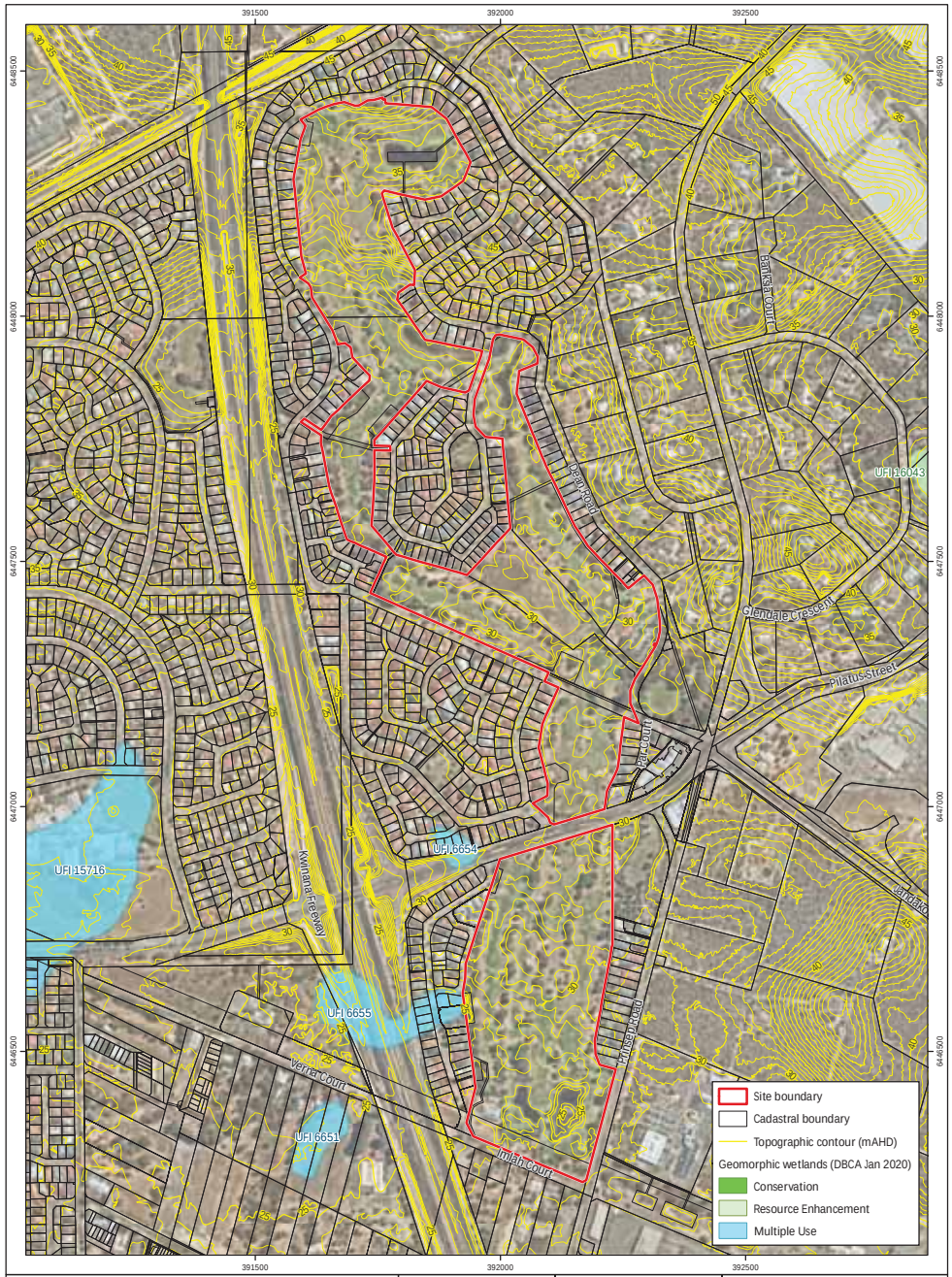

Figure 2: Environmental Features

Project: Detailed Flora and Vegetation Assessment
Former Glen Iris Golf Course

Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(03)--F03
Drawn: RAW
Date: 18/05/2020
Checked: RAW
Approved: TAA
Date: 16/06/2020

0 100 200
Metres

Scale: 1:10,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used

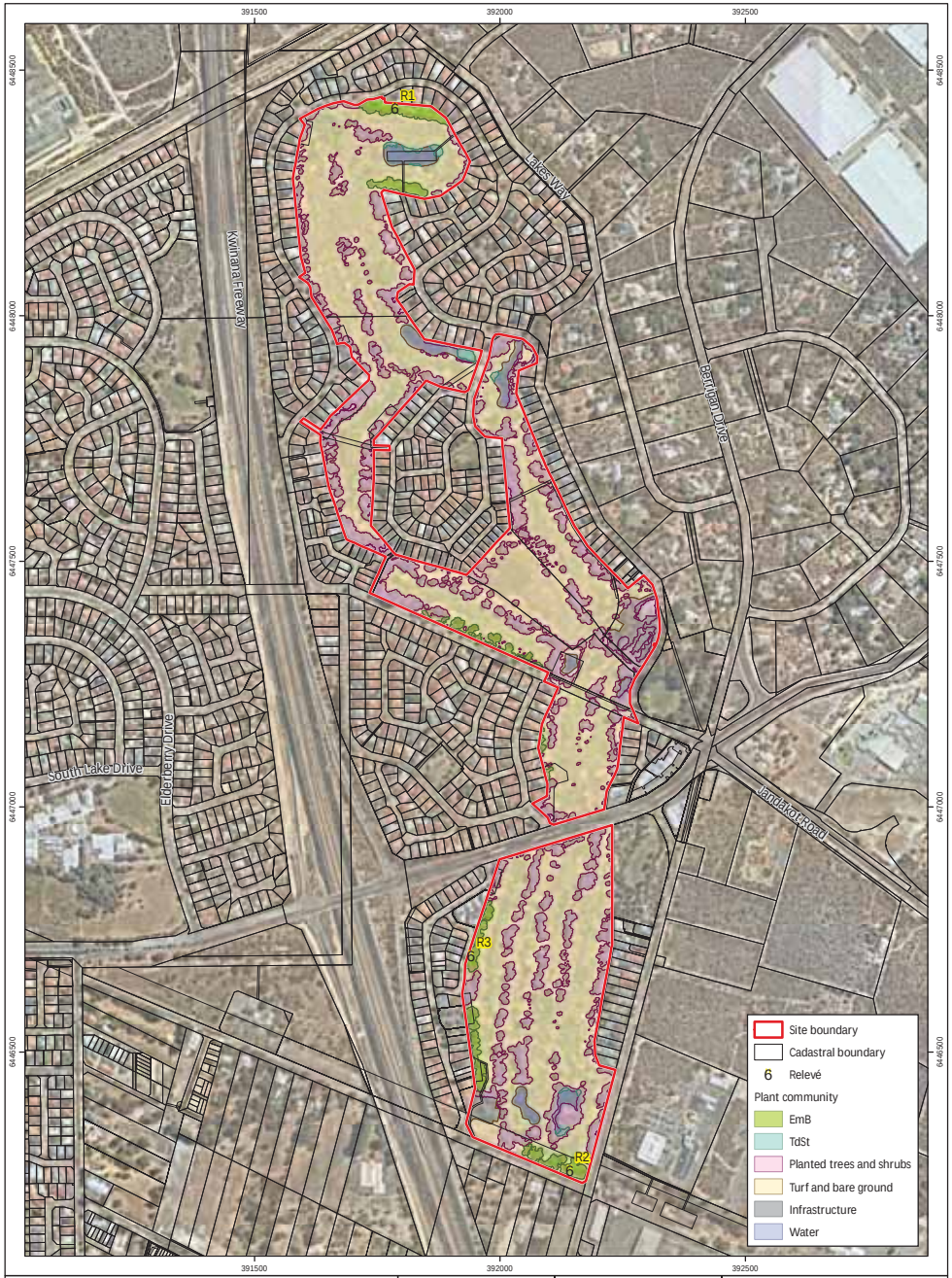

Figure 3: Plant Communities

Project: Detailed Flora and Vegetation Assessment
Former Glen Iris Golf Course

Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(03)--F04a
Drawn: GAR
Date: 14/09/2021
Checked: SKP
Approved: TAA
Date: 15/09/2021

0 100 200
Metres

Scale: 1:10,000@A4

GDA 1994 MGA Zone 50

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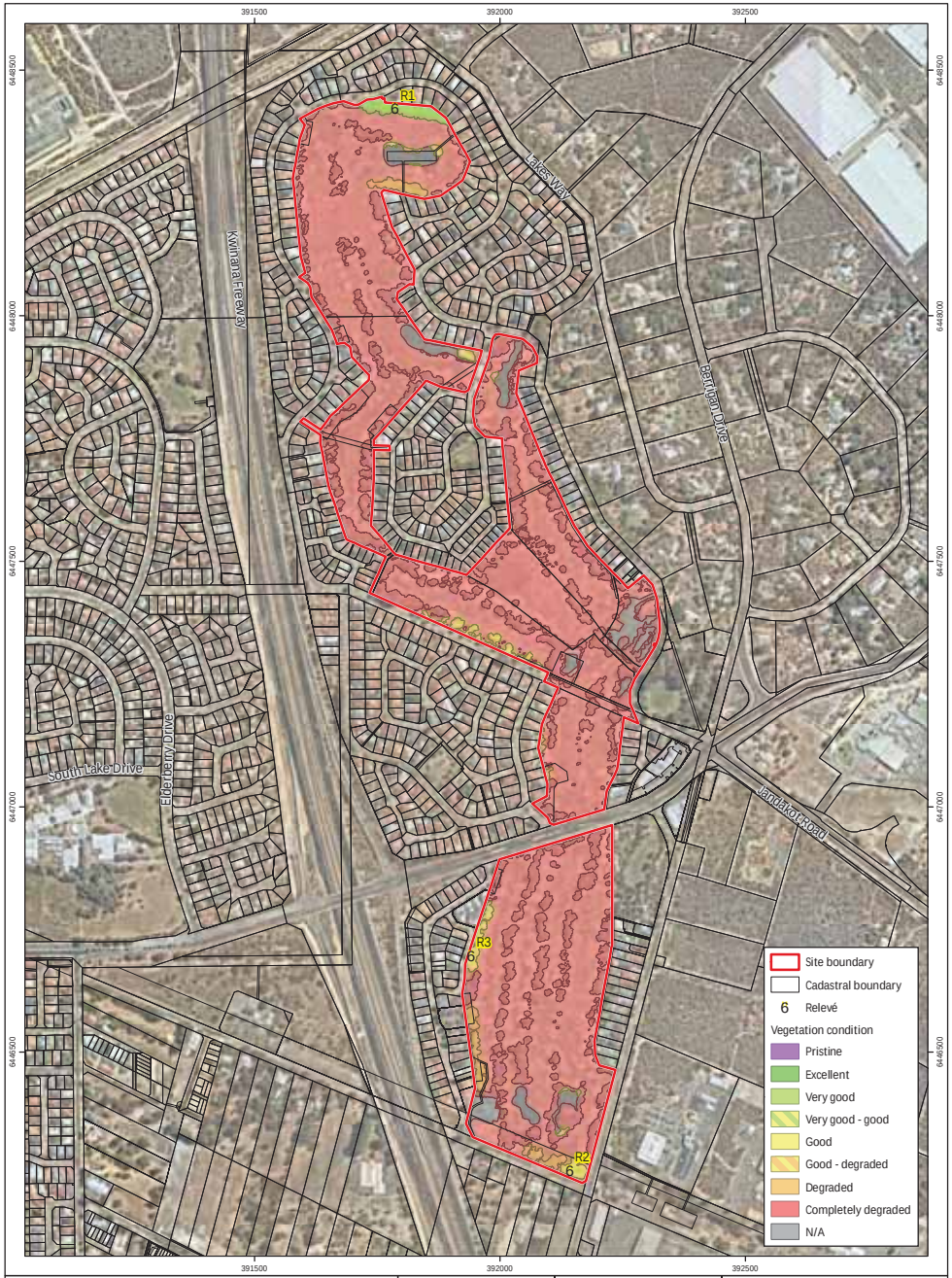

Figure 4: Vegetation Condition

Project: Detailed Flora and Vegetation Assessment
Former Glen Iris Golf Course
Client: ECP Acquisitions 6 Pty Ltd

Plan Number: EP20-009(03)--F05a
Drawn: GAR
Date: 14/09/2021
Checked: SKP
Approved: TAA
Date: 15/09/2021

0 100 200
Metres
Scale: 1:10,000@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

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Appendix A

Additional Information

Conservation Significant Flora and Vegetation

Threatened and priority flora

Flora species considered rare or under threat warrant special protection under Commonwealth and/or State legislation. At the Commonwealth level, flora species can be listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Flora species considered 'threatened' pursuant to Schedule 1 of the EPBC Act are assigned categories according to their conservation status, as outlined in Table 1.

In Western Australia, plant taxa may be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act) which is enforced by Department of Biodiversity Conservation and Attractions (DBCA). Threatened flora species are listed under sections 19(1) and 26(2) of the BC Act. It is an offence to 'take' or disturb threatened flora without Ministerial approval. Section 5(1)1 of the Act defines to take as including "… to gather, pluck, cut, pull up, destroy, dig up, remove, harvest or damage flora by any means" or to cause or permit the same to be done. The definition of threatened flora under the BC Act is provided in Table 1.

Section 43 of the BC Act requires that an occurrence of a threatened species or threatened ecological community is reported to DBCA where the occurrence has been identified as part of field work completed:

- as part of an assessment under Part IV of the *Environmental Protection Act 1986*; or
- in relation to an application for a clearing permit under the *Environmental Protection Act 1986* section 51E(1)(d).

Penalties apply to individuals and organisations that fail to provide accurate reports of threatened species or communities.

The *Biodiversity Conservation Regulations 2018* (BC Regulations 2018) came into effect on January 1 2019. The BC Regulations include provisions for licencing, charges, penalties and other provisions associated with the BC Act.

Flora species that may be threatened or near threatened but lack sufficient information to be listed under the BC Act may be added to the DBCA's *Priority Flora List* (DBCA 2018c). Priority flora species are considered during State approval processes. Priority flora categories and definitions are listed in Table 1.

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Table 1: Definitions of conservation significant flora species pursuant to the EPBC Act and BC Act and on DBCA's Priority Flora List (DBCA 2018c)

Conservation code	Description
EX†	Threatened Flora – Presumed Extinct 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, and have been gazetted as such.
T^†	Threatened Flora – Extant Taxa which are declared to be likely to become extinct or is rare, or otherwise in need of special protection.
CR^	Threatened Flora – Critically Endangered Taxa which are considered to be facing an extremely high risk of extinction in the wild.
EN^	Threatened Flora – Endangered Taxa which are considered to be facing a very high risk of extinction in the wild.
VU^	Threatened Flora – Vulnerable Taxa which are considered to be facing a high risk of extinction in the wild.
P1▯	Priority One – Poorly Known Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat e.g. road verges, urban areas, farmland, active mineral leases etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2▯	Priority Two – Poorly Known 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 (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey.
P3▯	Priority Three – Poorly Known Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but needs further survey.
P4▯	Priority Four – Rare Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

^pursuant to the EPBC Act, †pursuant to the BC Act, ▯on DBCA's *Priority Flora List*

Threatened and priority ecological communities

'Threatened ecological communities' (TECs) are recognised as ecological communities that are rare or under threat and therefore warrant special protection. Selected TECs are afforded statutory protection at a Commonwealth level under section 181 of the EPBC Act. TECs nominated for listing under the EPBC Act are considered by the Threatened Species Scientific Committee and a final decision is made by the Commonwealth Minister for the Environment. Once listed under the EPBC Act, communities are categorised as either 'critically endangered', 'endangered' or 'vulnerable' as defined in Table 2. Any action likely to have a significant impact on a community listed under the EPBC Act requires approval from the Minister for the Environment.

Within Western Australia TECs are determined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee (WATECSAC) and endorsed by the State Minister for the Environment. The WATECSAC is an independent group comprised of representatives from organisations including tertiary institutions, the Western Australian Museum and DBCA. The TECs endorsed by the State Minister are published by DBCA (DBCA 2018b).

TECs are assigned to one of the categories outlined in Table 2 according to their status (in relation to the level of threat). TECs are afforded direct statutory protection at a State level under the BC Act and BC Regulations. Ecological communities are listed under Section 27(1) and 33 of the BC Act. Their significance is also acknowledged through other state environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

Table 2: Categories of threatened ecological communities (English and Blyth 1997; DEC 2009)

Conservation code	Description
PD	Presumably Totally Destroyed An ecological community that has been adequately searched for but for which no representative occurrences have been located.
CE	Critically Endangered An ecological community that has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future.
E	Endangered An ecological community that has been adequately surveyed and is not critically endangered but is facing a very high risk of total destruction in the near future.
V	Vulnerable An ecological community that has been adequately surveyed and is not critically endangered or endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future.

An ecological community that is under consideration for listing as a TEC, but does not yet meet survey criteria or has not been adequately defined may be listed as a 'priority ecological community' (PEC). PECs are categorised as priority category 1, 2 or 3 as described in Table 3. Ecological communities that are adequately known and are rare but not threatened, or meet criteria for 'near threatened', or that have been recently removed from the threatened list, are placed in 'priority 4'. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in 'priority 5' (DEC 2013). Listed PECs are published by DBCA (DBCA 2017b).

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Table 3: Categories of priority ecological communities (DEC 2013)

Priority code	Description
P1	Priority One: Poorly known ecological communities Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2	Priority Two: Poorly known ecological communities Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3	Priority Three: Poorly known ecological communities (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4	Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
P5	Priority Five: Conservation Dependent ecological communities Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Weeds

A number of legislative and policy documents exist in relation to weed management at state and national levels. The *Biosecurity and Agriculture Management Act 2007* (BAM Act) is the principle legislation guiding weed management in Western Australia and lists declared pest species. At a national level, the Australian government has compiled a list of 32 Weeds of National Significance (WoNS) (DoEE 2018), of which many are also listed under the BAM Act.

Declared Pests

Part 2.3.23 of the BAM Act requires a person must not; "*a) keep, breed or cultivate the declared pest; b) keep, breed or cultivate an animal, plant or other thing that is infected or infested with the declared pest; c) release into the environment the declared pest, or an animal, plant or other thing that is infected or infested with the declared pest; or d) intentionally infect or infest, or expose to infection or infestation, a plant, animal or other thing with a declared pest*".

Under the BAM Act, all declared pests are assigned a legal status, as described in Table 4. Species assigned to the 'declared pest, prohibited - s12' category are placed in one of three control categories, as described in Table 5.

The *Biosecurity and Agriculture Management Regulations 2013* specify keeping categories for species assigned to the 'declared pest - s22(2)' category, which relate to the purposes of which species can be kept, as well as the entities that can keep them. The categories are described in Table 6.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act (DPIRD 2020).

Table 4: Legal status of declared pest species listed under the BAM Act (DPIRD 2020)

Category	Description
Declared Pest Prohibited - s12	May only be imported and kept subject to permits. Permit conditions applicable to some species may only be appropriate or available to research organisations or similarly secure institutions.
Declared Pest s22(2)	Must satisfy any applicable import requirements when imported, and may be subject to an import permit if they are potential carriers of high-risk organisms. They may also be subject to control and keeping requirements once within Western Australia

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Table 5: Control categories of declared pest species listed under the BAM Act (DPIRD 2020)

Category	Description
C1	Exclusion Not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2	Eradication Present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3	Management Established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Table 6: Keeping categories of declared pest species listed under the BAM Act (DPIRD 2020)

Category	Description
Prohibited	Can only be kept under a permit for public display and education purposes, and/or genuine scientific research, by entities approved by the state authority.
Exempt	No permit or conditions are required for keeping.
Restricted	Organisms which, relative to other species, have a low risk of becoming a problem for the environment, primary industry or public safety and can be kept under a permit by private individuals.

Wetland Habitat

Geomorphic wetland types

On the Swan Coastal Plain DBCA (2017a) have used the geomorphic wetland classification system developed by Semeniuk (1987) and Semeniuk and Semeniuk (1995) to classify wetlands based on the landform shape and water permanence (hydro-period) as outlined in Table 7.

Table 7: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017a)

Level of inundation	Geomorphology			
	Basin	Flat	Channel	Slope
Permanently inundated	Lake	-	River	-
Seasonally inundated	Sumpland	Floodplain	Creek	-
Seasonally waterlogged	Dampland	Palusplain	-	Paluslope

Wetland management categories

DBCA maintains the *Geomorphic Wetland of the Swan Coastal Plain* dataset (DBCA 2018a), which also categorises individual wetlands into specific management categories as described in Table 8.

Table 8: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017a)

Management category	Description of wetland	Management objectives
Conservation (CCW)	Support high levels of attributes	Preserve wetland attributes and functions through reservation in national parks, crown reserves and state owned land. Protection provided under environmental protection policies.
Resource enhancement (REW)	Partly modified but still supporting substantial functions and attributes	Restore wetland through maintenance and enhancement of wetland functions and attributes. Protection via crown reserves, state or local government owned land, environmental protection policies and sustainable management on private properties.
Multiple use (MUW)	Few wetland attributes but still provide important hydrological functions	Use, development and management considered in the context of water, town and environmental planning through land care.

The management categories of wetland features are determined based on hydrological, biological and human use features. The DBCA document *A methodology for the evaluation of specific wetland types on the Swan Coastal Plain, Western Australia* (DBCA 2017a) details the methodology by which wetlands on the Swan Coastal Plain are assigned management categories based on a two tiered evaluation system, with preliminary and secondary evaluation stages. The preliminary evaluation aims to identify any features of conservation significance that would immediately place the wetland within the CCW management category. Examples of these significant features include presence on significant wetland lists, presence of TECs or PECs (Priority 1 and 2), presence of threatened flora and

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over 90% of vegetation in good or better condition based on the Keighery (1994) scale. If such environmental values are identified the wetland would be categorised as CCW without further evaluation.

Should the preliminary evaluation indicate that no such features occur, the secondary evaluation and site assessment are then applied. In the secondary evaluation, an appropriate management category is determined through the assessment of a range of environmental attributes, functions and values.

Wetland reclassification

DBCA have a protocol for proposing changes to the wetland boundaries and management categories of the existing geomorphic wetland dataset (DEC 2007). The procedure involves a wetland desktop evaluation and site assessment which culminates in a recommended management category. Relevant information should be obtained in the optimal season for vegetation condition and water levels, which is usually spring (DEC 2007). In the case of larger wetlands that have undergone a degree of disturbance, a separate management category may be assigned to parts of the wetland in order to reflect the current values.

References

General references

Department of Biodiversity, Conservation and Attractions (DBCA) 2017a, *A methodology for the evaluation of wetlands on the Swan Coastal Plain*, draft prepared by the Wetlands Section of the Department of Biodiversity, Conservation and Attractions and the Urban Water Branch of the Department of Water and Environmental Regulation, Perth.

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Appendix B

Conservation Significant Flora Species and Likelihood of Occurrence Assessment

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	CR	CR	P	Low woodland on grey, clayey sand with lateritic pebbles (Pinjarra Plain) near winter wet flats.	Sep-Nov	Unlikely
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	CR	CR	P	Low woodland on grey, clayey sand with lateritic pebbles (Pinjarra Plain) near winter wet flats.	Sep-Nov	Unlikely
Andersonia gracilis	V	E	P	Seasonally damp, black sandy clay flats near or on the margins of swamps.	Sep-Nov	Unlikely
Caladenia huegelii	CR	E	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov	Unlikely
Diuris purdiei	E	E	PG	Sand to sandy clay soils in areas subject to winter inundation.	late Sep-mid-Oct, only after a summer or early autumn fire	Unlikely
Drakaea elastica	CR	E	PG	Bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps.	Late Sep-Oct/Nove (survey Jul-Aug)	Unlikely
Eucalyptus x balanites	CR	E	P	Light coloured sandy soils over laterite. Habitat consists of gently sloping heathlands; open mallee woodland over shrubland (Population 2) or heathland with emergent mallees (population 1)	Oct - Feb	Unlikely
Grevillea curviloba subsp. incurva	EN	E	P	Sand, sandy loam. Winter-wet heath.	Aug-Sep	Unlikely
Lepidosperma rostratum	EN	E	P	Peaty sand and clay amongst low heath, in winter-wet swamps.	May-Jun (survey late Jun-Aug)	Unlikely
Macarthuria keigheryi	E	E	P	Low-lying winter-wet damp gey/white sands in open patches.	Sep-Dec, Feb-Mar	Unlikely
Thelymitra dedmaniarum	CR	E	PG	Red brown sandy loam with dolerite and granite outcrops.	Oct-Nov	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Thelymitra stellata	E	E	PG	Sandy loam, clay or gravel over laterite or gravel.	Sep-Nov	Unlikely
Diuris drummondii	V	V	PG	In low-lying depressions in peaty and sandy clay swamps.	Nov-Jan	Unlikely
Diuris micrantha	V	V	PG	Dark grey-black sandly clay-loam in winter wet depressions or swamps. Often in shallow standing water.	Aug/Sep-early Oct	Unlikely
Drakaea micrantha	E	V	PG	Open sandy patches often adjacent to winter-wet swamps.	Sept- early Oct	Unlikely
Eleocharis keigheryi	V	V	P	Clay or sandy loam in freshwater creeks and transient waterbodies such as seasonally wet clay pans.	Aug-Dec	Unlikely
Austrostipa jacobsiana	CR	-	P	Grey sandy clay.	Nov-Jan	Unlikely
Eremophila glabra subsp. chlorella	EN	-	P	Sandy clay. Winter-wet depressions.	Jul-Nov	Unlikely
Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)	P1	-	P	Grey or black sand over clay in winter wet areas.	May-Aug	Unlikely
Hydrocotyle striata	P1	-	A	Sand and clay in springs and creeklines.	Nov	Unlikely
Acacia benthamii	P2	-	P	Sand, typically on limestone breakaways	Aug - Sept	Unlikely
Poranthera moorokatta	P2	-	A	Sandy or clay soils. Dampland or low sandy dunes.	Oct or Feb	Unlikely
Stenanthemum sublineare	P2	-	P	White sand on coastal plains.	Oct-Dec	Unlikely
Thelymitra variegata	P2	-	P	Sandy clay, sand, laterite.	Jun-Sep	Unlikely
Thysanotus sp. Badgingarra (E.A. Griffin 2511)	P2	-	P	Grey sand with lateritic gravel.	Dec	Unlikely
Angianthus micropodioides	P3	-	A	Saline sandy soils on edge of rivers, depressions and clay pans.	Nov-Dec or Jan-Feb	Unlikely
Byblis gigantea	P3	-	P	Sandy-peat swamps. Seasonally wet areas.	Sep-Jan	Unlikely
Cyathochaeta teretifolia	P3	-	P	Grey sand, sandy clay in swamps and creek edges.	Oct-Jan	Unlikely
Dampiera triloba	P3	-	P	Damp peat/loam soil.	Aug-Dec	Unlikely
Dillwynia dillwynioides	P3	-	P	Winter wet depressions on sandy soils	Aug - Dec	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Jacksonia gracillima	P3	-	P	Sand, often adjacent to winter wet areas	Sep-Dec	Unlikely
Phlebocarya pilosissima subsp. pilosissima	P3	-	P	White or grey sand, lateritic gravel.	Aug-Oct	Unlikely
Pimelea calcicola	P3	-	P	sand, limestone, coastal ridges	Sep-Nov	Unlikely
Schoenus benthamii	P3	-	P	White, grey ands, sandy clay in winter wet flats and swamps	Oct-Nov	Unlikely
Schoenus capillifolius	P3	-	A	Brown mud in claypans	Oct-Nov	Unlikely
Schoenus pennisetis	P3	-	A	Grey or peaty sand in swamps and winter-wet depressions.	Aug-Sep	Unlikely
Stylidium aceratum	P3	-	A	Sandy soils in swamp heathland.	Oct-Nov	Unlikely
Stylidium paludicola	P3	-	P	Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland	Oct-Dec	Unlikely
Styphelia filifolia	P3	-	P	Brown over pale yellow sand.	Feb-Apr	Unlikely
Aponogeton hexatepalus	P4	-	P	Mud. Freshwater: ponds, rivers, claypans.	Jul-Oct	Unlikely
Dodonaea	P4	-	P	Sand, outcropping limestone.	Jul-Oct	Unlikely
Drosera occidentalis	P4	-	P	Flat, brown/white/yellow moist	Oct-	Unlikely
Hydrocotyle	P4	-	A	Floating in swamps.	Aug-Oct	Unlikely
Jacksonia sericea	P4	-	P	Calcareous and sandy soils on Swan Coastal Plain	Dec-Feb	Unlikely
Kennedia beckxiana	P4	-	P	Sand or loam on granite hills and	Sep-Dec	Unlikely
Microtis quadrata	P4	-	PG	Sand, loam or peat in winter wet areas	Oct-Dec	Unlikely
Ornduffia submersa	P4	-	A	Sandy clay in inundated	Aug-Nov	Unlikely
Stylidium longitubum	P4	-	A	Seasonal wetlands.	Oct-Dec	Unlikely
Tripterococcus sp.	P4	-	P	Winter-wet areas on grey sand.	Oct-Feb	Unlikely
Verticordia lindleyi subsp. lindleyi	P4	-	P	Sand and sandy clay in winter wet areas.	May or Nov-Jan	Unlikely

Note: T=threatened, CE=critically endangered, E=endangered, V=vulnerable, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4, P=perennial, PG=perennial geophyte, A=annual. Species considered to potentially occur within the site are shaded green

Appendix C

Flora Species List

Family	Status	Species
Aizoaceae		
	*	*Carpobrotus edulis*
Anacardiaceae		
	*	*Schinus terebinthifolia*
Anarthriaceae		
		Lyginia imberbis
Apocynaceae		
		?Alyxia buxifolia
	*	*Nerium oleander*
Arecaceae		
	*	*Washingtonia filifera*
Asparagaceae		
		Lomandra caespitosa
		Lomandra hermaphrodita
		Sowerbaea laxiflora
Asteraceae		
	*	*Conyza bonariensis*
	*	*Hypochaeris ?glabra*
	*	*Lactuca seriata*
	*	*Sonchus oleraceus*
	*	*Ursinia anthemoides*
Casuarinaceae		
		Allocasuarina fraseriana
		Allocasuarina humilis
Chenopodiaceae		
		Rhagodia baccata subsp. baccata
Colchicaceae		
		Burchardia congesta
Convolvulaceae		
	*	*Ipomoea cairica*
Cupressaceae		
		Callitris preissii
Cyperaceae		
		Baumea sp.
	*	*Cyperus congestus*
		Lepidosperma sp.
		Mesomelaena pseudostygia
		?Schoenus sp.
		Schoenoplectus tabernaemontani
Dasypogonaceae		
		Dasypogon bromeliifolius
Dilleniaceae		
		Hibbertia huegelii
		Hibbertia hypericoides
Droseraceae		
		Drosera erythrorhiza
		Drosera menziesii

Family	Status	Species
Ericaceae		
		Conostephium pendulum
		Leucopogon sp.
		Styphelia propinqua
Fabaceae		
	*	*Acacia baileyana*
	*	*Acacia longifolia*
		Acacia pulchella
		Acacia rostellifera
		Acacia saligna
		Acacia stenoptera
		Bossiaea eriocarpa
		Daviesia nudiflora
		Daviesia triflora
		Gastrolobium capitatum
		Gompholobium tomentosum
		Hardenbergia comptoniana
		Jacksonia furcellata
		Jacksonia sternbergiana
	*	*Robinia sp.*
	*	*Trifolium sp.*
Geraniaceae		
	*	*Pelargonium capitatum*
Goodeniaceae		
		Dampiera linearis
		Lechenaultia biloba
		Scaevola canescens
		Scaevola repens
Haemodoraceae		
		Conostylis aculeata
		Conostylis setigera
		Phlebocarya ciliata
Hemerocallidaceae		
		Arnocrinum preissii
		Corynotheca micrantha var. micrantha
		Tricoryne elatior
Iridaceae		
	*	*Gladiolus caryophyllaceus*
	*	*Patersonia occidentalis*
Juncaceae		
		Juncus pallidus
Lamiaceae		
	*	*Salvia rosmarinus*
Loranthaceae		
		Nuytsia floribunda
Malvaceae		
	*	*Lagunaria patersonia*
Meliaceae		

Family	Status	Species
	*	*Melia azedarach*
Myrtaceae		
		Agonis flexuosa
		?Calytrix sp
		Corymbia calophylla
	*Pl	*Corymbia citriodora*
	*Pl	*Corymbia ficifolia*
	*Pl	*Corymbia maculata*
		Eremaea pauciflora
	*Pl	*Eucalyptus caesia*
	*Pl	*Eucalyptus camaldulensis*
		Eucalyptus gomphocephala var. gomphocephala
	*Pl	*Eucalyptus grandis*
		Eucalyptus marginata subsp. marginata
	*Pl	*Eucalyptus sideroxylon*
	*Pl	*Eucalyptus sp. 1*
	*Pl	*Eucalyptus sp. 2*
		Eucalyptus todtiana
	*Pl	*Eucalyptus utilis*
		Hypocalymma angustifolium
		Hypocalymma robustum
		Kunzea glabrescens
	*	*Leptospermum laevigatum*
	*Pl	*Lophostemon confertus*
	*Pl	*Melaleuca sp.*
		?Melaleuca systena
		Melaleuca thymoides
		Regelia ciliata
		Regelia inops
		Scholtzia involucrata
Nyctaginaceae		
	*	*Bougainvillea sp.*
Oleaceae		
	*Pl	*Olea europaea subsp. europaea*
Orchidaceae		
		Caladenia latifolia
		Microtis media
Pinaceae		
	*Pl	*Pinus sp.*
Poaceae		
	*	*Avena barbata*
	*	*Briza maxima*
	*	*Bromus diandrus*
	*	*Cenchrus clandestinus*
	*	*Cortaderia selloana*
	*	*Cynodon dactylon*
	*	*Ehrharta calycina*
	*	*Eragrostis curvula*

Family	Status	Species
	*	*Lagurus ovatus*
	*	*Paspalum dilatatum*
	*	*Sporobolus africanus*
Portulacaceae		
		Portulaca oleracea
Proteaceae		
		Adenanthos cygnorum
		Banksia attenuata
		Banksia ilicifolia
		Banksia menziesii
	*Pl	*Grevillea sp.*
		Persoonia saccata
		Petrophile linearis
	*Pl	*Protea sp.*
		Stirlingia latifolia
Restionaceae		
		Desmocladus flexuosus
		Hypolaena exsulca
Santalaceae		
		Exocarpos sparteus
Simaroubaceae		
	*	*Ailanthus altissima*
Thymelaeaceae		
		Pimelea suaveolens
Typhaceae		
		Typha domingensis
Violaceae		
		Hybanthus calycinus
Xanthorrhoeaceae		
		Xanthorrhoea preissii
Zamiaceae		
		Macrozamia fraseri

Note: * denotes non-native species, Pl denotes planted

Appendix D

Conservation Significant Communities and Likelihood of Occurrence Assessment

Conservation significant communities known or likely to occur within 10 km of the site

Former Glen Iris Golf Course

Code	Community name	TEC/PEC	Level of significance	
			State	EPBC Act
	Clay pans of the Swan Coastal Plain	TEC	VU/EN	CR
	Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain	TEC	-	CR
SCP22	*Banksia ilicifolia* woodlands, southern Swan Coastal Plain	TEC/PEC	P3	EN (Banksia woodlands of the Swan Coastal Plain)
SCP24	Northern Spearwood shrublands and woodlands	TEC/PEC	P3	
	Banksia woodlands of the Swan Coastal Plain	TEC/PEC	P3	EN
	Subtropical and temperate coastal saltmarsh	TEC	-	VU

Note: TEC=threatened ecological community, PEC=priority ecological community, CR=critically endangered, EN=endangered, VU=vulnerable, P3=priority 3

Appendix E

Sample Data

Sample Name: R1

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R1: Page 2 of 3

Quadrat and landform details

Sample type:	releve	Size:	other
NW corner easting:	391786	NW corner northing:	6448422
Altitude (m):	N/A	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	flat
Time since fire:	> 5 yrs	Disturbance:	moderate - weeds
Soil type/texture	sand/	Bare ground (%):	10
Rocks (%) and type:	No rocks	Soil colour:	brown/white
Litter:	30% (leaves,branches,)	Vegetation condition:	very good

Vegetation Sample Data
Former Glen Iris Golf Course

Sample Name: R1

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R1: Page 2 of 3

Species Data
* denotes non-native species

Status	Confirmed name
	Acacia pulchella
	Acacia stenoptera
	Allocasuarina humilis
	Banksia attenuata
	Banksia menziesii
*	*Carpobrotus edulis*
	Conostephium pendulum
	Conostylis ?aculeata
	Dampiera linearis
	Daviesia nudiflora
	Desmocladus flexuosus
*	*Ehrharta calycina*
*	*Eragrostis curvula*
	Eucalyptus marginata subsp. marginata
	Gastrolobium capitatum
	Gompholobium tomentosum
*Pl	*Grevillea sp.*
	Hardenbergia comptoniana
	Hibbertia hypericoides
	Jacksonia furcellata
	Jacksonia sternbergiana
	Lepidosperma sp.
*	*Leptospermum laevigatum*
	Lyginia imberbis
	Mesomelaena pseudostygia
*	*Nerium oleander*
	Patersonia occidentalis
*	*Pelargonium capitatum*
	Petrophile linearis
	Phlebocarya ciliata
	Scaevola canescens
	Stirlingia latifolia
	Xanthorrhoea preissii
	Pimelea ?suaveolens subsp. suaveolens
	Tricoryne elatior

Sample Name: R1

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R1: Page 3 of 3

Conostylis setigera
Hybanthus calycinus
Sowerbaea laxiflora
Drosera menziesii
Hypocalymma robustum
Lomandra caespitosa

* = non-native, Pl=planted

Sample Name: R2

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R2: Page 2 of 2

Quadrat and landform details

Sample type:	releve	Size:	other
NW corner easting:	392142	NW corner northing:	6446258
Altitude (m):	N/A	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	flat
Time since fire:	no evidence	Disturbance:	moderate - weeds
Soil type/texture	sand/	Bare ground (%):	30
Rocks (%) and type:	No rocks	Soil colour:	brown/white
Litter:	15% (leaves,twigs,)	Vegetation condition:	very good

Sample Name: R2

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R2: Page 2 of 2

Species Data
* denotes non-native species

Status	Confirmed name
*	*Acacia longifolia*
	Allocasuarina fraseriana
	Burchardia congesta
*	*Cynodon dactylon*
	Dasypogon bromeliifolius
*	*Ehrharta calycina*
	Hypolaena exsulca
	Kunzea glabrescens
*	*Lagurus ovatus*
	Lyginia imberbis
	Melaleuca thymoides
	Scholtzia involucrata
	Xanthorrhoea preissii

* = non-native

Sample Name: R3

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R3: Page 2 of 2

Quadrat and landform details

Sample type:	releve	Size:	other
NW corner easting:	391941	NW corner northing:	6446696
Altitude (m):	N/A	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	flat
Time since fire:	> 5 yrs	Disturbance:	moderate - weeds
Soil type/texture	sand/	Bare ground (%):	20
Rocks (%) and type:	No rocks	Soil colour:	brown/white
Litter:	20% (leaves,branches,)	Vegetation condition:	very good

Vegetation Sample Data
Former Glen Iris Golf Course

Sample Name: R3

Project no.: EP20-009
Date: 11/03/2020, 19/08/21, 9/9/21 Status Non-permanent
Author: TAA,SKP R3: Page 2 of 2

Species Data
* denotes non-native species

Status	Confirmed name
	Adenanthos cygnorum
	Allocasuarina humilis
	Banksia attenuata
	Banksia menziesii
	Callitris preissii
*	*Carpobrotus edulis*
	Conostephium pendulum
	Daviesia nudiflora
	Daviesia triflora
*	*Ehrharta calycina*
*Pl	*Eucalyptus caesia*
	Eucalyptus marginata subsp. marginata
	Gastrolobium capitatum
	Gompholobium tomentosum
	Hibbertia hypericoides
	Hypocalymma angustifolium
	Jacksonia furcellata
	Lomandra hermaphrodita
	Lyginia imberbis
	Macrozamia fraseri
	Mesomelaena pseudostygia
	Patersonia occidentalis
*	*Pelargonium capitatum*
	Persoonia saccata
	Scaevola repens
	Scholtzia involucrata
	Stirlingia latifolia
	Styphelia propinqua
	Caladenia latifolia
	Hypocalymma robustum

* = non-native, Pl=planted

GLEN IRIS ESTATE

APPENDIX 9
TRANSPORT IMPACT ASSESSMENT

Eastcourt Property Group

Glen Iris Estate

Structure Plan Transport Impact Assessment: updated report

August 2023

Project Code: 06066

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1 Introduction

1.1 Background & Proposal

The site of the proposed structure plan is the previous Glen Iris Estate Golf Course, currently undergoing structure planning under the City of Cockburn's Town Planning Scheme No. 3 to facilitate predominantly residential development. The proposed structure plan will have between 500 – 600 dwellings on large sized lots (typically 600sq.m), as well as a 0.7ha area set aside for a local centre likely to include a small supermarket and supporting shops. The structure plan concept assessed in this Transport Impact Assessment (TIA) is the result of over 12 months of focussed community consultation and input from a range of subject matter experts including town planners, landscape architects, civil engineers and environmental scientists.

PJA has been engaged by Acumen Development Solutions on behalf of the landowner Eastcourt Property Group, in May 2023 to undertake a transport impact assessment of the proposed Structure Plan. This updated report is an extension to the previous work undertaken by GTA Consultants (GTA) in April 2020.

1.2 Purpose of this Report

Volume 2 of the Western Australian Planning Commission Transport Assessment Guidelines (WAPC Guidelines) provide direction on the preparation of a TIA for Structure Plans. The WAPC Guidelines identify that a TIA for a Structure Plan is to provide a broad-brush assessment.

The WAPC policy requires structure plans to be supported by a transport impact assessment.

In accordance with the WAPC Guidelines, this TIA outlines:

- Existing transport conditions proximate to the site
- Suitability of the proposed parking provision within the site
- The adequacy of the proposed site layout
- The traffic generating characteristics of the proposed development
- The anticipated impact of the proposed development on the surrounding road network.

1.3 Summary of key issues

From a traffic and transport point of view, the following key provisions are immediately identified for this TIA:

- The existing road network currently supporting the existing Glen Iris Estate was not intended to cater for a high proportion of future increase in traffic volumes. As such, the structure plan will likely need to rely on the provision of its own movement network and new intersections.
- The existing road network geometry is prohibitive to the running of public transport vehicles through the existing Glen Iris Estate and consequently, the existing residence have poor public transport access to services. More than three-quarters of the existing estate is outside of a 400m typical walking catchment of the bus stops on Berrigan Drive.

  As such, the structure plan should provide opportunity to improve the accessibility and services of public transport to existing and future residents and visitors of the estate.

- Traffic volumes along Berrigan Drive have continued to grow at a consistent and relatively high rate over the past 5 years to 2021, resulting in very poor and worsening levels of service and diminishing safety for existing residents to be able to access Berrigan Drive and beyond. Currently, most of the residents are wholly dependent on priority controlled (also referred to as "uncontrolled") full movement intersections with long queues and delays.

  As such, the structure plan should provide bold traffic management solutions which should assist the existing residents in Glen Iris Estate with an improved level of service and improved safety to be able to access the wider network.

1.4 Previous Studies

- Cockburn Regional Analysis (Main Roads WA) March 2016
- Centre Development Strategy – DRAFT (Taktics4) March 2021.

1.5 References

In preparing this report, reference has been made to the following:

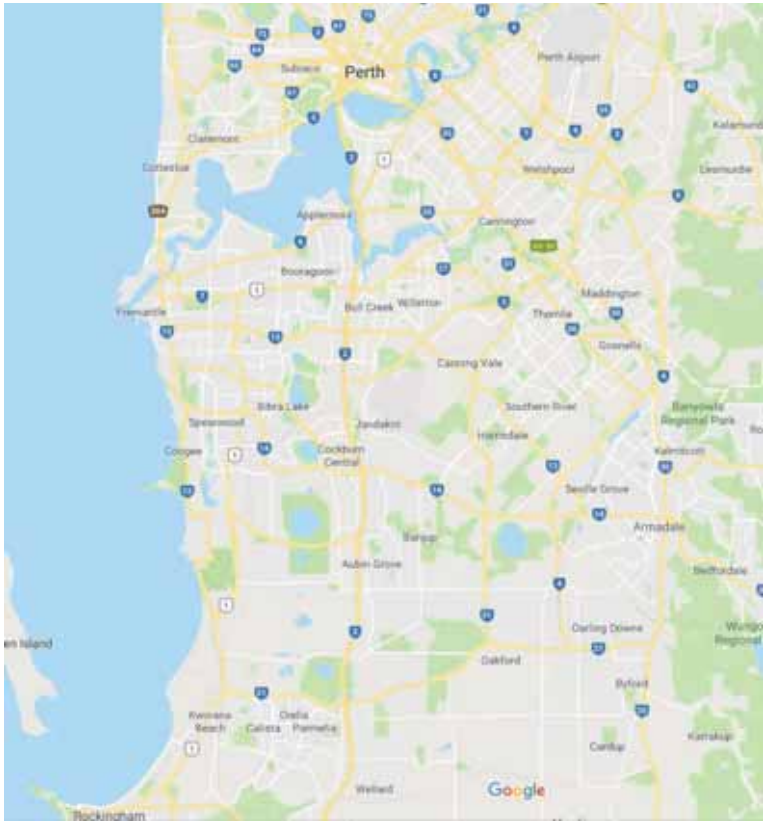
- City of Cockburn Town Planning Scheme No. 3
- Liveable Neighbourhoods Guidelines – 2009
- WAPC Transport Assessment Guidelines for Development: Volume 2 – Planning Schemes, Structure
- Plans and Activity Centre Plans
- plans for the proposed structure plan prepared by Rowe Group
- traffic surveys as referenced in the context of this report
- various technical data as referenced in this report
- an inspection of the site and its surrounds
- other documents as nominated.

2 Structure Plan Outline

2.1 Regional Context

The subject site is in the suburb of Jandakot, within the City of Cockburn. The site is approximately 17 km south of the Perth CBD and directly adjacent the eastern side of the Kwinana Freeway.

Figure 2.1: Location Map



(PhotoMap courtesy of Google Maps)

2.2 Proposed Land Uses

The Structure Plan is predominantly residential with current planning to provide 500 – 600 dwellings at full development. This quantum of lots proposed is much less than otherwise possible on this land under the permissible zoning (some 900 lots). There is also provision for a small supermarket-based local centre totalling 2,500sq.m of Gross Floor Area (GFA). The proposed layout is shown below in Figure 2.2 (overleaf).

2.3 Attractors or Generators of Traffic (non-residential)

The only non-residential land use with the potential to attract external trips is the proposed local centre which is currently located immediately to the north of Berrigan Drive, abutting the existing commercial centre on the Berrigan Drive / Dean Road north-west corner.

The catchment for this local centre would be limited to predominantly residents local to the Glen Iris Estate due to its size and commercial offerings discussed further in the Centre Development Strategy . The Centre Development Strategy predicts a very localised catchment with a small external market from outside the Jandakot / Glen Iris community as follows:

- South Lake: 6%
- Cockburn Central: 1%
- Leeming: 9%
- Treeby: 4%.

Figure 2-2: Structure Plan Layout

(Source: Rowe Group)

3 Existing Situation

3.1 Subject Site

The site comprises 54ha of land previously used as the Glen Iris Golf Course. This golf course was central in the Glen Iris Golf Course Estate which established residential development around all edges of the course. In 2020 the previous owners of the land closed the golf course and then sold the land to a local property developer who is now in the process of lodging the necessary structure plan over the site to facilitate residential development.

The 54ha of golf course land runs in a north-south alignment separated by Berrigan Drive. The structure plan area is bound by Dean Road, Glen Iris Drive and Prinsep Road on the east and The Lakes Boulevard, Hartwell Parade and Glen Iris Drive on the west. Vehicular access to and from the site is only possible via Berrigan Drive with full movement priority-controlled intersections at The Lakes Boulevard, Turnbury Park Drive and Prinsep Road as well as a four-way signal-controlled intersection at Dean Road/Jandakot Road/Berrigan Drive.

The site also has Kwinana Freeway immediately to the west and Roe Highway to the north, however, given these are major roads in the network hierarchy, these cannot facilitate any new intersections for this development.

The existing heavy rail Thornlie Railway Line also runs east-west along to the north of the site providing public transport services from Perth to Armadale. The Perth to Mandurah Railway Line runs north south in the middle of the Kwinana Freeway. METRONET is also currently constructing the heavy rail connection between Thornlie and Cockburn Railway Stations, discussed further in Section 4.4.

The City of Cockburn Town Planning Scheme No. 3 currently identifies the subject site as 'Special Use 1 Zone', with a small portion of 'Residential R40' and it is zoned 'Urban' under the Metropolitan Region Scheme (MRS).

The surrounding properties include a mix of zones including the Residential R-20 and Resource Zone (predominantly rural-residential dwellings).

The location of the subject site and the surrounding environs is shown in Figure 3.1, and the land zoning is shown in Figure 3.2.

Figure 3.1: Subject Site and its Environs

(PhotoMap courtesy of NearMap Pty Ltd)

Figure 3.2: Land Zoning Map

(Reproduced from City of Cockburn Intramaps)

3.2 Existing Movement Network

3.2.1 Roads (inc RAV Networks)

The existing road network internal to the structure plan area does not exist given the historic use as a golf course. However, for the purpose of this Transport Impact Assessment the internal road network of the existing Glen Iris Estate north and south (of Berrigan Drive) is included and discussed.

3.2.2 Distributor A Roads

Berrigan Drive

Berrigan Drive runs east-west between the north and southern portions of the structure plan area connecting Jandakot Road to the Kwinana Freeway. It is identified as a District Distributor A road under the Main Roads WA functional road hierarchy and has a posted speed limit of 70km/hr. Berrigan Drive also forms part of the Restricted Access Vehicle Network up to and including Category 4 vehicles which can be represented by a 27.5m B-Double road train.

Existing traffic volumes are provided in Table 3.1.

3.2.3 Local Distributor Roads

Prinsep Road

Prinsep Road runs north-south along the eastern boundary of the southern portion of the structure plan forming a connection between Berrigan Drive and Verde Drive. It is a Local Distributor under the Main Roads WA functional road hierarchy and has a posted speed limit of 60km/hr.

Existing traffic volumes are provided in Table 3.1.

3.2.4 Access Roads

The road network within the Glen Iris Estate is limited to 'Access Roads'. These roads have typical local street typologies with pavement widths ranging from 6.5m to 7.2m. Majority of these streets have footpaths on one verge and do not support frequent on street parking. There are Local Area Traffic Management (LATM) devices implemented through-out the existing Glen Iris Estate in the form of slow points, central blister islands and raised flat top speed humps. As these streets do not provide any access for 'external – external' trips through Glen Iris, the purpose of these LATM devices are primarily to control vehicle speeds within the precinct. All local streets within Glen Iris are subject to the default 50km/h built up speed limit. 'Access Roads' with direct interaction with the proposed structure plan include the following:

- Dean Road
- Glen Iris Drive
- Turnbury Park Drive
- Hartwell Parade
- The Lakes Boulevard
- Imlah Court.

In 2017 the City of Cockburn constructed two culs-de-sacs at the intersection of Imlah Court and The Lakes Boulevard to improve local amenity and discourage heavy vehicle traffic that was using Imlah Court and The Lakes Boulevard as a shortcut to the Kwinana Freeway to by-pass the Prinsep Road / Berrigan Drive intersection. The structure plan does not propose to modify this existing road layout and intends for the two local roads to remain disconnected, as desired by the existing residents.

3.2.5 Pedestrian and Cyclist Network

As the structure plan area was previously a public golf course there is no formal pedestrian or cycling network within the site itself.

In the adjacent areas, concrete paths typically 1.5 – 2.0m wide are provided on one-side only over much of the local street network that surrounds the site including:

- Dean Road
- Glen Iris Drive
- Hartwell Parade
- Turnbury Park Drive.

There are no formal cycling facilities throughout the development but traffic volumes and speeds on the local streets themselves are conducive to shared on-street cycling. However, the long winding internal road with few opportunities to safely overtake (for cars that may want to overtake bikes) could lead to frustration from drivers and result in risky driving behaviour which is of a safety concern for residents.

The existing Principal Shared Path (PSP) that is only on the western side of the Kwinana Freeway means residents must travel north or south in the area to Berrigan Drive and then ride / walk along Berrigan Drive, over the freeway to access the PSP.

There is also an existing pedestrian underpass connecting the northern and southern golf course areas under Berrigan Drive. This existing underpass does not meet the latest best practice standards such as Crime Prevention Through Environmental Design (CPTED), however, the project team is

currently investigating the upgrade of this facility with a preference to retain the underpass if possible.

3.2.6 Public Transport

Bus services in the Glen Iris area are limited. The 515 service has two bus stops either side of Berrigan Drive shown in Figure 3.3.

Due to the long north-south nature of the Glen Iris Estate there is a limited number of dwellings within the 400m walkable catchment to these existing stops, with over three-quarters of residences outside this typical walkable catchment (refer Figure 3.4). As an example, the existing northern dwellings in the estate are over a 2.0km walk away to any public transport facilities.

The Cockburn Central Railway Station is accessible via cycling along the PSP on the western side of the Kwinana Freeway, this trip is approximately 3.0km from the bus stops on Berrigan Drive, or 5.0km from the northern residencies.

The Cockburn Central Railway Station park and ride facility is an 8-minute drive via Prinsep Road or the Kwinana Freeway.

There was a clear desire noted in the community consultations to date to improve current bus service accessibility.

Figure 3.3: Existing Bus Stop Locations

(map source: Google)

Figure 3.4: Existing Bus Stops 400m Walking Catchment

(map source: Google)

3.3 Existing Road Network (Within 2km)

There are several key roads within 2km of the proposed structure plan that warrant discussion in this TIA most importantly the works currently been undertaken by Main Roads WA for the Northlake Road Extension and Grade Separated Interchange with Kwinana Freeway discussed in more detail in Chapter 5.

Figure 3.5: Existing Road Network within 2km

(map source: Reproduced with permission from Nearmap)

3.4 Traffic Counts (within 2km)

Several different sources were referred to obtain a full picture of the current traffic movements in the Glen Iris area.

Table 3.1 details publicly available tube counts showing Average Week Daily Traffic from Main Roads WA and the City of Cockburn, collected between 2018 and 2020.

Without any change in development of the Glen Iris Estate between 2018 and 2021, it is considered the 2018 counts are suitably accurate for the purpose of structure planning assessment.

Traffic volumes on external routes such as Berrigan Drive and Jandakot Road with a much larger catchment are referenced for years more recent.

Table 3.1 : Existing Traffic Volumes

	Location	Year	Monday to Friday Average	% Cars	% Trucks
1	Berrigan Drive – East of Kwinana Freeway	2020	27,780	89.2	10.8
2	Jandakot Road – East of Berrigan Drive	2019	18,261	91.7	8.3
3	Prinsep Road – South of Berrigan Drive	2020	5,525	81.8	18.2
4	The Lakes Boulevard – South of Berrigan Drive	2020	499	95.5	4.5
5	Turnbury Park Drive – West of Hartwell Parade	2018	1,067	96.0	4.0
6	Hartwell Parade – North of St James Mews	2018	1,049	96.3	3.7
7	Glen Iris Drive – North of Edie Court	2020	598	93.7	6.3
8	Glen Iris Drive – South of Bonville Glen	2020	405	96.2	3.8
9	Dean Road – North of Berrigan Drive	2021	2,187	94.6	5.4

In addition to the publicly available counts, the project team also commissioned turning vehicle movement surveys. These were undertaken in November 2020 between 7:00 – 9:00am during the AM period and between 4:00pm – 6:00pm during the PM peak period for the following intersections along Berrigan Drive for the purpose of undertaking traffic analysis of these intersections:

1 The Lakes Boulevard / Berrigan Drive

2 Turnbury Park Drive / Berrigan Drive

3 Prinsep Road / Berrigan Drive.

These collated turning volumes are shown in Figure 3.6 and Figure 3.7.

Figure 3-6: Intersection Turning Movement Counts – AM Peak

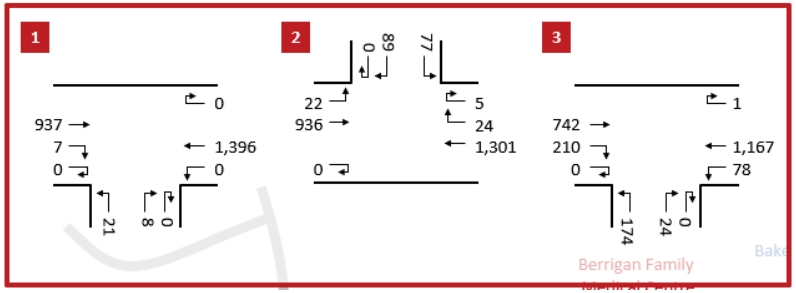


Figure 3-7: Intersection Turning Movement Counts – PM Peak

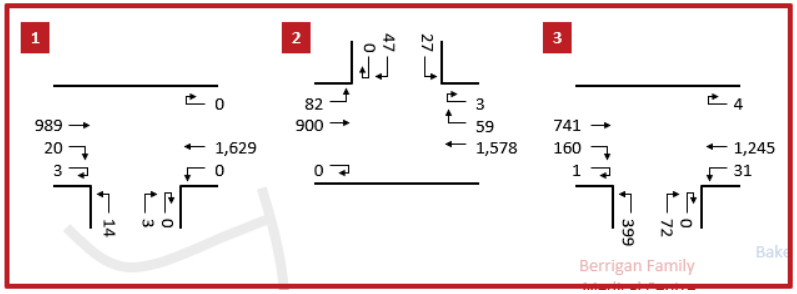


Figure 3-8: Existing Intersections – Berrigan Drive

Source: Google Maps

4 Proposed Internal Transport Networks

4.1 Proposed Road Hierarchy, Road Reserve Widths and Speed Limits

Due to the nature of this structure plan with large amounts of linear open spaces and larger lot sizes, reduces the need for on street parking. As such, typical cross-sections from Liveable Neighbourhoods guidelines can be modified to suit the intended purposes of the street typology without providing infrastructure unlikely to be used.

Figure 4.1 shows the proposed road hierarchy for the structure plan. The structure plan area contains a short section of Neighbourhood Connector A road off Berrigan Drive and a *modified* Neighbourhood Connector B or Access Street road running north-south through the structure plan area. The remaining of the street network will be Give-Way type lower order Access Streets. The internal road network within the structure plan area has been designed to provide frequent and logical connections to the existing road network to allow existing residents to travel through the structure plan area to access the Berrigan Drive corridor, thus relieving some existing traffic pressure on existing local roads such as Dean Road and Turnbury Park Drive.

As the area will be built up residential, the road network will be subject to default 50km/h speed limit, however through thoughtful street design it is proposed that the Neighbourhood Connector roads will have a target operating speed of no more than 50km/h while the Access Streets will be designed with target operating speeds between 30 – 40km/h. Additionally, street amenity is to be prioritised through the provision of trees and slow speeds.

Due to the larger sized residential blocks being proposed, on-street parking is *not* envisaged to be frequently required. As such dedicated on-street parking has been excluded from the typical Neighbourhood Connector style roads and road reservations could be as follows:

- Neighbourhood Connector A: typically 20m, allowing for traffic lanes, a dual use path on one side, with trees, light poles and drainage structures to be provided either within the verge area or proposed central median.
- Neighbourhood Connector B: typically 13.5 – 15m, allowing for traffic lanes, and a dual use path on one side of the road.
- Access Street: typically 13.5 – 15m, with a similar layout to Neighbourhood Connector B roads.

Proposed Internal Transport Networks

Figure 4-1: Structure Plan Road Hierarchy

(map base: Rowe Group, 2023

The road cross section layouts will be finalised through the detailed design of civil engineering drawings in the subdivision stages. A number of indicative cross section layouts have been prepared; however, it should be noted that these are representative only with flexibility in the layout enabling changes with final infrastructure selected or omitted (i.e. parking, cycle lanes and bus route, becomes apparent). Items to be addressed in the further development of the cross sections includes such things as:

- Neighbourhood Connector A Lane width of 3.2 to 3.5m (3.2m width is preferred to remove unsafe squeeze points for cyclists riding on the road) and flexibility for Public Transport Authority (PTA) buses, if there is opportunity for future public transport buses to connect from Karel Avenue (refer discussion in Section 4.4 – Public Transport)
- Provision for embayed parking in the street surrounding public open spaces.

Figure 4-2: Indicative Road Reserve for Neighbourhood Connector A

While it is not proposed to provide on street parking for the full length of Neighbourhood Connector Roads, there are areas where embayed parking can be provided. These areas will be focused around public open space and the medium density dwellings as required. Embayed parking allows the development to retain tighter and low-speed local streets while still providing the parking function to support relevant land uses.

Neighbourhood Connectors A road reserves of 20m allow flexibility in the pavement lane widths of 3.2m to 3.5m (preferred to be 3.2m to avoid a car or truck trying to take over a cyclist in this section and creating a cyclist squeeze points).

Liveable Neighbourhoods allows for flexibility in the various cross-sectional elements in a road reserve. In the case of each of the Neighbourhood Connectors the following has been considered:

- Neighbourhood Connector A: The 'typical' cross section is 24.4m and includes 1.5m wide on-road cycle lanes, 3.5m wide traffic lanes and a 2m wide median. It also allows the verge area of 6.5m to be narrowed to indented parking where provided. The basic indented parking can thus reduce the road reserve to 23m and this is noted in Liveable Neighbourhoods guidelines. If the provision for cyclists is to be off-road in the form of shared paths, the removal of the on-road cycle lanes from this 'typical' width would then reduce the road reserve to 20m. Additionally, if there was provision of an on-road bike lanes here, it will be only for short lengths either side of Berrigan Drive and have no connectivity to the road network further north and south along the Neighbourhood Connector B or Access Streets. The provision of off-road shared paths however, will allow connectivity into the shared path on the north side of Berrigan Drive which then connects to the PSP within the Kwinana Freeway reserve. Omitting any on-road bike lanes with a road reserve width of 20m is suitable and can provide for traffic lanes of 3.2m with a median or cut into the median for lane widths of 3.5m width (if enforced and creating undesirable cyclist squeeze points). The 3.2m is recommended as cyclists riding on a lane of 3.1m provides for increased cyclists' safety. At the same time, to allow for the possibility of long term future bus services, a bus lane with a median should not be any narrower than 3.2m. Thus, a 3.2m lane has been suggested as it provides for use by both cyclists on-road (if they so desire) and allows bus services to operate on the roadway in the long term future if land allows the connection to/from Karel Avenue.

Figure 4-3: Indicative Road Reserve for Neighbourhood Connector B / Access Street

- Neighbourhood Connector B / Access Street: These streets are required where they link neighbourhoods and towns. Neighbourhood Connector B are akin to higher order Access Streets. These road types typically carry up to about 3,000vpd. The main distinction between

Neighbourhood Connector B streets and Access Streets is that buses are typically provided for on Neighbourhood Connector B streets. Also, parking in both Neighbourhood Connector B and Access Streets should only need to be provided where there is expected to be parking demand on the street.

In the case of the proposed Neighbourhood Connector B in the southern cell, there is not proposed to be any bus route in this section and the street does not connect neighbourhoods and therefore is really a local Access Street. The function of this section of street is more closely aligned to an Access Street and thus 3.5m wide traffic lanes with embayed parking would not be required as would a Neighbourhood Connector B type street cross section. Traffic flows on this section of street are expected to be in the order of 1,000vpd and a cross section of an Access Street D could suffice (this with a 6m wide roadway and allowing for on-road parking). The proposed 15m road reserve on this section can then allow for the expected traffic flow and traffic composition.

For the proposed Neighbourhood Connector B / Access Street in the northern cell north of Hartwell Parade roundabout, this section is unlikely to carry a bus route in the immediate future. It is also not performing the function of a neighbourhood connector but an Access Street. This street will function similar to the parallel Dean Road, east of the structure plan area. Dean Road carries about 2,100vpd and is approximately 6.4m wide with a barrier line prohibiting on-road parking along its length. That is the same approach proposed for the proposed Neighbourhood Connector B in the proposed northern cell. The roadway is a meandering 6m width with a barrier line. This 6m pavement width is adopted to avoid removal of significant portions of trees along the roadway and maximising the amenity which the scheme amendment approval was to prioritise. The barrier line will also prohibit on-road parking. With no on-road parking, this road will be able to carry 3,000vpd. The expected daily flows on this road are expected to be 2,900vpd (conservative on the high side estimate) and thus catered for.

Apart from the roadway, the required verge of 4.1m can be provided on the western side, to cater for servicing and footpaths. On the side of the street with trees, the verge only needs to be wide enough to cater for drainage and street lighting (if provided on that side of the roadway). Any proposed pathway/shared path can then meander through the trees maximising residential amenity.

Thus the 4.1m wide verge on the western side of the roadway, the 6m wide roadway and the 1.5m for drainage/lighting on the eastern side would only require a road reservation of 11.6m. The proposed typical cross section of 15m will be able to cater for this requirement.

If there is to be a bus route in the long term future connecting to Karel Avenue, then the trees could then be removed at that time and the roadway widened to 7m width.

On sections of the street where there may be the requirement to provide on-street parking to one side the verge area could then be 5.5m width (with indented parking). With the 6m wide roadway the verge on the non-parking side of the street could be 3.5m width, this wide enough to cater for drainage and street lighting.

Typically, Access Streets throughout the proposed structure plan (due to it being a 'closed' catchment – ie no through traffic) will all carry well below 1,000 vehicles per day and will be designed with 5.5m – 6.0m pavements intended to function as yield or give-way streets.

External to the subject site, adjacent to the east, Prinsep Road has a history of resident complaints regarding speeding, noise and vibration. Previously installed speed humps were removed in 2020 as part of the Soloman Road Upgrade Project. The City has undertaken community consultation regarding the need for slow point treatments. The final outcome of the community consultation is yet to be determined; however has been noted by the City that the speed humps or similar may be reinstated. The reinstallation of the speed humps on Prinsep Road is unlikely to have an effect on the internal road network of the Structure Plan as there is no direct alternative route that would enable a faster travel path than that of Prinsep Road.

4.2 Intersection Controls

In response to the Department of Planning, Lands and Heritage (DPLH) requested modifications to the scheme amendment in May 2023, the Applicant can confirm that:

- The Fairway, to the south of Berrigan Drive, has a road reservation that involves an offset carriageway and if the road is required to be widened, will be to the golf course side.
- The Twin Waters Pass Bridge will be preserved, as a significant element of the existing character of the area.
- The potential for a mini-roundabout at the future four-way intersection of Twin Waters Pass / Portsea Gardens / New Road will be considered as part of the implementation of the subdivision and detailed on the civil engineering design plans. Notwithstanding, further discussion and a recommendation on a preferred treatment of Twin Waters Pass / Portsea Gardens / New Road is provided below for the City's consideration.

Any modifications to the existing local road network, required to facilitate development of the Structure Plan area, are to be undertaken entirely at the landowner/applicant's cost.

Internal to the structure plan, many intersections are adequate as priority-controlled T-intersections due to the very low traffic volumes.

There are two roundabouts proposed internally to the structure plan and two existing roundabouts that are proposed to be modified to include a fourth leg.

The two existing roundabouts that are proposed to be modified to provide a fourth leg are located at Bonville Glen / Glen Iris Drive and Turtle Point Cove / Glen Iris Drive, as shown below in Figure 4.4 and Figure 4.5 (overleaf).

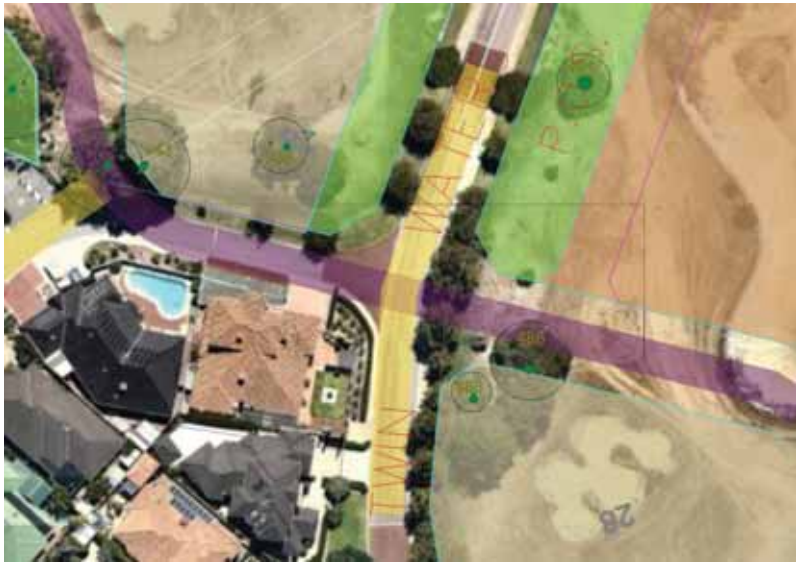
Figure 4-4: Bonville Glen / Glen Iris Drive

Figure 4-5: Turtle Point Cove / Glen Iris Drive

Both roundabouts have central islands of 6m radius and 7m circulating widths and are considered appropriate for the volume of future traffic anticipated (i.e. with development) which is less than 2,000 vehicles per day.

Another alternative intersection arrangement is the four-way priority-controlled intersection with the existing Twin Waters Pass shown below in Figure 4.6. Given that a four-way intersection has a likely higher crash risk than other alternative layouts, such as roundabout or a staggered T-intersection, treatment of this intersection as a raised intersection to control traffic speeds along the Neighbourhood Connector / Access Street and control speeds through the intersection is recommended. The future volume of traffic through this intersection is likely to be between 2,000 – 2,900 vehicles per day. However, given the location constraints with Portsea Drive verges, the need to retain the Twin Water Pass Bridge as a signification element of the existing character of the area and to meet adequate sight distances while minimising impacts to existing properties, a raised four-way intersection design is considered a better and more appropriate intersection treatment at this location.

Figure 4-6: Twin Waters Pass 4-Way Intersection



(map source: Reproduced with permission from Nearmap)

The DPLH also requested an assessment of the proposed and/or modified intersections of Bonville Glen / Glen Iris Drive, Turtle Point Cove / Glen Iris Drive and Twin Water Pass / planned new road, OR the DPLH asked for a suitable justification as to why an assessment of these proposals is not required. From a traffic engineering perspective, these streets will be low volume (below 3,000 vehicles per day at full development) and low speeds (target below 50km/hr) and operationally do not require capacity assessment as they will operate with spare capacity and very little vehicular delays. However, engineering assessments will be undertaken at all three aforementioned intersections and will be considered as part of the implementation of the subdivision.

Lastly there is a proposal to include an important and new signalised intersection along Berrigan Drive to cater for new development traffic but also to greatly improve the unsafe and inefficient access for the existing residents who are currently having to use uncontrolled intersections at Turnbury Parkway and The Lakes Boulevard. The current inefficiency and diminishing safety were a strong and consistent message from the community consultation undertaken from all residents who provided input into traffic matters.

Therefore, a high level concept plan for a proposed new signalised intersection is shown in Figure 4.7. While this concept does not show any pedestrian facilities, it is intended that the intersection provides protected pedestrian crossing ability across Berrigan Drive. This intersection is in concept stage and is currently undergoing the formal endorsement process through Main Roads WA with the support of the City of Cockburn at the time of writing this report. The proposed signalised intersection provides existing residents who are struggling to maintain good access with the ability to make protected right turn movements to and from Berrigan Drive, also a protected pedestrian crossing ability and it also provides a better access point for future bus services north and south into the Glen Iris Estate.

In relation to the proposed signals, the project team met with Main Roads WA officers along with City of Cockburn's Traffic Engineering representative in May 2021. The City of Cockburn expressed in-principal support for the proposed intersection in response to community concerns around safety and performance of the existing priority-controlled intersections along Berrigan Drive. Main Roads WA has since provided Gateway 1 endorsement for traffic signals at this location (submitted 6 September 2021) under the Traffic Signal Approval Policy determining that traffic signal control was the most appropriate form of intersection control for the new required intersection as detailed in Appendix D.

Figure 4-7: Berrigan Drive Intersection – Concept Design only

(map source: Reproduced with permission from Nearmap)

4.3 Pedestrian/Cycle Networks and Crossing Facilities

In April 2016, WA's laws were changed to allow cyclists of all ages to use footpaths, unless otherwise signed. The amendment to the Road Traffic Code 2000 brought WA's bicycle laws into line with the rest of Australia, making it legal for parents to cycle alongside their children on footpaths, improving safety.

All streets within the structure plan are proposed to include a 2.0m path on one side of the street as a minimum. Strategic routes through the structure plan including those that follow any future bus routes will have paths provided on both sides of the street.

In addition to the path network provided within the road reserve, there is also a proposed dual-use path that travels through all 25% open space proposed within the structure plan. This trail is approximately 7km long and provides excellent recreational amenity for both existing residents and residents within the structure plan area.

City of Cockburn long term cycle network supports the duplication of the Kwinana Freeway PSP with a PSP on the eastern side of the freeway in addition to the existing PSP, with local connections planned into the Glen Iris Estate. A commuter cycle route is also proposed along Prinsep Road that links in with the new PSP and provides access to Cockburn Central Railway Station. At the time of writing this TIA no timing for these works is confirmed, it is noted that the additional density and development at Glen Iris would likely have a positive impact on any business cases to support these works.

4.4 Public Transport Routes

The project team met with the PTA in May 2021 to discuss future public transport servicing for the Glen Iris Structure Plan. The PTA expressed a keen interest in making the existing 515 route more attractive by providing a connection between Murdoch and Cockburn train stations. The PTA suggested that if there was to be a future service that travelled into the Glen Iris Structure Plan area it would need to enter from the north and exit at Berrigan Drive. Given the closed catchment, the route that was put forward was the 515-bus travel along Karel Avenue turning into Lakes Way then accessing the structure plan area via the historical road reserve that exists between Dean Road and Lakes Way. The bus would then use Twin Waters Pass to access the proposed new internal road network within the new structure plan area and travel south to the proposed signalised intersection at Berrigan Drive before continuing its journey west along Berrigan Drive to Cockburn station via Semple Court and Muriel Way.

The feasibility of this route to connect into the Glen Iris structure plan is dependent on land availability as the desired bus route would need to traverse what is currently privately owned land.

Feasibility internal to the structure plan is dependent on available sight distance, appropriate road widths and turning circles, and potential stop locations. The structure plan provides a north-south orientated internal road network that is capable of accommodating future PTA buses but the

Proposed Internal Transport Networks

feasibility of a road connection to the north-east outside of the structure plan area is not currently possible.

The PTA confirmed the southern area of the structure plan (south of Berrigan Drive) is reasonably well covered in terms of the 400m walking catchment to the existing PTA bus stops on Berrigan Drive. As such, it is more critical to provide a bus service that travels through the northern estate to increase the walkable catchment to a bus stop.

In addition to the more localised public transport there is the current METRONET project for the construction of Perth's first orbital (i.e. cross line - not direct to/from the Perth CBD) heavy rail line connecting the Mandurah and Armadale/Thornlie line. Residents of existing and future Glen Iris will be able to access areas such as Canning Vale, Cannington Strategic Metropolitan Centre and the Burswood Peninsula for a range of employment, sporting and recreation opportunities. Currently residents would have to travel all the way back into the Perth CBD before switching lines to travel back down to Thornlie / Armadale.

As noted earlier in this TIA under Section 1.3, more than three-quarters of the existing estate is outside of a 400m typical walking catchment of the only bus stops on Berrigan Drive. As such, should land ownership allow the opportunity, the structure plan does not omit the possibility to improve the accessibility and services of public transport to existing and future residents and visitors of the estate.

5 External Transport Networks

5.1 Proposed Modifications to Existing Road Network

As introduced in Section 4.2 the structure plan proposes to modify the three existing uncontrolled intersections with Berrigan Drive to enable the creation of a single, new, safer and “controlled” intersection with Berrigan Drive. This intersection will improve the efficiency for all approach demands.

For this to occur it is proposed to convert the existing full-movement uncontrolled intersection of Berrigan Drive / The Lakes Boulevard into a left-in-left-out arrangement. This will still provide a level of permeability in the local road network and a convenient access to the Kwinana Freeway for residents. The problematic right turn movements which is currently experiencing unacceptable delays would be removed and instead undertaken at the proposed signalised intersection. This proposal received positive support from the resident representatives during the consultation phase leading to this structure plan.

Due to the geometric requirements of a signalised intersection and maintaining adequate separation between the Kwinana Freeway interchange and the existing Dean Road traffic signals, Turnbury Park Drive is required to be closed completely with no access permitted onto Berrigan Drive. Instead, residents will be able to access their local street network via the proposed controlled signalised intersection. While this is a marginally longer vehicle trip for a small portion of residents, the benefit of a dedicated right turn priority at the new signalised intersection makes for a safer and more efficient journey overall removing the long wait times currently being experienced. Turnbury Park Drive cannot be retained as a left-in-left-out arrangement like The Lakes Boulevard due to the proximity of the intersection to the new intersection. Again, this proposal received positive support from the resident representatives during the consultation phase leading to this structure plan.

5.2 Armadale Road to North Lake Road Bridge

There is a large construction project being undertaken by Main Roads WA to the south of the structure plan area at North Lake Road / Armadale Road. The North Lake Road Bridge Project will connect North Lake Road to Armadale Road via a bridge over the Kwinana Freeway. It also includes a Collector Distributor (CD) road between the Berrigan Drive freeway interchange and the North Lake Road freeway interchange.

This project has the potential to significantly impact (improve) the local road network adjacent to the structure plan, in particular Berrigan Drive. The fast-growing suburb of Treeby and the existing light industry / service commercial land uses surrounding Cutler Road and Solomon Road all have

access to and from Armadale Road. At present though Armadale Road is experience very high levels of traffic congestion, so much so, it is plausible that residents and other drivers that frequent the area are seeking out alternative routes.

Once the North Lake Road Bridge Project is completed it would provide a much more convenient and direct route for traffic accessing these areas directly via the Kwinana Freeway instead of using Berrigan Drive to exit. This could see potentially between 3,000 – 6,000 vehicles per day transfer from Berrigan Drive onto North Lake Road / Armadale Road.

Figure 5-1: Schematic - Armadale Road to North Lake Road Project

Source: Main Roads WA

6 Integration with Surrounding Area

6.1 Trip Attractors/Generators within 800m

The proposed structure plan is primarily residential with a relatively small local centre designed to service the immediate community. As such there is limited potential for attraction of high proportions of external trips outside of the Glen Iris community into the structure plan area.

Most trip attractors for this community are outside of an 800m catchment as the Glen Iris area is predominately residential in nature. There is potential Jandakot Airport and the service-industrial land around Cutler Road could be considered as employment attractors with both areas connected via the existing road network.

Lakelands Senior High School and South Lake Primary School are the closest schools to the proposed structure plan approximately 1.2km and 2.5km to the west of the structure plan area, respectively.

6.2 Proposed Changes to Land Uses within 800m

The current rural residential land east of Glen Iris is currently subject to a Planning Investigation Area (PIA) known as the Jandakot/Treeby Planning Investigation Area. According to the DPLH, a land use for this PIA will be finalised as part of the 2021 review of the *South Metropolitan Peel Sub-Regional Planning Framework*.

6.3 Travel Desire Lines from Structure Plan to these Attractors/Generators

Due to the shape of the existing Glen Iris Estate, the travel and desire lines to/from external trip attractors rely on Berrigan Drive and residents must travel north / south to Berrigan Drive to then travel along Berrigan Drive to access the Kwinana Freeway or Roe Highway.

6.4 Adequacy and Deficiencies in External Transport Networks

Berrigan Drive exists as a major barrier to pedestrians and cyclists wishing to cross the road corridor unprotected. Being a four-lane dual carriageway carrying approx. 27,000 vehicles per day, the road presents a challenge to cross, particularly for vulnerable road users.

At present, the only controlled crossing points are at the Kwinana Freeway traffic signals or the Dean Road traffic signals. The underpass is available however does not currently meet CPTED design requirements as previously noted.

Therefore, the proposed new signalised intersection with protected crossing phases and a potentially refurbished underpass will provide much needed alternatives for pedestrians and cyclists wishing to cross Berrigan Drive.

At present emergency access to the northern portion of Glen Iris Estate from Berrigan Drive is limited to the Dean Road / Berrigan Drive signalised intersection and the uncontrolled intersection of Turnbury Park Drive / Berrigan Drive. The proposed structure plan and accompanying street network proposes a new signalised intersection for safe and more efficient access onto Berrigan Drive as well as a new and more direct street network that runs directly to the north of the existing Glen Iris Estate. This new intersection and street network will reduce pressure on the existing lower order street networks of Glen Iris Drive and Dean Road and will allow emergency services such as police, fire and ambulances a more direct and efficient access into the area than the current street network allows.

7 Analysis of Transport Networks

7.1 Assessment Year(s) and Time Period(s)

The site is currently undergoing a formal structure planning process with development envisaged to commence around 2023. It is expected that full development of the site could be completed within 4-5 years making the full build out year 2028.

Accordingly, this TIA assesses the existing road network in 2023 as the 'base year without development' and then '2028 with full development', as per WAPC Guidelines Volumes 2, to satisfy "the structure plan should be undertaken for the (assumed) year of full development".

There is a concurrent process of traffic signals approval for the Berrigan Drive intersection and the modified (closed) intersection of Turnbury Park Drive and this is being undertaken as a separate but concurrent exercise through the Main Roads Traffic Signal Approval Policy (TSAP) process. This modelling for a new set of traffic signals assesses the same 2023 base opening year and then a full build out at 2028, with an additional plus five years to 2033 in accordance with the policy. These time horizons were pre-agreed with Main Roads WA through their formal Traffic Modelling Instruction Form (TMIF) at the start of the Stage 1 TSAP process.

Stage 1 TSAP application for a set of traffic signals at Berrigan Drive was endorsed by Main Roads WA in 2022.

At present (July 2023) the project team is working through the Stage 2 TSAP LinSig models which are currently being assessed by Main Roads Network Operations Directorate. This includes the two future year scenarios (2028 and 2033) and traffic flows have been completed following multiple consultations and are being reviewed by Main Roads. Weekday AM and PM peak periods form the basis for assessment of the LinSig modelling.

A specific query relating to a community oval in the structure plan has been raised in the scheme amendment approval. However, this land use typically has a trip generation peak during weekends outside of the weekday commuter AM and PM peak periods. The survey data shows that the daily and peak flows on weekends in the area are some 30% less than the busiest weekday PM peak period on the road network and therefore the use of a future community oval is not expected to result in detrimental traffic flow effects. Further, this non-competing peak traffic demand impact assessment is a detail that can be assessed post structure plan approval.

7.2 Structure Plan Generated Traffic

The trip generation rates used in this TIA are shown in Table 7.1 below. As mentioned previously, the local centre will predominately service residents who are local to Glen Iris with the project's

Glen Iris Retail Assessment study concluding 80% of the trips associated with the local centre will likely be internal – internal trips. Relating this to traffic modelling, this 80% is supported by the fact that it is an existing local centre being expanded and the existing retail trips are collected as 'existing' data in the traffic surveys. The 80% has therefore been adopted in the traffic modelling.

It is assumed most of the vehicle traffic generated by the residential component will be travelling externally to the site given the limited local trip attraction. Total trips on the external road network from the structure plan is expected to be about 4,200 to 5,000 trips per day, with up to approximately 485 trips in the AM peak and 500 trips in the PM peak (this generated from the north, central and south precincts). To put this into context and assuming an even traffic distribution in the peak hours, the new traffic because of development is only 8.3 vehicle trips per minute two-way (north, central and south precincts).

Figure 7-1: Structure Plan Trips Generation Rates

Land Use	Units	Weekday	AM	PM	AM In	AM Out	PM In	PM Out	Source
Residential	Dwelling	8	0.8	0.8	25%	75%	63%	37%	WAPC
Local Centre	100m² GFA	46.0	1.0	4.0	62%	38%	48%	52%	ITE – 9th Edition

At the time of the preparation of the initial TIA, the trip rates for the local centre were based on the Institute of Transportation Engineers (ITE) Trip Generation Manual rates (9th/10th editions that were the latest available at the time of the preparation of the original TIA). A metrically converted rate of 1 trip per 100m2 in the AM peak and 4 trips per 100m2 in the PM peak was applied. This aligns close to the non-food Retail rates suggested in the Transport Assessment Guidelines (WAPC 2016). However, the recent 11th edition ITE manual was released just after the submission of this TIA. At the request of the WAPC, a comparison was undertaken of the various editions and the resultant effect on the traffic flows adopted in the modelling in the AM and PM peak periods. This is summarised below in Figure 7-2.

Figure 7-2: Trip Generation Rates Comparison

	ITE 9th Edition	ITE 10th Edition	ITE 11th Edition	WAPC
2,500m² existing Local Centre - Daily				
Daily per 100m²	46	41	59	~45
Total Daily Generation	1,150	1,020	1,465	~1,125
After 80% Discount	230	205	295	~225
2,500m² existing Local Centre - PM				
PM per 100m²	4.0	4.1	7.1	4.0
Total PM Generation	100	105	180	100
After 80% Discount	20	20	36 (~+2 to +3 per mvt)	20
5,000m² combined Local Centre - PM				
PM per 100m²	4.0	4.1	5.6	4.0
Total PM Generation	100	105	140	100
After 80% Discount	20	20	28 (~+1 to +2 per mvt)	20

A comparison of the total floor area of the commercial/retail strip that will be created on the north side of Berrigan Drive was undertaken. The development proposes the existing local centre be expanded to create a total commercial centre of approximately 5,000m2.

The assessment shows that the choice of traffic flow edition will not make a material difference as the generation has not changed substantially (as expected) when directions and movements are taken into account and considering the overall commercial floorspace. It has been found that the difference in traffic lows would be in the order of 1-2vph per movement at the Berrigan Drive intersection and this does not materially change the modelling results.

The above was presented to WAPC in a meeting in June 2023 and was verbally accepted and agreed by the attending officers, subject to the TIA being updated accordingly (this report).

Figure 7-3: Structure Plan Trip Generation

Land Use	Quantity	Weekday	AM	PM
Residential	500 – 600 dwellings	4,000 – 4,800	400 - 480	400 - 480
Local Centre	2,500m2 GFA	230 (external trips)	5 (external trips)	20 (external trips)
Total		5,030	485	500

7.3 Extraneous (Through) Traffic

The internal street network for the proposed structure plan area has been carefully designed to assist existing traffic from the existing Glen Iris Estate to be able to use the new road network. This to enable significantly better access to/from Berrigan Drive then what is currently being afforded.

As requested by the City of Cockburn in a separate exercise, the effects of the proposed Surf Park near Cockburn Central has also been assessed with a traffic modelling sensitivity test undertaken to examine the effects of the additional traffic expected from this proposed development. An interim period of 2025/26 was assessed, where the modified intersection of Turnbury Drive at Berrigan Drive had not yet been constructed but 250 lots of the Glen Iris structure plan had been delivered, north of Berrigan Drive.

The SIDRA modelling for intersection of Berrigan Drive / Jandakot Road / Dean Road intersection was re-modelled with the trips to be generated by the Surf Park. Given the smaller traffic distribution of 25% of Surf Park traffic to use Prinsep Road to then head north-east, it was found that these will be likely to turn right to Berrigan Drive (or left from Berrigan Drive going the other way) and then to/from Berrigan Drive north-south road's north approach.

The traffic report that was prepared to support the Surf Park development notes trips of 74 eastbound and 74 westbound trips in the peaks, which was therefore applied to Berrigan Drive and added on top of the Glen Iris structure plan traffic in 2025 and 2026, in both the AM and PM peak scenarios.

In the AM peak, the impact of Surf Park onto the Berrigan Drive new Glen Iris signalised intersection is insignificant in both 2025 and 2026 scenarios due to the directional distribution of the Surf Park. Additionally, the existing Berrigan Drive / Jandakot Road / Dean Road signalised intersection has an overall DoS remaining the same as without the Surf Park, as the through movements are not the critical movement.

For the PM peak, the Surf Park additional trips will increase the Berrigan Drive / Jandakot Road / Dean Road signalised intersection DoS of the intersection from 0.69 to 0.72 in 2025 and 0.73 to 0.75 in 2026. This is still within capacity, however the queue on the westbound approach is expected to slightly increase as previously reported, due to additional demand.

Other than that, the additional Surf Park trips do not materially change the traffic performance of the delay and cycle time of the intersections assessed.

Again, the Surf Park traffic is not expected to impact the proposed new signalised intersection, west of Prinsep Road. The location of the Surf Park is such that it has a more attractive access (and close proximity) towards the south via Armadale Road and the Kwinana Freeway interchange, as highlighted by the Surf Park report's assumed traffic distribution.

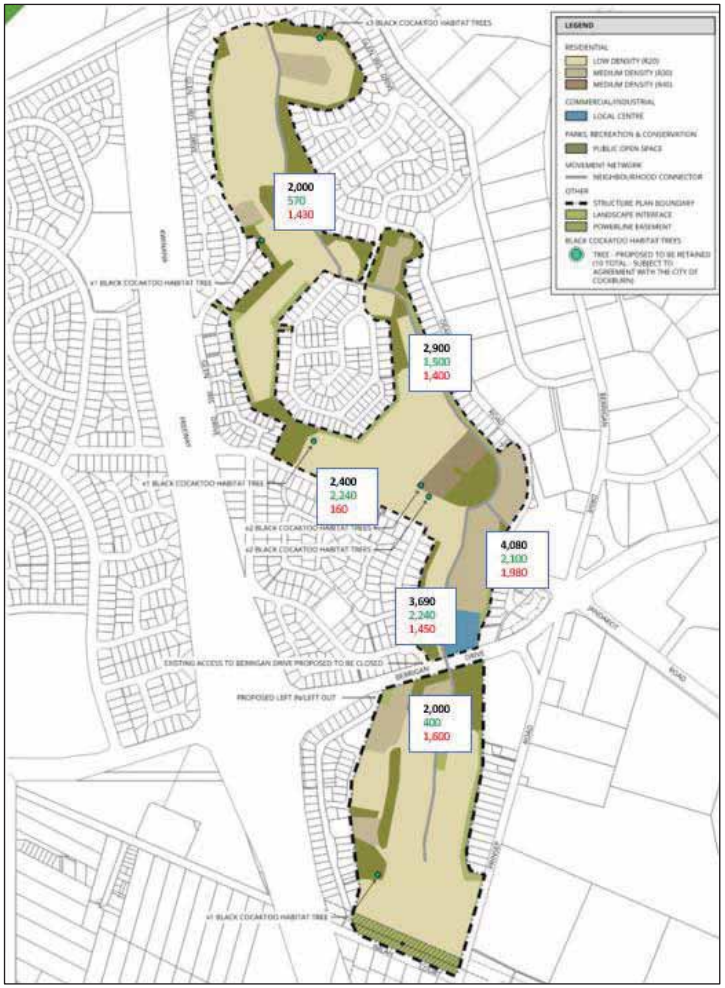
The previous conclusions remains the same in that the intersection of Berrigan Drive / Jandakot Road / Dean Road can accommodate the development of the Glen Iris Structure Plan of some 250 occupied dwellings by end of 2026 and with the Surf Park noted estimated traffic, without the proposed new traffic signals required at Berrigan Drive.

7.4 Design Traffic Flows (i.e., Total Traffic)

Vehicle trips were manually assigned onto the road network based on directness of the route and length of travel.

Figure 7.1 shows the total traffic generated onto the external road network. The numbers in bold represents the total traffic. The numbers green represent vehicle trips associated with existing dwellings within the Glen Iris Estate. The numbers in red represent the expected structure plan traffic. As can be seen, the traffic associated with the proposed structure plan largely stays on the proposed internal network, which was purposely designed for. There are however some trips associated with lots directly fronting Hartwell Parade, but these are minor at only 160 trips per day (1 vehicle every 3.8 minutes in the busiest peak hour, two-way).

Figure 7-1: Expected Total Trip (two-way) Daily Volumes



(base map source: Rowe Group, 2023)

7.5 Level of Service Concepts

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: Primarily free flow operations at average travel speeds, usually about 90% of the FFS (free flow speed) for the given street class. Vehicles are completely unimpeded in their ability to manoeuvre within the traffic stream. Control delay at signalised intersections is less than 10 seconds. At non-signalised intersections the average control delay is less than 10 seconds.
- LOS B: Reasonably unimpeded operations at average travel speeds, usually about 70% of the FFS for the street class. The ability to manoeuvre within the traffic stream is only slightly restricted, and control delays at signalised intersections are between 10 and 20 seconds. At non-signalised intersections the average control delay is between 10 and 15 seconds.
- LOS C: Stable operations; however, ability to manoeuvre and change lanes in mid-block locations may be more restricted than at LOS B, and longer queues, adverse signal coordination, or both may contribute to lower average travel speeds of about 50% of the FFS for the street class. Signalised intersection delays are between 20 and 35 seconds. At non-signalised intersections the average control delay is between 15 and 25 seconds.
- LOS D: A range in which small increases in flow may cause substantial increases in delay and decreases in travel speed. LOS D may be due to adverse signal progression, inappropriate signal timing, high volumes, or a combination of these factors. Average travel speeds are about 40% of FFS. Signalised intersection delays are between 35 and 55 seconds. At non-signalised intersections the average control delay is between 25 and 35 seconds.
- LOS E: Characterised by significant delays and average travel speeds of 33% of the FFS or less. Such operations are caused by a combination of adverse progression, high signal density, high volumes, extensive delays at critical intersections (between 55 and 80 seconds), and inappropriate signal timing. At non-signalised intersections the average control delay is between 35 and 50 seconds; and,
- LOS F: Characterised by urban street flow at extremely low speeds, typically 25% to 33% of the FFS. Intersection congestion is likely at critical signalised locations, with high delays (in excess of 80 seconds), high volumes, and extensive queuing. At non-signalised intersections the average control delay is greater than 50 seconds.

In addition to the above:

- Average Delay: is the average of all travel time delays for vehicles through the intersection; and,
- Queue: is the queue length below which 95% of all observed queue lengths fall.

Degree of Saturation: Ratio of the traffic flow to the capacity for that lane/movement.

7.6 Intersection Controls

The project team also undertook traffic counts at the existing priority-controlled intersections and have subsequently analysed their performance in SIDRA as a network with the Kwinana Freeway intersections and the existing signalised intersection at Dean Road.

Table 7-4: Existing Intersection Performance – 2020 AM Peak

Location	Arm	DOS	Avrg Delay	95th %ile Q
Berrigan Drive / The Lakes Boulevard - AM 2020	The Lakes Boulevard (S)	0.22	31s	3m
	Berrigan Drive (E)	0.54	0s	95m
	Median RT (W)	0.07	34s	2m
	Berrigan Drive (W)	0.28	0s	0m
	Intersection	0.54	1s	95m
Berrigan Drive / Turnbury Park Dr - AM 2020	Median RT (E)	0.11	16s	3m
	Berrigan Drive (E)	0.39	1s	0m
	Turnbury Park Drive	0.53	47s	14m
	Berrigan Drive (W)	0.28	0s	0m
	Intersection	0.53	7s	14m
Berrigan Drive / Prinsep Road - AM 2020	Prinsep Road (S)	0.38	30s	20m
	Berrigan Drive (E)	0.33	0s	0m
	Median RT (W)	1.13	174s	18m
	Berrigan Drive (W)	0.22	0s	176m
	Intersection	1.13	26s	358m

Figure 7-5: Existing Intersection Performance – 2020 PM Peak

Location	Arm	DOS	Avrg Delay	95th %ile Q
Berrigan Drive / The Lakes Boulevard - PM 2020	The Lakes Boulevard (S)	0.13	32s	5m
	Berrigan Drive (E)	0.44	0s	196m
	Median RT (W)	0.20	44s	4m
	Berrigan Drive (W)	0.28	0s	0m
	Intersection	0.44	1s	196m
Berrigan Drive / Turnbury Park Dr - PM 2020	Median RT (E)	0.19	13s	5m
	Berrigan Drive (E)	0.44	0s	338m
	Turnbury Park Drive	0.49	62s	12m
	Berrigan Drive (W)	0.28	0s	0m
	Intersection	0.49	4s	338m
Berrigan Drive / Prinsep Road - PM 2020	Prinsep Road (S)	1.03	75s	187m
	Berrigan Drive (E)	0.45	0s	0m
	Median RT (W)	0.71	34.5	30m
	Berrigan Drive (W)	0.22	0s	0m
	Intersection	1.34	17.8	187m

As can be seen from the intersection performance above (and as expressed by residents through the community consultation), the uncontrolled intersections are resulting in very high levels of delays. In the case of Prinsep Road, significant queuing is modelled and observed largely due to the high volume of through traffic along Berrigan Drive.

As these intersections are uncontrolled there is no delays attributed to the through movements along Berrigan Drive as they are unopposed. The presence of queuing on these legs in the above table is due to downstream lane blocking at the Kwinana Freeway intersection in the case of the Berrigan Drive (E) approach and Dean Road signals for the Berrigan Drive (W) approach in the peak periods modelled.

It is apparent from the above analysis that the uncontrolled intersections of Turnbury Park Drive and The Lakes Boulevard would not continue to function with increased traffic growth from either the proposed structure plan or the background growth occurring along Berrigan Drive. These SIDRA analysis results, coupled with a review of the existing crash history, and of course the consistent community feedback, led the project team to conclude that an alternative access arrangement needed to be put in place for the proposed structure plan as well as increase safety and efficiency for the existing residents of Glen Iris.

A signalised intersection was selected in order to provide the opportunity to coordinate the new intersection with the existing signals at the Kwinana Freeway and Dean Road / Jandakot Road intersection. The approval of this critically needed new intersection and its form needs to adhere to the Main Roads WA Intersection Control Guidelines and the Main Roads WA TSAP, and this supporting documentation was submitted as part of the Gateway 1 application to Main Road WA in September 2021. Gateway 1 received formal endorsement from Main Roads WA in 2022.

For completeness, the modelling analysis of all intersection form options (roundabout and signals) assessed is provided within Appendix C. This also includes the modelling (now updated following discussions with DPLH) that was included in the TSAP Stage 1 approvals with Main Roads. This includes models for 2023, 2028 and 2033 networked from the Kwinana Freeway to the intersection of Dean Road/Jandakot Road/Pilatus Street.

Dean Road

Dean Road currently forms a four-way signalised intersection with Berrigan Drive and Jandakot Road. SCATS data was collected from September 2020 to obtain traffic volumes to undertake the intersection traffic analysis. Phasing and signal timings were also adopted from SCATS for the 2020 scenario. The analysis results shown in Table 7.6 and Table 7.7 show an intersection that is currently operating with a good Degree of Saturation and delay. The analysis suggests that if needed the Dean Road intersection could cater for an increase in traffic volumes on Dean Road in the short to medium term but not in the medium to longer term.

The SCATS data also confirms that the priority movements from Dean Road are the left and right turns out onto Berrigan Drive, this presents a possibility for the intersection to be modified with the Dean Road approach being double right turning lanes and a single through lane to Jandakot Drive. This is supported by the current phasing arrangement where Dean Road and Jandakot Road are running in split phases so there is no overlap turn.

Table 7-6: Dean Road / Jandakot Road / Berrigan Drive – 2020 AM Peak

Location	Arm	DOS	Avrg Delay	95th %ile Q
Berrigan Drive Jandakot Road_AM 2020	Jandakot Road	0.90	28s	219m
	Berrigan Drive East	0.21	22s	30m
	Dean Road	0.42	37s	35m
	Berrigan Dr West	0.60	33s	69m
	Intersection	0.90	30s	219m

Table 7-7: Dean Road / Jandakot Road / Berrigan Drive -2020 PM Peak

Location	Arm	DOS	Avrg Delay	95th %ile Q
Berrigan Drive Jandakot Road_PM 2020	Jandakot Road	0.46	22s	74m
	Berrigan Drive East	0.78	36s	148m
	Dean Road	0.36	42s	24m
	Berrigan Dr West	0.59	34s	100m
	Intersection	0.78	32s	148m

There is currently a proposal by others to modify the Dean Road intersection to include a double signalised left turn lane from Jandakot Road onto Berrigan Drive (south to west). This is being progressed separately to the Glen Iris structure plan by another landowner. The project team had not had the opportunity to review the modelling or supporting documentation for this separate proposal, however it will be accounted for in any future decision making on the form and function of the existing Dean Road traffic signals for the longer term.

7.7 Pedestrian / Cycle Networks

With a path network proposed throughout a deliberately connected public open space within the structure plan, the residents of Glen Iris Estate will have access to over 7km of new walking/cycling trails. This is in addition to the path network that exists along the street alignments.

The additional street network also provides a more direct link to Berrigan Drive for pedestrians and cyclists that are required to the use the Berrigan Drive path network to access the PSP along Roe Highway and the Kwinana Freeway.

In the medium to longer term City of Cockburn has planning in place for the duplication of the Kwinana Freeway PSP to/from the western side of the Kwinana Freeway via local connections into the Glen Iris Estate. The proposed structure plan will assist with this east-west future desire line, providing a path network that currently does not exist through the previous golf course land.

7.8 Impact Assessment

7.8.1 Trip Distribution

Given that the land use proposed within the structure plan will be the same as the existing land use within Glen Iris Estate, the trip distribution for new trips was adopted from current traffic movements at the existing intersections with Berrigan Drive.

AM + PM Peak:

- 60% trips west

- 40% trips east.

Trips were assigned at individual intersections based on existing turning movements.

7.8.2 Traffic Impact of Development Traffic

The proposed structure plan has the potential to introduce an additional 5,000 vehicle trips onto Berrigan Drive per day (two-way, from both the north, central and south precincts, equating to 8.3 vehicle trips trip every minute), an increase of approximately 15% based on the most recent traffic counts along Berrigan Drive. Please note that "trips" are NOT the same as the number of "vehicles", rather a trip or direction of travel from an origin to a destination. Therefore, a visit to the shops from a house as an example would equate to TWO trips for the 'to' trip and the 'return' trip.

Impact of the structure plan on the existing local street network within Glen Iris can be considered minimal with up to 95% of the dwellings proposed within the structure plan utilising the new street network and only 5% of the generated trips needing to use a small portion of the existing local network.

Conversely it is estimated that traffic from the existing development could contribute up to 50% of total trips on some streets within the structure plan area closer to Berrigan Drive.

The structure plan therefore has the potential to have a positive impact on the existing residents within Glen Iris providing for safer and more efficient access out onto Berrigan Drive.

It is expected that with the additional trips assigned to Berrigan Drive, there will be some reduction in the performance of Berrigan Drive for through vehicles travelling to / from Dean Road and the Kwinana Freeway, however this is countered by the improved safety and access for right turning vehicles making turns to/from Berrigan Drive.

Getting the balance of safety and performance for a corridor such as Berrigan Drive is crucial for all involved. Developing an approved solution is underway with Main Roads WA and will be presented outside the scope of this impact assessment report. At the time of writing this TIA consultation is already underway for the modelling of the Berrigan Drive corridor and the consideration of various access options to best facilitate development and improve safety along this section of road. It is also worth noting that current traffic volumes along Berrigan Drive have a high probability of changing (reducing) with the opening of the North Lake Road Bridge and interchange with the Kwinana Freeway. The completion of this project will likely see the volumes along Berrigan Drive decrease, allowing for improved operational performance for the critically needed new traffic signals along this route.

8 Conclusion

Based on the analysis and discussions presented within this report, the following traffic and transport conclusions are made:

1 The scheme amendment approval was on the basis of modifications prioritising amenity in the development for existing and new residents of Glen Iris. Accordingly, there are proposed to be over 7km of new path network within the Structure Plan for walking and cycling through the area with numerous opportunities for connections to the existing network for existing residents to be able to make use of the new paths. The path network will be made attractive to walking and cycling through landscaping and shade which is a characteristic of the existing estate that will be retained.

2 The proposed road reserve widths provide flexibility to enable public transport services from Karel Avenue towards Berrigan Drive signals once a route can be established through private land outside the structure plan area to the north-east.

3 The existing road network in the existing Glen Iris Estate was not intended to cater for a high proportion of future increase in traffic volumes. Further, traffic volumes along Berrigan Drive have continued to grow at a consistent and relatively high rate over the past 5 years to 2021, resulting in very poor and worsening levels of service and diminishing safety for existing Glen Iris Estate residents to access Berrigan Drive and beyond. Currently, most of the residents are wholly dependent on priority controlled (also referred to as "uncontrolled") full movement intersections and experiencing long queues and delays.

   As such, the Glen Iris Structure Plan has been designed to rely on the provision of its own movement network with 95% of the proposed lots accessing the new internal street network rather than existing streets. A new intersection with Berrigan Drive is also critically needed and desired to alleviate much of the existing traffic delays currently experienced by road users to improve safety.

   The new intersection, if in the form of signals, will also support protected pedestrian and cycling crossing opportunities across Berrigan Drive (north to south).

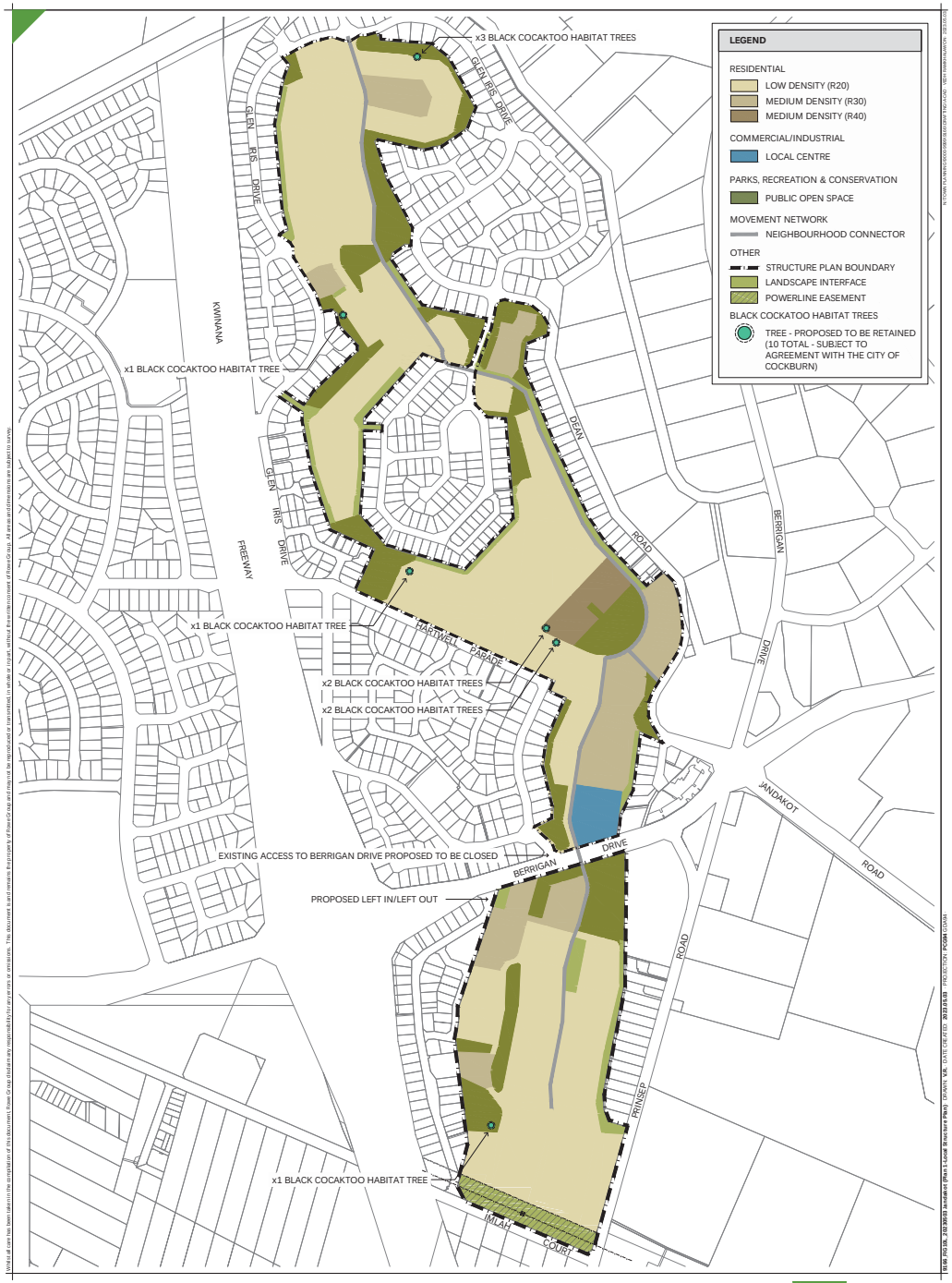
4 The existing traffic that is being generated by the existing Glen Iris Estate is in the order of 7,200 vehicle trips per day. The new Structure Plan with 500-600 lots proposed and a small local centre is estimated to generate up to 5,000 vehicle trips per day (two-way, from both the north, central and south precincts, equating to ~8.3 vehicle trips every minute). Please note that "trips" are not the number of "vehicles", rather a direction of travel from an origin to a destination. Therefore, a visit to the shops from a house as an example would equate to TWO trips for the 'to' trip and the 'return' trip.

5 Figure 4.1 shows the proposed road hierarchy for the Structure Plan. The structure plan area contains a short section of Neighbourhood Connector A road from Berrigan Drive and a modified Neighbourhood Connector B/Access Street running north-south through the structure plan area. The remaining of the street network will be Give Way type lower order Access Streets. The road cross section widths will be detailed with subdivision to include:

- Neighbourhood Connector A, which are relatively short sections of streets, will have lane widths of 3.2m with a wide median as proposed to avoid cyclist squeeze zone while allowing flexibility for longer term buses (subject to land). The road reserve width of 20m accommodates this with a dual use path on the verges to prioritise pedestrian and cycle lanes.
- Typically, Access Streets throughout the structure plan will be well below 1,000 vehicles per day and will be designed with 5.5m – 6.0m pavements.

6 Overall, from a traffic impact perspective, with the combination of the existing capacity available at the Dean Road signalised intersection in the short term and a new signalised intersection on Berrigan Drive in the medium to longer term, the proposed Structure Plan impacts can be managed acceptably to support the proposed development to the year 2028 with full buildout.

Appendix A Proposed Structure Plan



PLAN 1 - LOCAL STRUCTURE PLAN
GLEN IRIS DRIVE
JANDAKOT

9166-FIG-10-L

ROWE GROUP DESIGN

Appendix B SIDRA Reports

USER REPORT FOR NETWORK SITE

All Movement Classes

Project: 210824_W191120_Berrigan Drive - TSAP_Gate_1 **Template: Default Site User Report**

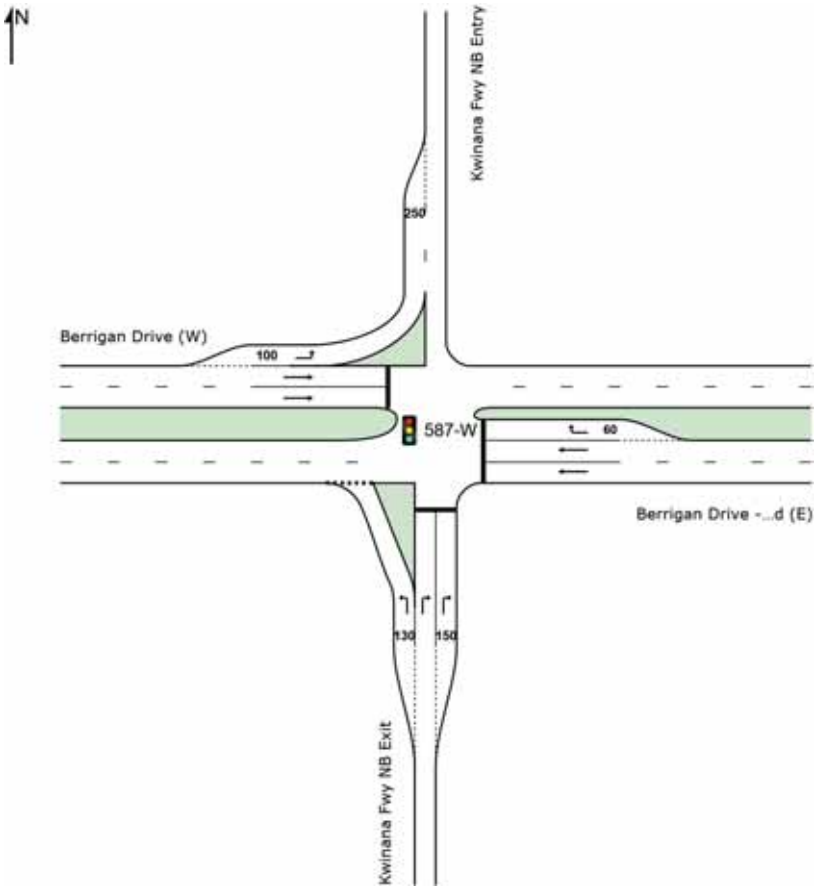
Site: 587-W [Kwinana Freeway / Berrigan West - AM 2033 (Site Folder: Proposed - 2033)] **Network: 3 [TCS - 2033 AM (Network Folder: Proposed Option - 2033)]**

2036 AM Peak (Report Option 1)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 138 seconds (Network User-Given Cycle Time)
Common Control Group: CCG1 [Fwy]

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, F
Output Phase Sequence: A, B, C, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



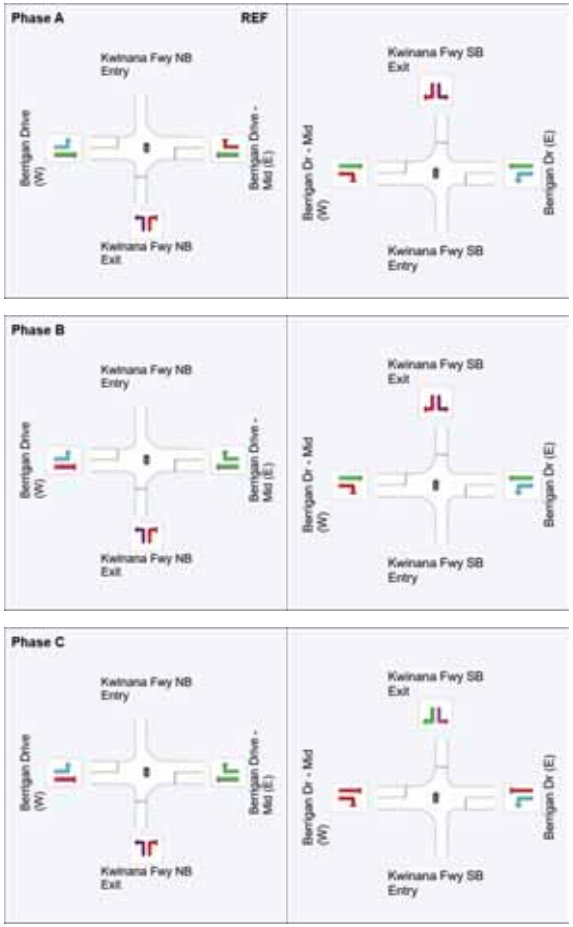
Lane Use and Performance (CCG)

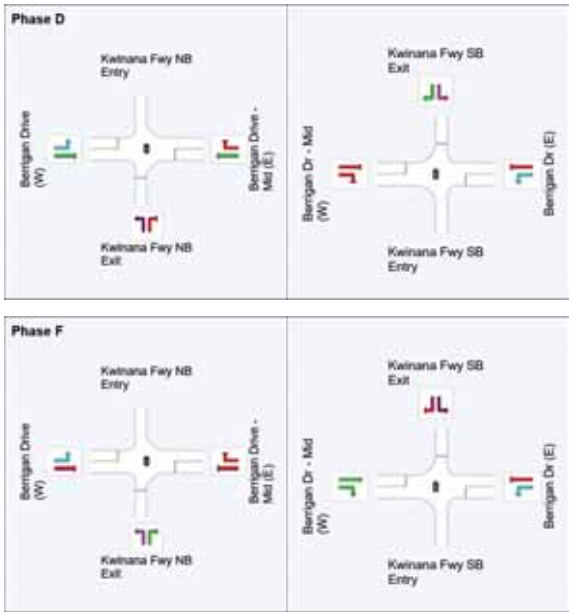
	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
Site: 587-W [Kwinana Freeway / Berrigan West - AM 2033]															
South: Kwinana Fwy NB Exit															
Lane 1	89	3.6	89	3.6	482	0.186	100	6.3	LOS A	0.3	2.5	Short	130	0.0	NA
Lane 2	125	6.4	125	6.4	114	1.089	100	172.6	LOS F	8.8	68.6	Full	500	0.0	0.0
Lane 3	125	6.4	125	6.4	114	1.089	100	172.6	LOS F	8.8	68.6	Short	150	0.0	NA
Approach	339	5.7	339	5.7		1.089		128.7	LOS F	8.8	68.6				
East: Berrigan Drive - Mid (E)															
Lane 1	1019	7.5	800	8.0	1455	0.550	100	0.5	LOS A	1.4	11.1	Full	120	0.0	0.0
Lane 2	560	7.5	440	8.0	1455	0.302	55[7]	0.4	LOS A	0.5	4.0	Full	120	0.0	50.0[8]
Lane 3	917	3.9	718	4.2	731[1]	0.982	100	46.8	LOS D	15.7[N4]	120.0[N4]	Short	60	35.0[N2]	NA
Approach	2496	6.2	1958[N1]	6.6		0.982		17.5	LOS B	15.7	120.0				
West: Berrigan Drive (W)															
Lane 1	928	5.5	928	5.5	1772	0.524	100	14.8	LOS B	0.0	0.0	Short	100	0.0	NA
Lane 2	308	5.6	308	5.6	406	0.759	100	36.2	LOS D	9.3	72.1	Full	500	0.0	0.0
Lane 3	308	5.6	308	5.6	406	0.759	100	36.2	LOS D	9.3	72.1	Full	500	0.0	0.0
Approach	1544	5.5	1544	5.5		0.759		23.3	LOS C	9.3	72.1				
Intersection	4379	5.9	3841[N1]	6.7		1.089		29.6	LOS C	15.7	120.0				
Site: 587-E [Kwinana Freeway / Berrigan East - AM 2033]															
East: Berrigan Dr (E)															
Lane 1	1312	4.9	1057	5.1	882	1.199	100	242.1	LOS F	38.8[N4]	300.0[N4]	Full	300	0.0	50.0
Lane 2	630	4.4	507	4.6	423	1.199	100	255.5	LOS F	39.0[N4]	300.0[N4]	Full	300	-50.0[N3]	50.0
Approach	1942	4.7	1565[N1]	4.9		1.199		246.4	LOS F	39.0	300.0				
North: Kwinana Fwy SB Exit															
Lane 1	460	5.0	460	5.0	964	0.477	100	6.4	LOS A	2.5	19.1	Short	115	0.0	NA
Lane 2	463	10.5	463	10.5	386[1]	1.198	100	256.6	LOS F	42.2	344.1	Full	500	0.0	15.5
Lane 3	241	10.5	241	10.5	202	1.198	100	266.2	LOS F	22.8	185.6	Short	130	-50.0[N3]	NA
Approach	1164	8.3	1164	8.3		1.198		159.8	LOS F	42.2	344.1				
West: Berrigan Dr - Mid (W)															
Lane 1	382	6.5	374	6.5	1154	0.324	100	0.7	LOS A	0.4	3.5	Full	120	0.0	0.0
Lane 2	382	6.5	374	6.5	1154	0.324	100	0.7	LOS A	0.4	3.5	Full	120	0.0	0.0
Lane 3	165	3.3	162	3.3	184	0.879	100	73.5	LOS E	7.1	53.8	Short	50	0.0	NA
Approach	929	5.9	909[N1]	5.9		0.879		13.6	LOS B	7.1	53.8				
Intersection	4036	6.0	3638[N1]	6.7		1.199		160.5	LOS F	42.2	344.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
7 Lane under-utilisation specified by the user

Output Phase Sequence (CCG)





REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Site: 587-E [Kwinana Freeway / Berrigan East - AM 2033 (Site Folder: Proposed - 2033)]

Network: 3 [TCS - 2033 AM (Network Folder: Proposed Option - 2033)]

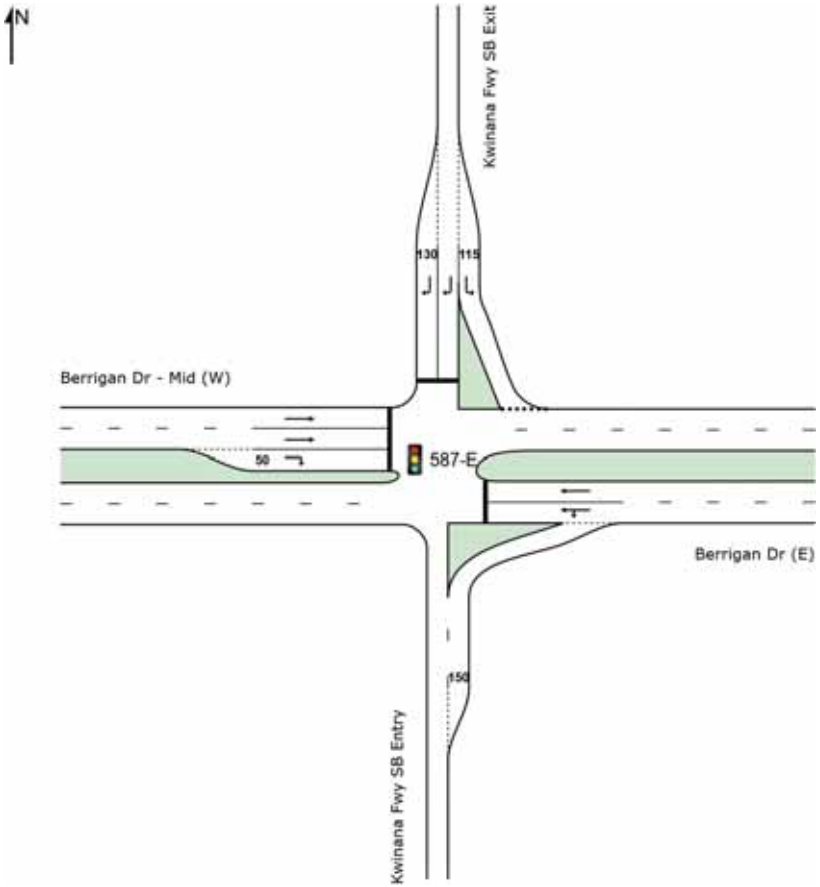
Glen Iris
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 138 seconds (Network User-Given Cycle Time)
Common Control Group: CCG1 [Fwy]

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, F
Output Phase Sequence: A, B, C, D, F

Some CCG output elements have been omitted as they have already been included under other Sites belonging to the same CCG.

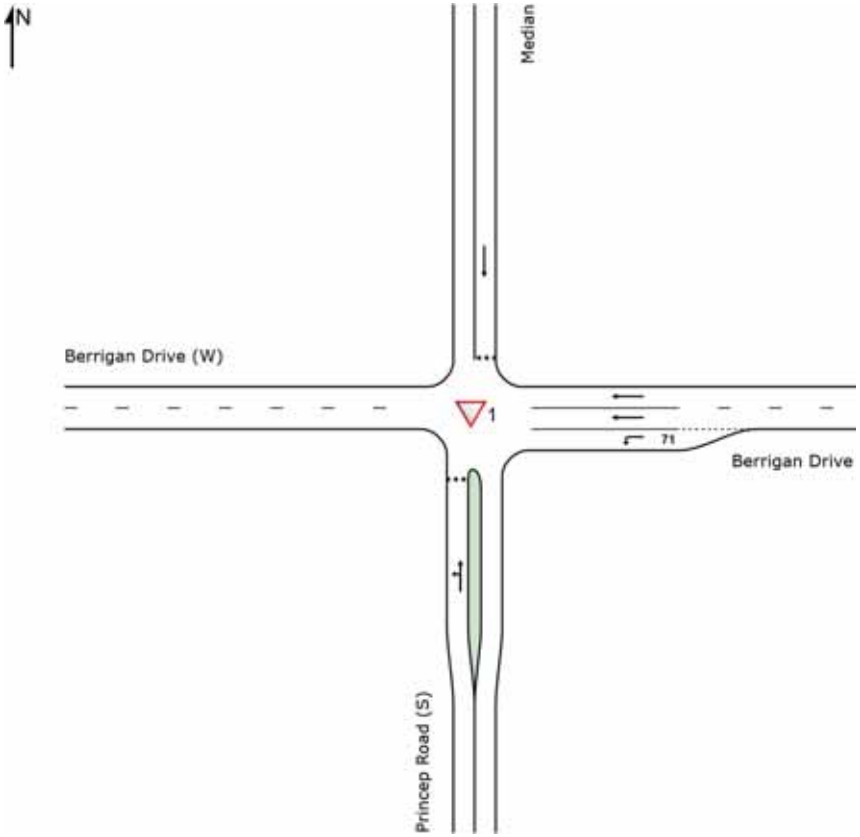
Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

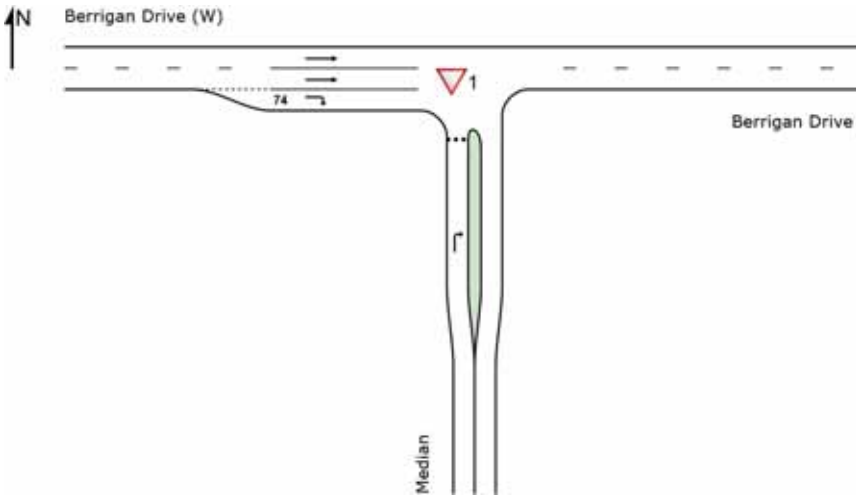
	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Princep Road (S)															
Lane 1	208	28.3	208	28.3	309	0.675	100	20.8	LOS C	1.3	12.0	Full	200	-46.8 N7	0.0
Approach	208	28.3	208	28.3		0.675		20.8	LOS C	1.3	12.0				
East: Berrigan Drive (E)															
Lane 1	82	8.9	71	9.4	1623	0.044	100	5.7	LOS A	0.0	0.0	Short	71	0.0	NA
Lane 2	766	4.2	663	4.4	1841	0.360	100	0.0	LOS A	4.5 N5	35.1 N5	Full	135	0.0	35.7
Lane 3	766	4.2	663	4.4	1841	0.360	100	0.0	LOS A	6.8 N5	53.0 N5	Full	135	0.0	37.1
Approach	1614	4.4	1398 N1	4.7		0.360		0.3	NA	6.8	53.0				
North: Median															
Lane 1	221	9.0	219	9.0	274	0.799	100	39.5	LOS E	0.8 N4	7.0 N4	Full	7	0.0	49.9
Approach	221	9.0	219 N1	9.0		0.799		39.5	LOS E	0.8	7.0				
Intersection	2043	7.4	1825 N1	8.2		0.799		7.4	NA	6.8	53.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N4 Average back of queue has been restricted to the available queue storage space.
N5 Continuous Lane results determined by Back of Queue values of downstream lanes (proportional to lane movement flows).
N7 The capacity reduction has been determined from the queue blockage probability of a Site further downstream due to intermediate continuous lanes.

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Median															
Lane 1	25	33.3	25	33.3	235	0.108	100	17.0	LOS C	0.1	1.4	Full	7	0.0	0.0
Approach	25	33.3	25	33.3		0.108		17.0	LOS C	0.1	1.4				
West: Berrigan Drive (W)															
Lane 1	509	5.5	503	5.5	1802	0.279	100	0.0	LOS A	0.0	0.0	Full	190	0.0	0.0
Lane 2	509	5.5	503	5.5	1802	0.279	100	0.0	LOS A	0.0	0.0	Full	190	0.0	0.0
Lane 3	221	9.0	219	9.0	1600	0.137	100	5.9	LOS A	1.8[N5]	14.9[N5]	Short	74	0.0	NA
Approach	1239	6.1	1225[N] 1	6.1		0.279		1.1	NA	1.8	14.9				
Intersection	1264	6.7	1250[N] 1	6.7		0.279		1.4	NA	1.8	14.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N5 Continuous Lane results determined by Back of Queue values of downstream lanes (proportional to lane movement flows).

Site: LM01173 [Berrigan Drive_Jandakot Road_AM 2033 (Site Folder: Proposed - 2033)]

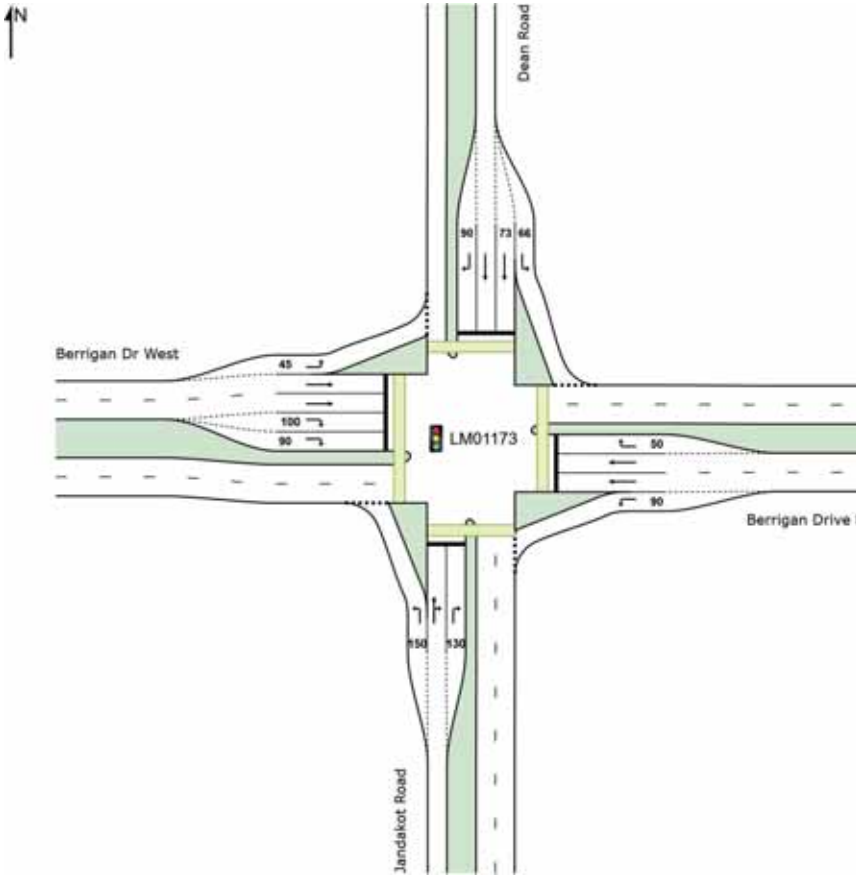
Network: 3 [TCS - 2033 AM (Network Folder: Proposed Option - 2033)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 138 seconds (Network User-Given Cycle Time)

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: Variable Phasing
Reference Phase: Phase E
Input Phase Sequence: A, B, C, D, E
Output Phase Sequence: A, B, C, D, E

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



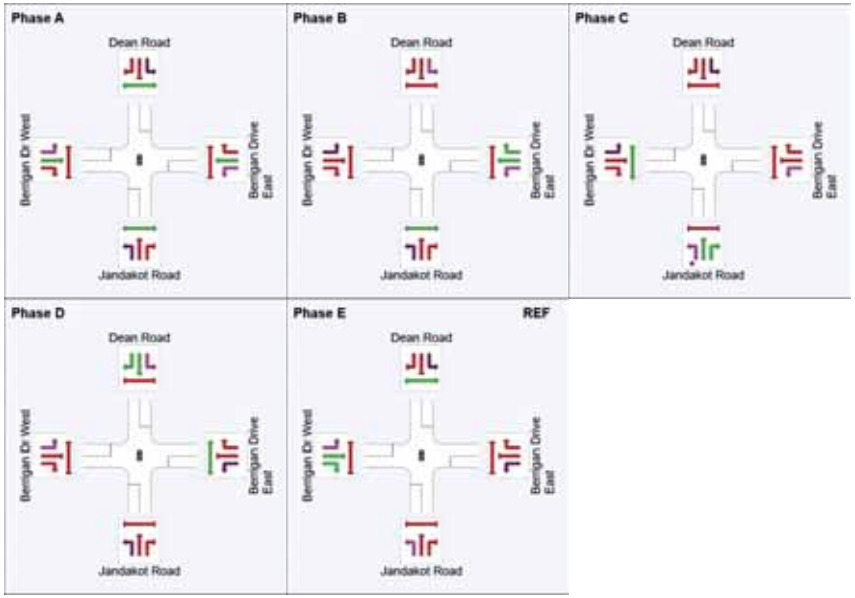
Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Jandakot Road															
Lane 1	1351	5.2	1351	5.2	1167[1]	1.158	100	194.4	LOS F	95.5	707.5	Short	150	0.0	NA
Lane 2	258	4.9	258	4.9	510	0.506	100	48.5	LOS D	9.0	66.2	Full	230	0.0	100.0[8]
Lane 3	252	5.2	252	5.2	498	0.506	100	50.9	LOS D	8.8	64.9	Short	130	0.0	NA
Approach	1861	5.2	1861	5.2		1.158		154.7	LOS F	95.5	707.5				
East: Berrigan Drive East															
Lane 1	161	23.3	161	23.3	1113	0.145	100	8.7	LOS A	1.3	11.8	Short	90	0.0	NA
Lane 2	90	23.3	90	23.3	174	0.518	100	65.6	LOS E	3.7	32.3	Full	125	0.0	0.0
Lane 3	90	23.3	90	23.3	174	0.518	100	65.6	LOS E	3.7	32.3	Full	125	0.0	0.0
Lane 4	14	4.5	14	4.5	79	0.173	100	78.2	LOS E	0.6	4.2	Short	50	0.0	NA
Approach	355	22.6	355	22.6		0.518		40.2	LOS D	3.7	32.3				
North: Dean Road															
Lane 1	102	5.2	102	5.2	859	0.119	100	11.7	LOS B	1.2	9.1	Short	66	0.0	NA
Lane 2	23	5.2	23	5.2	290	0.078	100	54.1	LOS D	0.8	5.9	Short	73	0.0	NA
Lane 3	23	5.2	23	5.2	290	0.078	100	54.1	LOS D	0.8	5.9	Full	110	0.0	0.0
Lane 4	147	0.0	147	0.0	286	0.516	100	64.5	LOS E	5.7	39.8	Short	90	0.0	NA
Approach	295	2.6	295	2.6		0.516		44.6	LOS D	5.7	39.8				
West: Berrigan Dr West															
Lane 1	27	4.5	27	4.5	1380	0.020	100	6.6	LOS A	0.1	0.8	Short	45	0.0	NA
Lane 2	272	4.6	269	4.6	622[1]	0.433	100	38.1	LOS D	8.5	62.9	Full	135	0.0	0.0
Lane 3	279	4.6	276	4.6	638	0.433	100	38.2	LOS D	8.8	64.8	Full	135	0.0	0.0
Lane 4	257	4.6	255	4.6	500	0.509	100	50.9	LOS D	8.8	65.1	Short	100	0.0	NA
Lane 5	257	4.6	255	4.6	500	0.509	100	50.9	LOS D	8.8	65.1	Short	90	0.0	NA
Approach	1094	4.6	1082[N1]	4.6		0.509		43.4	LOS D	8.8	65.1				
Intersection	3604	6.5	3593[N1]	6.5		1.158		100.8	LOS F	95.5	707.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
8 Probability of Blockage has been set on the basis of a queue that overflows from a short lane.
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

Site: 101 [Berrigan Drive / Turnbury Park Dr / Access - AM 2033 - TCS (Site Folder: Proposed - 2033)]

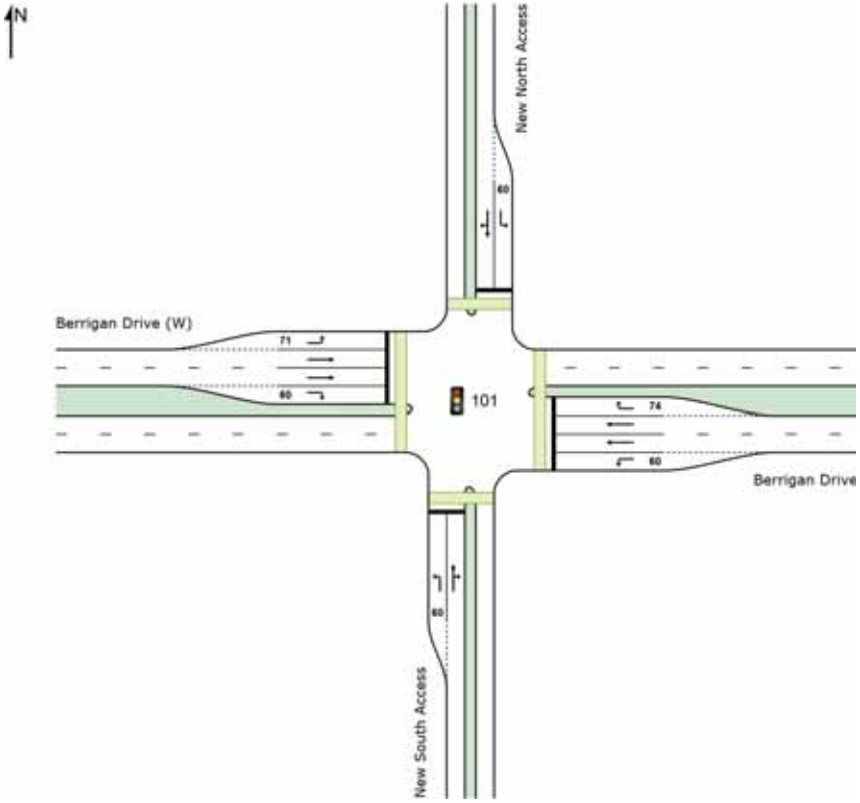
Network: 3 [TCS - 2033 AM (Network Folder: Proposed Option - 2033)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, C1*, C2*
Output Phase Sequence: A, B, C
(* Variable Phase)

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



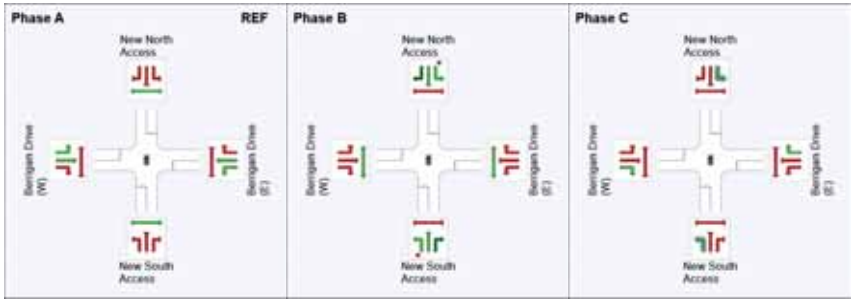
Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: New South Access															
Lane 1	29	0.0	29	0.0	204	0.144	100	52.7	LOS D	2.0[N5]	14.0[N5]	Short	60	-50.0[N3]	NA
Lane 2	37	3.9	37	3.9	223	0.165	100	64.3	LOS E	1.5	10.6	Full	500	0.0	0.0
Approach	66	2.1	66	2.1		0.165		59.1	LOS E	2.0	14.0				
East: Berrigan Drive (E)															
Lane 1	91	4.5	80	4.9	1137	0.070	100	16.6	LOS B	1.3	9.8	Short	60	0.0	NA
Lane 2	826	6.3	729	6.8	570[1]	1.280	100	323.1	LOS F	25.2[N6]	190.0[N6]	Full	190	-50.0[N3]	50.0
Lane 3	840	6.3	742	6.8	579[1]	1.280	100	322.8	LOS F	7.1[N5]	53.8[N5]	Full	190	-50.0[N3]	0.0
Lane 4	49	20.8	44	22.3	64	0.689	100	90.2	LOS F	2.2	18.9	Short	74	0.0	NA
Approach	1806	6.6	1595[N] 1	7.1		1.280		301.2	LOS F	25.2	190.0				
North: New North Access															
Lane 1	146	5.2	146	5.2	394	0.371	100	54.3	LOS D	5.3	39.5	Short	60	0.0	NA
Lane 2	172	0.0	172	0.0	136	1.261	100	325.5	LOS F	1.7[N5]	11.6[N5]	Full	500	-49.7[N3]	0.0
Approach	318	2.4	318	2.4		1.261		200.7	LOS F	5.3	39.5				
West: Berrigan Drive (W)															
Lane 1	45	4.5	45	4.5	1140	0.039	100	16.3	LOS B	0.7	5.4	Short	71	0.0	NA
Lane 2	590	3.7	582	3.7	1182[1]	0.492	100	15.2	LOS B	13.4	97.9	Full	300	0.0	0.0
Lane 3	581	3.7	573	3.7	1165[1]	0.492	100	15.1	LOS B	13.2	95.8	Full	300	0.0	0.0
Lane 4	23	4.5	23	4.5	72	0.317	100	86.0	LOS F	1.1	7.8	Short	60	0.0	NA
Approach	1239	3.7	1223[N] 1	3.7		0.492		16.6	LOS B	13.4	97.9				
Intersection	3429	5.1	3202[N] 1	5.5		1.280		177.5	LOS F	25.2	190.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.
N5 Continuous Lane results determined by Back of Queue values of downstream lanes (proportional to lane movement flows).
N6 Continuous Lane results determined by Back of Queue values of downstream lanes (proportional to lane movement flows) but average back of queue has been restricted to the available queue storage space.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

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Organisation: STANTEC NEW ZEALAND | Licence: NETWORK / Enterprise | Created: Monday, 13 September 2021 1:35:12 PM
Project: P:\W19100-19199\W191120 Glen Iris Golf Course Re-Develop\Modelling\210824_W191120_Berrigan Drive - TSAP_Gate_1.sip9

USER REPORT FOR NETWORK SITE

All Movement Classes

Project: 210824_W191120_Berrigan Drive - TSAP_Gate_1 **Template: Default Site User Report**

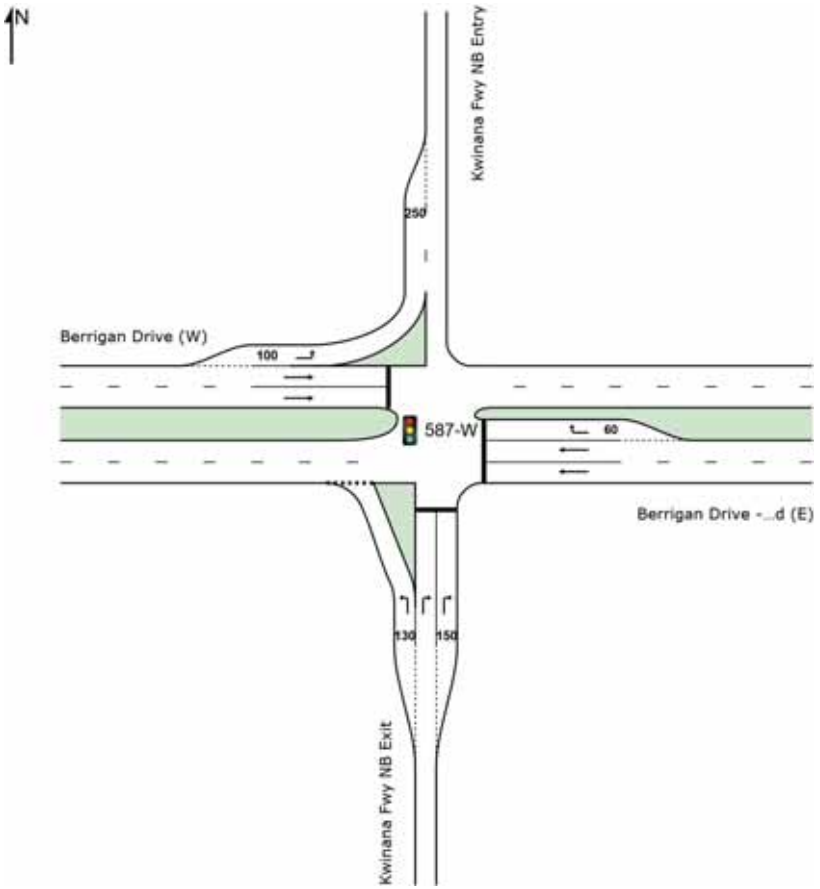
Site: 587-W [Kwinana Freeway / Berrigan West - PM 2033 (Site Folder: Proposed - 2033)] **Network: 6 [Roundabout - 2033 PM (Network Folder: Proposed Option - 2033)]**

2036 AM Peak (Report Option 1)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 132 seconds (Network User-Given Cycle Time)
Common Control Group: CCG1 [Fwy]

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, F
Output Phase Sequence: A, B, C, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



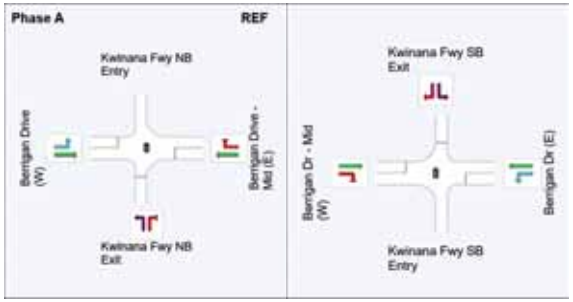
Lane Use and Performance (CCG)

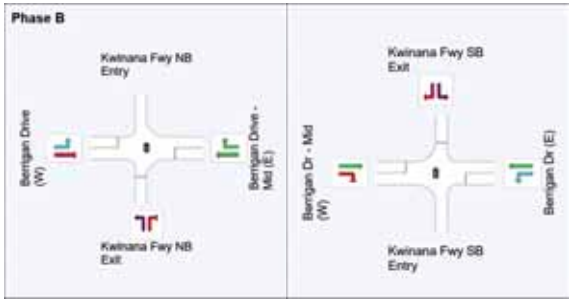
	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
Site: 587-W [Kwinana Freeway / Berrigan West - PM 2033]															
South: Kwinana Fwy NB Exit															
Lane 1	132	3.6	132	3.6	314	0.419	100	6.9	LOS A	1.1	8.1	Short	130	0.0	NA
Lane 2	43	6.4	43	6.4	80	0.539	100	76.7	LOS E	1.8	14.1	Full	500	0.0	0.0
Lane 3	43	6.4	43	6.4	80	0.539	100	76.7	LOS E	1.8	14.1	Short	150	0.0	NA
Approach	218	4.7	218	4.7		0.539		34.5	LOS C	1.8	14.1				
East: Berrigan Drive - Mid (E)															
Lane 1	1027	3.1	897	3.3	1546	0.580	100	0.5	LOS A	1.6	12.2	Full	120	0.0	0.0
Lane 2	1027	3.1	897	3.3	1546	0.580	100	0.5	LOS A	1.6	12.2	Full	120	0.0	0.0
Lane 3	573	3.1	500	3.3	951	0.525	100	13.4	LOS B	5.7	43.7	Short	60	5.0 N2	NA
Approach	2626	3.1	2293 N 1	3.3		0.580		3.3	LOS A	5.7	43.7				
West: Berrigan Drive (W)															
Lane 1	620	3.3	620	3.3	1812	0.342	100	7.8	LOS A	0.0	0.0	Short	100	0.0	NA
Lane 2	368	3.2	368	3.2	391	0.941	100	59.0	LOS E	14.5	109.8	Full	500	0.0	0.0
Lane 3	368	3.2	368	3.2	391	0.941	100	59.0	LOS E	14.5	109.8	Full	500	0.0	0.0
Approach	1356	3.2	1356	3.2		0.941		35.6	LOS D	14.5	109.8				
Intersection	4200	3.2	3867 N 1	3.5		0.941		16.4	LOS B	14.5	109.8				
Site: 587-E [Kwinana Freeway / Berrigan East - PM 2033]															
East: Berrigan Dr (E)															
Lane 1	1286	1.2	1016	1.2	1104	0.920	100	41.7	LOS D	40.3 N4	300.0 N4	Full	300	0.0	50.0
Lane 2	825	1.3	651	1.3	708	0.920	100	59.5	LOS E	29.4	219.1	Full	300	0.0	20.9
Approach	2111	1.2	1667 N 1	1.2		0.920		48.7	LOS D	40.3	300.0				
North: Kwinana Fwy SB Exit															
Lane 1	719	3.3	719	3.3	1084	0.663	100	9.6	LOS A	16.7	127.1	Short	115	0.0	NA
Lane 2	506	6.1	506	6.1	551 1	0.919	100	69.0	LOS E	23.0	179.6	Full	500	0.0	0.0
Lane 3	506	6.1	506	6.1	551 1	0.919	100	69.0	LOS E	23.0	179.5	Short	130	0.0	NA
Approach	1732	4.9	1732	4.9		0.919		44.4	LOS D	23.0	179.6				
West: Berrigan Dr - Mid (W)															
Lane 1	356	2.6	356	2.6	1004	0.354	100	5.2	LOS A	2.6	19.3	Full	120	0.0	0.0
Lane 2	356	2.6	356	2.6	1004	0.354	100	5.2	LOS A	2.6	19.3	Full	120	0.0	0.0
Lane 3	105	3.8	105	3.8	150	0.701	100	68.6	LOS E	4.2	32.0	Short	50	0.0	NA
Approach	817	2.8	817	2.8		0.701		13.4	LOS B	4.2	32.0				
Intersection	4659	2.9	4216 N 1	3.2		0.920		40.1	LOS D	40.3	300.0				

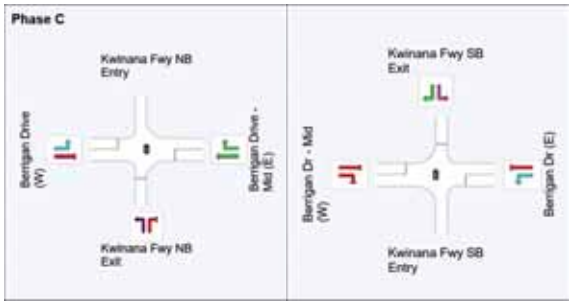
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

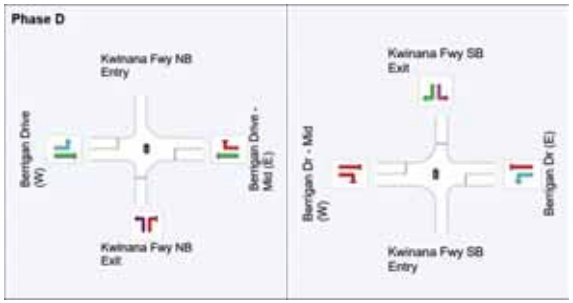
1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

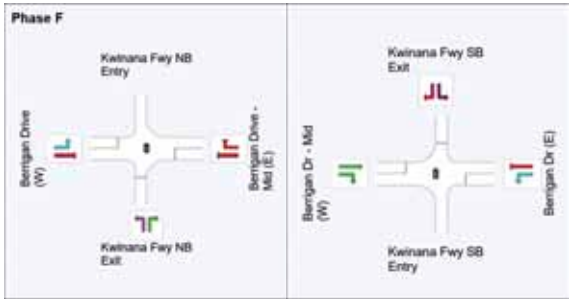
Output Phase Sequence (CCG)



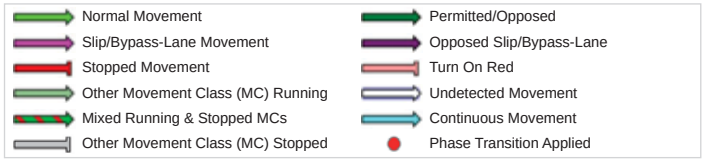








REF: Reference Phase
VAR: Variable Phase



Site: 587-E [Kwinana Freeway / Berrigan East - PM 2033 (Site Folder: Proposed - 2033)]

Network: 6 [Roundabout - 2033 PM (Network Folder: Proposed Option - 2033)]

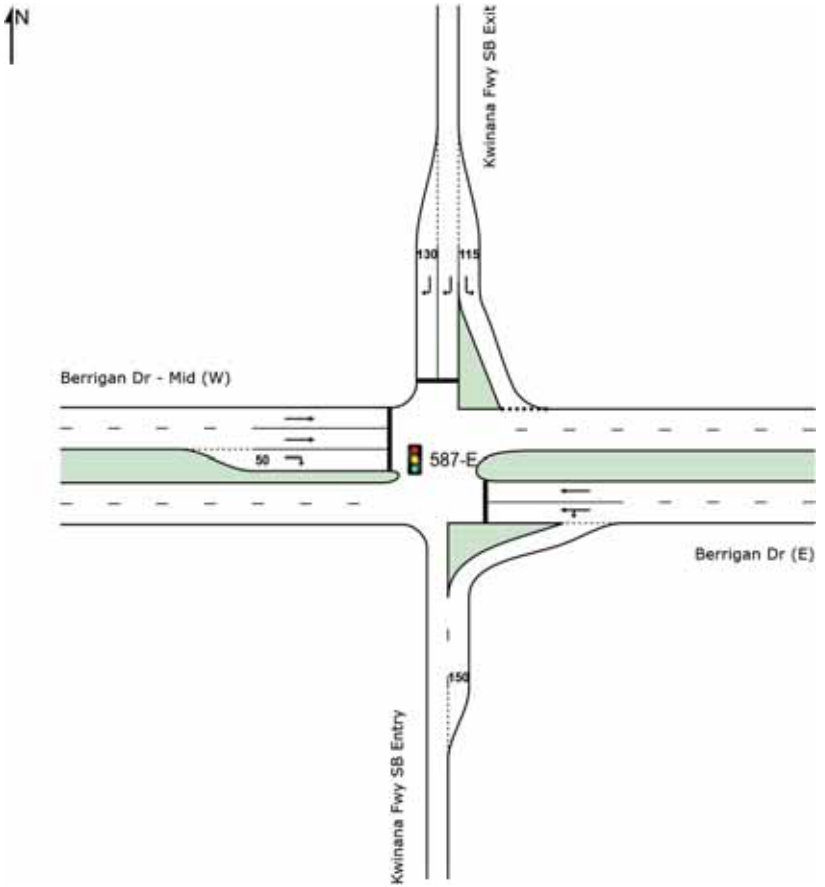
Glen Iris
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 132 seconds (Network User-Given Cycle Time)
Common Control Group: CCG1 [Fwy]

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, F
Output Phase Sequence: A, B, C, D, F

Some CCG output elements have been omitted as they have already been included under other Sites belonging to the same CCG.

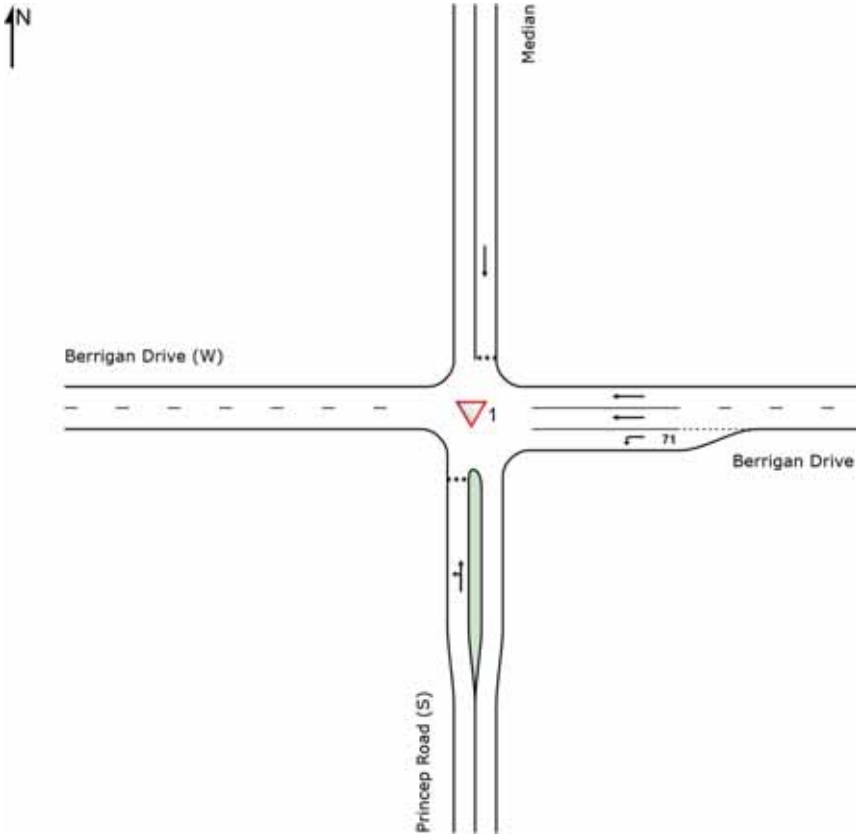
Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

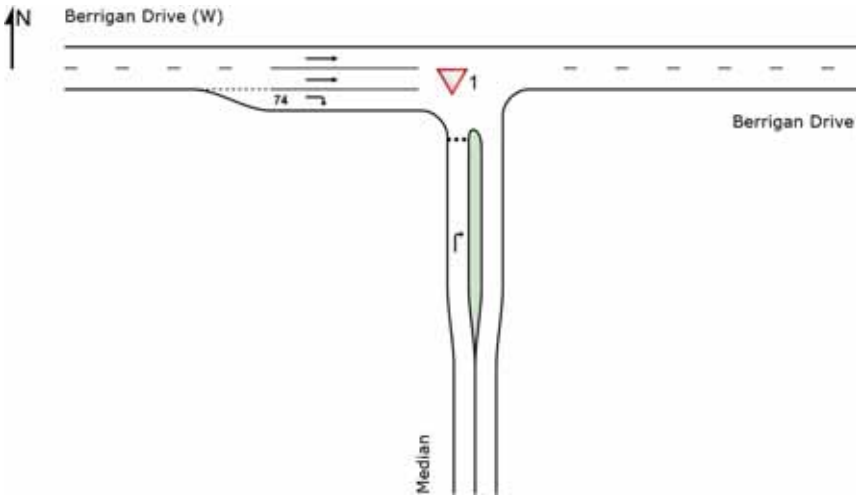
	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Princep Road (S)															
Lane 1	452	3.5	452	3.5	285	1.583	100	547.8	LOS F	44.8	341.9	Full	200	-45.8 N7	100.0
Approach	452	3.5	452	3.5		1.583		547.8	LOS F	44.8	341.9				
East: Berrigan Drive (E)															
Lane 1	34	12.1	33	12.1	1643	0.020	100	5.7	LOS A	0.0	0.0	Short	71	0.0	NA
Lane 2	822	3.1	814	3.1	945	0.862	100	0.7	LOS A	0.0	0.0	Full	135	-49.9 N7	0.0
Lane 3	822	3.1	814	3.1	945	0.862	100	0.7	LOS A	0.0	0.0	Full	135	-49.9 N7	0.0
Approach	1678	3.3	1662 N 1	3.3		0.862		0.8	NA	0.0	0.0				
North: Median															
Lane 1	167	7.5	167	7.5	192	0.872	100	67.4	LOS F	0.9 N4	7.0 N4	Full	7	0.0	49.9
Approach	167	7.5	167	7.5		0.872		67.4	LOS F	0.9	7.0				
Intersection	2297	3.6	2281 N 1	3.7		1.583		114.0	NA	44.8	341.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N4 Average back of queue has been restricted to the available queue storage space.
N7 The capacity reduction has been determined from the queue blockage probability of a Site further downstream due to intermediate continuous lanes.

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Median															
Lane 1	69	1.5	48	1.5	265	0.181	100	14.7	LOS B	0.2	1.7	Full	7	-6.1 N3	0.0
Approach	69	1.5	48 N1	1.5		0.181		14.7	LOS B	0.2	1.7				
West: Berrigan Drive (W)															
Lane 1	534	1.8	534	1.8	1908	0.280	100	0.0	LOS A	0.0	0.0	Full	190	0.0	0.0
Lane 2	502	1.8	502	1.8	1792	0.280	100	0.0	LOS A	0.0	0.0	Full	190	-6.1 N3	0.0
Lane 3	167	7.5	167	7.5	1709	0.098	100	5.8	LOS A	2.3 N5	17.9 N5	Short	74	0.0	NA
Approach	1203	2.6	1203	2.6		0.280		0.8	NA	2.3	17.9				
Intersection	1273	2.5	1251 N1	2.6		0.280		1.4	NA	2.3	17.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.
N5 Continuous Lane results determined by Back of Queue values of downstream lanes (proportional to lane movement flows).

Site: LM01173 [Berrigan Drive_Jandakot Road_PM 2033 (Site Folder: Proposed - 2033)]

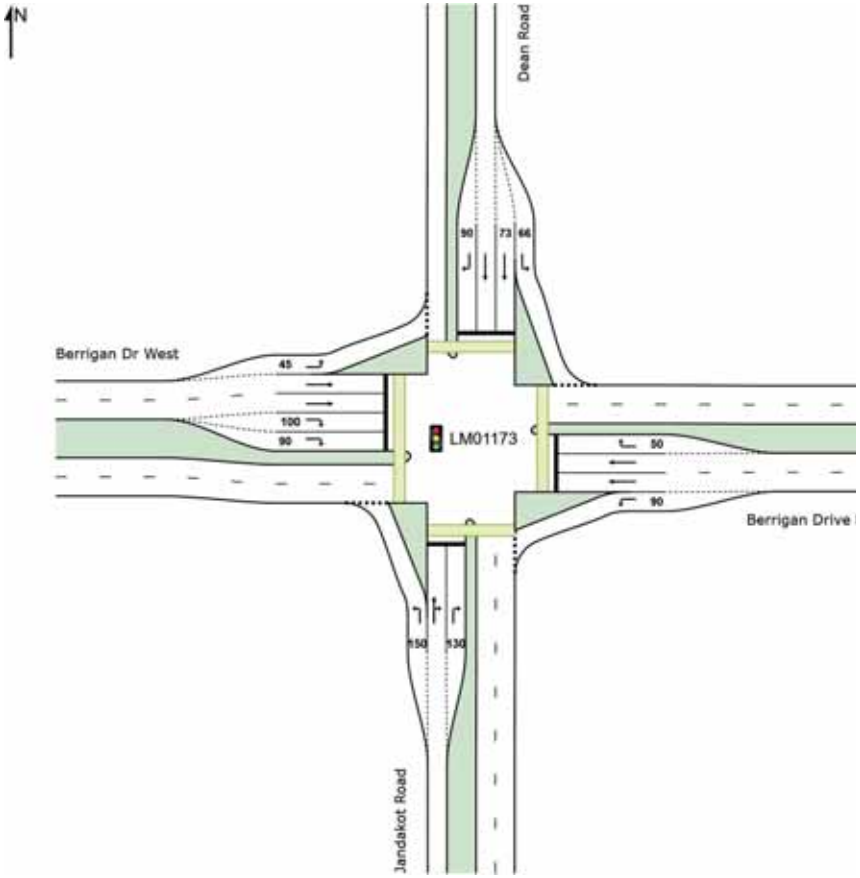
Network: 6 [Roundabout - 2033 PM (Network Folder: Proposed Option - 2033)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 106 seconds (Site User-Given Phase Times)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times specified by the user
Phase Sequence: Variable Phasing
Reference Phase: Phase E
Input Phase Sequence: A, B, C, D, E
Output Phase Sequence: A, B, C, D, E

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



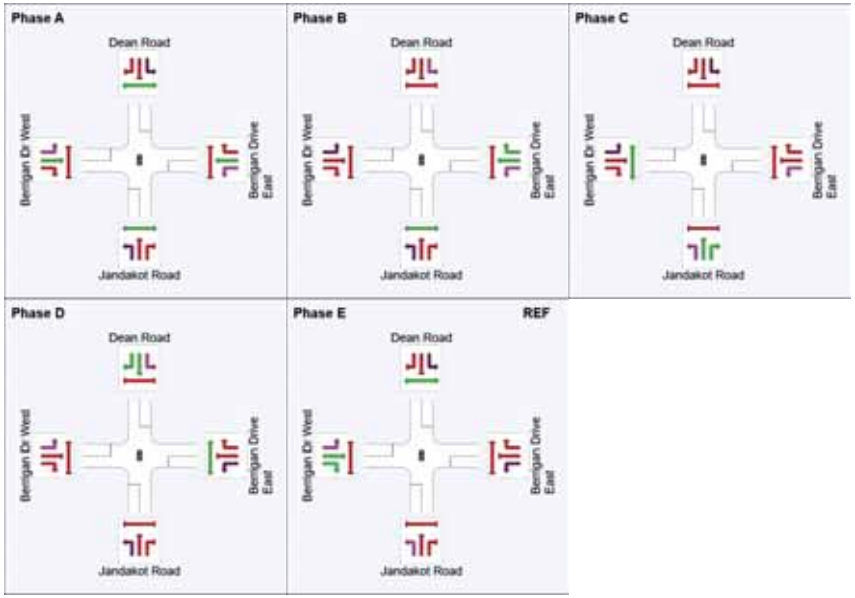
Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Jandakot Road															
Lane 1	637	5.5	637	5.5	1002	0.636	100	18.2	LOS B	11.7	86.8	Short	150	0.0	NA
Lane 2	137	1.8	137	1.8	294	0.466	100	45.4	LOS D	4.1	29.0	Full	230	0.0	0.0
Lane 3	97	5.5	97	5.5	273	0.355	76[5]	50.3	LOS D	2.8	21.0	Short	130	0.0	NA
Approach	871	4.9	871	4.9		0.636		26.0	LOS C	11.7	86.8				
East: Berrigan Drive East															
Lane 1	495	4.3	495	4.3	1207	0.410	100	10.6	LOS B	5.6	41.2	Short	90	0.0	NA
Lane 2	472	4.3	472	4.3	468[1]	1.010	100	96.1	LOS F	23.6	173.5	Full	125	0.0	81.4
Lane 3	487	4.3	487	4.3	482[1]	1.010	100	95.6	LOS F	24.3	178.5	Full	125	0.0	84.2
Lane 4	79	1.8	79	1.8	140	0.565	100	59.9	LOS E	2.6	18.4	Short	50	0.0	NA
Approach	1533	4.2	1533	4.2		1.010		66.5	LOS E	24.3	178.5				
North: Dean Road															
Lane 1	46	3.2	46	3.2	796	0.058	100	12.3	LOS B	0.5	3.6	Short	66	0.0	NA
Lane 2	15	3.2	15	3.2	200	0.074	100	47.2	LOS D	0.4	3.1	Short	73	0.0	NA
Lane 3	15	3.2	15	3.2	200	0.074	100	47.2	LOS D	0.4	3.1	Full	110	0.0	0.0
Lane 4	96	0.0	96	0.0	195	0.492	100	56.0	LOS E	3.0	21.0	Short	90	0.0	NA
Approach	172	1.4	172	1.4		0.492		42.7	LOS D	3.0	21.0				
West: Berrigan Dr West															
Lane 1	97	0.0	95	0.0	1401	0.068	100	7.4	LOS A	0.5	3.8	Short	45	0.0	NA
Lane 2	137	1.4	134	1.4	884	0.152	100	18.1	LOS B	2.5	17.5	Full	135	0.0	0.0
Lane 3	137	1.4	134	1.4	884	0.152	100	18.1	LOS B	2.5	17.5	Full	135	0.0	6.1[8]
Lane 4	397	1.4	390	1.4	521	0.749	100	46.4	LOS D	11.8	83.7	Short	100	10.0[N2]	NA
Lane 5	397	1.4	390	1.4	521	0.749	100	46.4	LOS D	11.8	83.7	Short	90	10.0[N2]	NA
Approach	1164	1.3	1144[N1]	1.3		0.749		36.5	LOS D	11.8	83.7				
Intersection	3739	3.3	3719[N1]	3.3		1.010		46.7	LOS D	24.3	178.5				

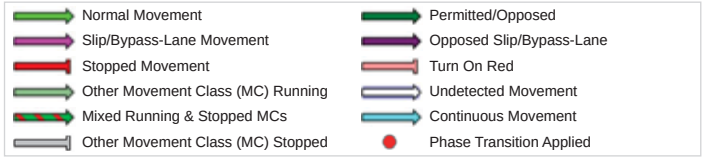
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
5 Lane under-utilisation found by the program
8 Probability of Blockage has been set on the basis of a queue that overflows from a short lane.
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N2 Capacity Adjustment specified by user.

Output Phase Sequence

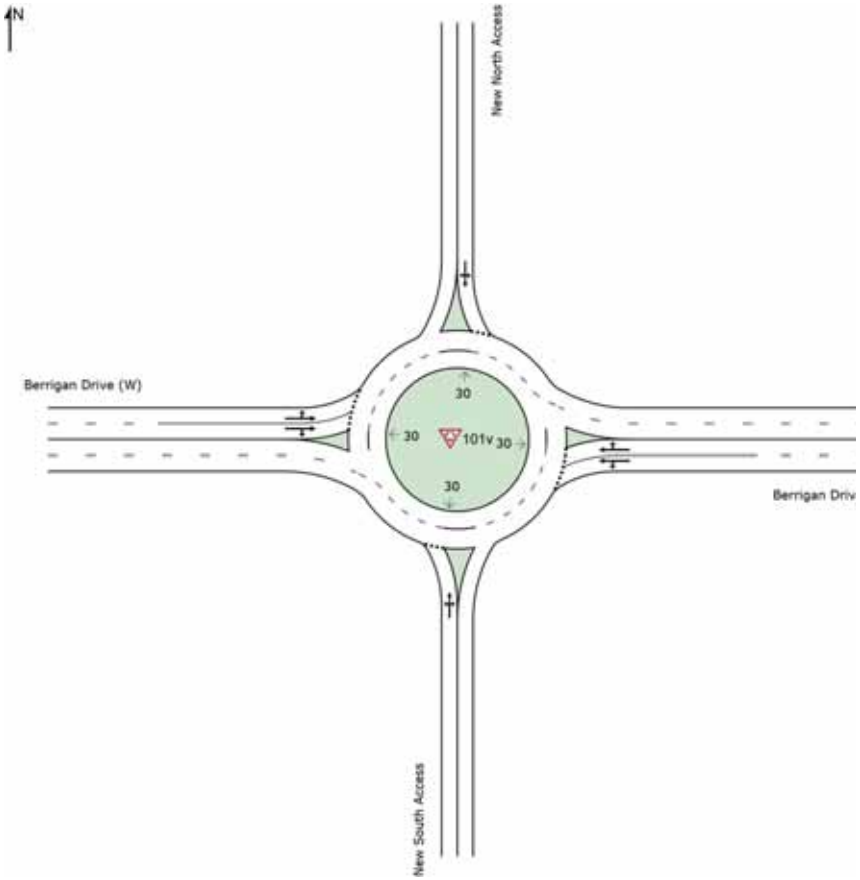


REF: Reference Phase
VAR: Variable Phase



Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: New South Access															
Lane 1[d]	37	1.3	37	1.3	184	0.200	100	17.1	LOS B	0.3	2.3	Full	500	-28.6[N3]	0.0
Approach	37	1.3	37	1.3		0.200		17.1	LOS B	0.3	2.3				
East: Berrigan Drive (E)															
Lane 1	731	2.0	684	2.0	590	1.160	100	159.0	LOS F	26.5[N4]	189.9[N4]	Full	190	-48.4[N3]	49.9
Lane 2[d]	1393	2.0	1305	2.0	1125	1.160	100	154.7	LOS F	26.5[N4]	189.9[N4]	Full	190	-20.9[N3]	49.9
Approach	2124	2.0	1989[N1]	2.0		1.160		156.2	LOS F	26.5	189.9				
North: New North Access															
Lane 1[d]	154	1.2	154	1.2	511	0.301	100	11.9	LOS B	0.5	3.8	Full	500	-14.6[N3]	0.0
Approach	154	1.2	154	1.2		0.301		11.9	LOS B	0.5	3.8				
West: Berrigan Drive (W)															
Lane 1[d]	760	2.0	760	2.0	1451	0.523	100	4.2	LOS A	1.8	13.0	Full	300	0.0	0.0
Lane 2	673	2.3	673	2.3	1286	0.523	100	4.9	LOS A	1.8	12.7	Full	300	0.0	0.0
Approach	1433	2.1	1433	2.1		0.523		4.5	LOS A	1.8	13.0				
Intersection	3747	2.0	3612[N1]	2.1		1.160		88.5	LOS F	26.5	189.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.
N4 Average back of queue has been restricted to the available queue storage space.

USER REPORT FOR NETWORK SITE

All Movement Classes

Project: 210824_W191120_Berrigan Drive - TSAP_Gate_1 **Template: Default Site User Report**

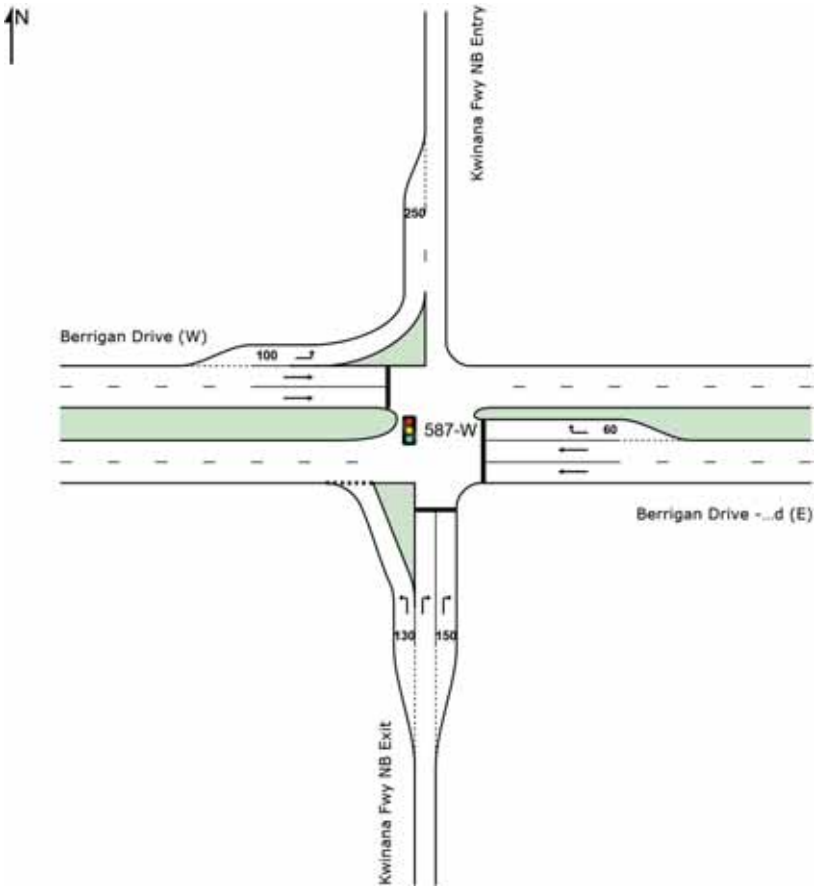
Site: 587-W [Kwinana Freeway / Berrigan West - PM 2033 (Site Folder: Proposed - 2033)] **Network: 4 [TCS - 2033 PM (Network Folder: Proposed Option - 2033)]**

2036 AM Peak (Report Option 1)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 132 seconds (Network User-Given Cycle Time)
Common Control Group: CCG1 [Fwy]

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, F
Output Phase Sequence: A, B, C, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



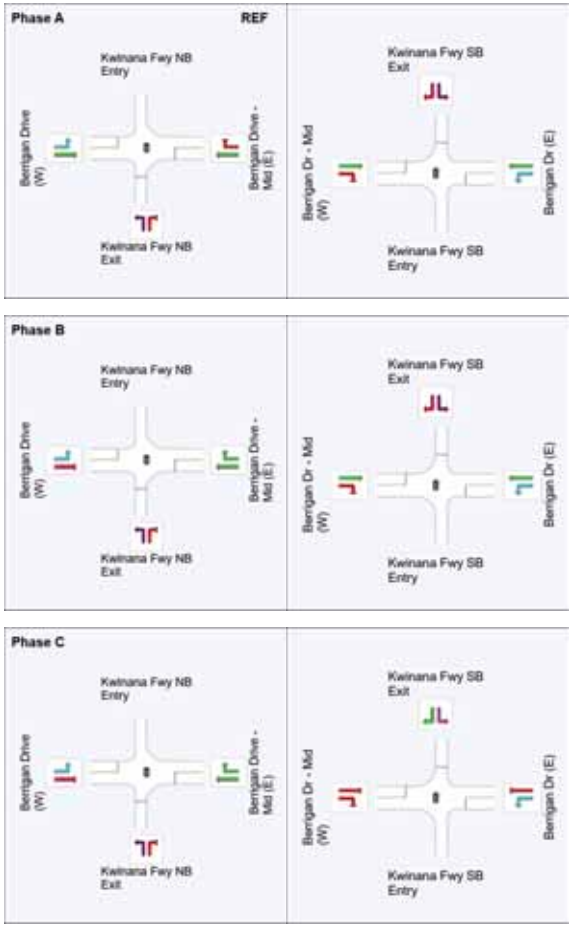
Lane Use and Performance (CCG)

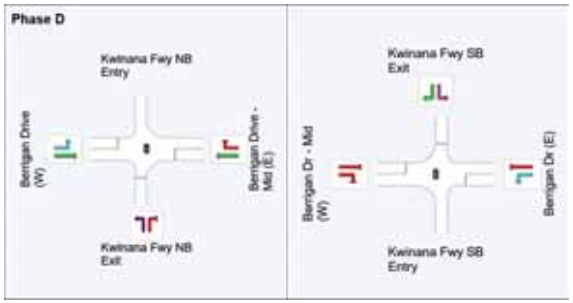
	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
Site: 587-W [Kwinana Freeway / Berrigan West - PM 2033]															
South: Kwinana Fwy NB Exit															
Lane 1	132	3.6	132	3.6	303	0.434	100	7.3	LOS A	1.3	10.1	Short	130	0.0	NA
Lane 2	43	6.4	43	6.4	80	0.539	100	76.7	LOS E	1.8	14.1	Full	500	0.0	0.0
Lane 3	43	6.4	43	6.4	80	0.539	100	76.7	LOS E	1.8	14.1	Short	150	0.0	NA
Approach	218	4.7	218	4.7		0.539		34.8	LOS C	1.8	14.1				
East: Berrigan Drive - Mid (E)															
Lane 1	1027	3.1	923	3.3	1547	0.597	100	0.5	LOS A	1.7	13.0	Full	120	0.0	0.0
Lane 2	1027	3.1	923	3.3	1547	0.597	100	0.5	LOS A	1.7	13.0	Full	120	0.0	0.0
Lane 3	573	3.1	514	3.3	879	0.585	100	17.4	LOS B	8.4	63.6	Short	60	5.0 N2	NA
Approach	2626	3.1	2360 N 1	3.3		0.597		4.2	LOS A	8.4	63.6				
West: Berrigan Drive (W)															
Lane 1	620	3.3	620	3.3	1812	0.342	100	7.9	LOS A	0.0	0.0	Short	100	0.0	NA
Lane 2	368	3.2	368	3.2	463	0.794	100	35.3	LOS D	11.0	83.3	Full	500	0.0	0.0
Lane 3	368	3.2	368	3.2	463	0.794	100	35.3	LOS D	11.0	83.3	Full	500	0.0	0.0
Approach	1356	3.2	1356	3.2		0.794		22.8	LOS C	11.0	83.3				
Intersection	4200	3.2	3934 N 1	3.4		0.794		12.3	LOS B	11.0	83.3				
Site: 587-E [Kwinana Freeway / Berrigan East - PM 2033]															
East: Berrigan Dr (E)															
Lane 1	1286	1.2	1040	1.2	1103	0.943	100	49.6	LOS D	40.3 N4	300.0 N4	Full	300	0.0	50.0
Lane 2	825	1.3	667	1.3	708	0.943	100	66.6	LOS E	32.0	238.2	Full	300	0.0	28.6
Approach	2111	1.2	1707 N 1	1.2		0.943		56.3	LOS E	40.3	300.0				
North: Kwinana Fwy SB Exit															
Lane 1	719	3.3	719	3.3	1084	0.663	100	9.6	LOS A	16.7	127.1	Short	115	0.0	NA
Lane 2	506	6.1	506	6.1	551 1	0.919	100	69.0	LOS E	23.0	179.6	Full	500	0.0	0.0
Lane 3	506	6.1	506	6.1	551 1	0.919	100	69.0	LOS E	23.0	179.6	Short	130	0.0	NA
Approach	1732	4.9	1732	4.9		0.919		44.4	LOS D	23.0	179.6				
West: Berrigan Dr - Mid (W)															
Lane 1	356	2.6	356	2.6	1004	0.354	100	5.2	LOS A	2.6	19.3	Full	120	0.0	0.0
Lane 2	356	2.6	356	2.6	1004	0.354	100	5.2	LOS A	2.6	19.3	Full	120	0.0	0.0
Lane 3	105	3.8	105	3.8	150	0.701	100	68.6	LOS E	4.2	32.0	Short	50	0.0	NA
Approach	817	2.8	817	2.8		0.701		13.4	LOS B	4.2	32.0				
Intersection	4659	2.9	4255 N 1	3.2		0.943		43.2	LOS D	40.3	300.0				

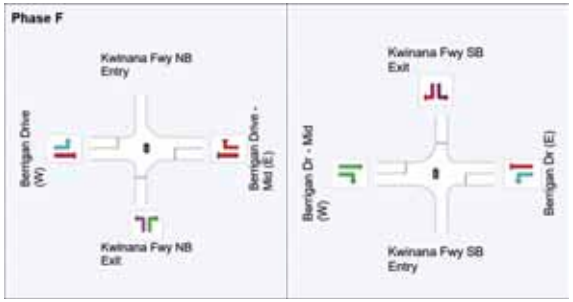
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Output Phase Sequence (CCG)







REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Site: 587-E [Kwinana Freeway / Berrigan East - PM 2033 (Site Folder: Proposed - 2033)]

Network: 4 [TCS - 2033 PM (Network Folder: Proposed Option - 2033)]

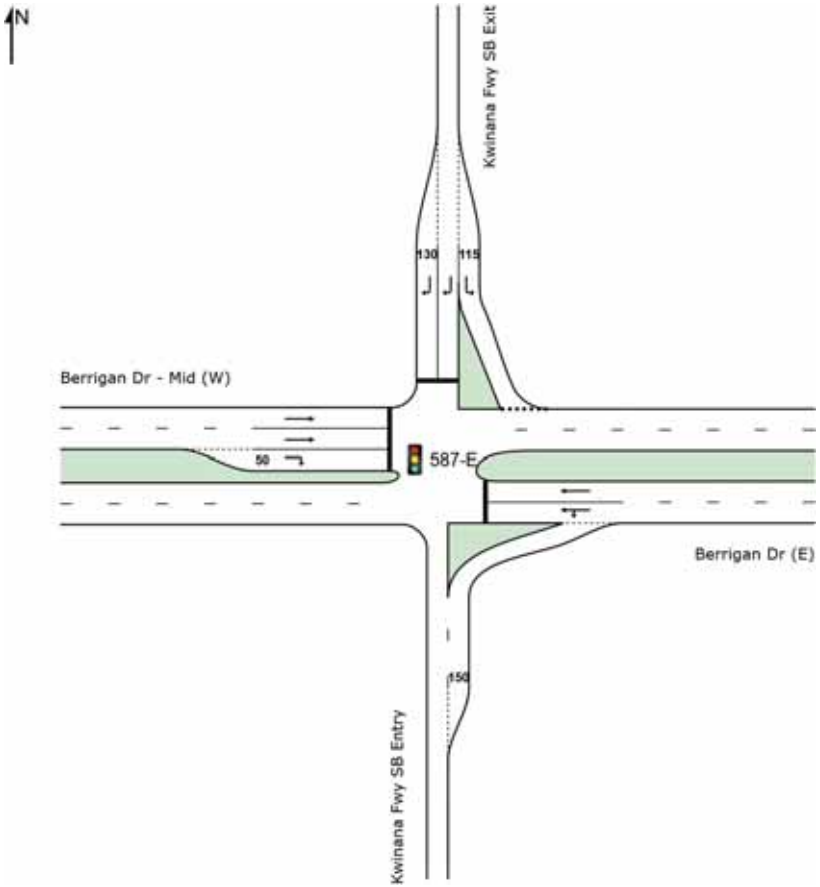
Glen Iris
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 132 seconds (Network User-Given Cycle Time)
Common Control Group: CCG1 [Fwy]

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, F
Output Phase Sequence: A, B, C, D, F

Some CCG output elements have been omitted as they have already been included under other Sites belonging to the same CCG.

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Site Layout

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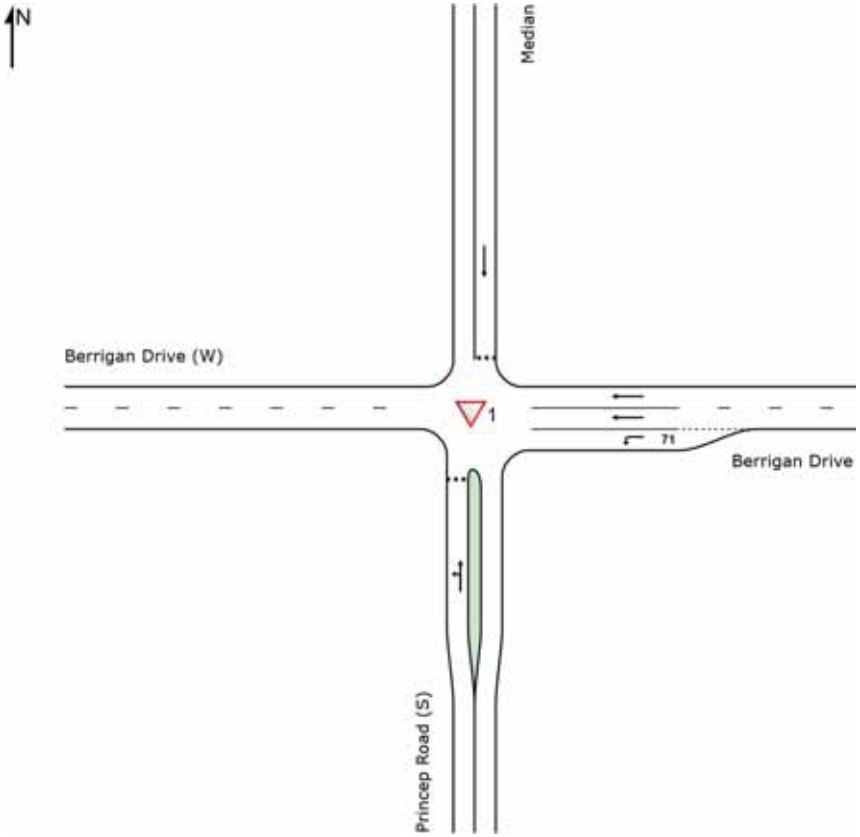


Lane Use and Performance

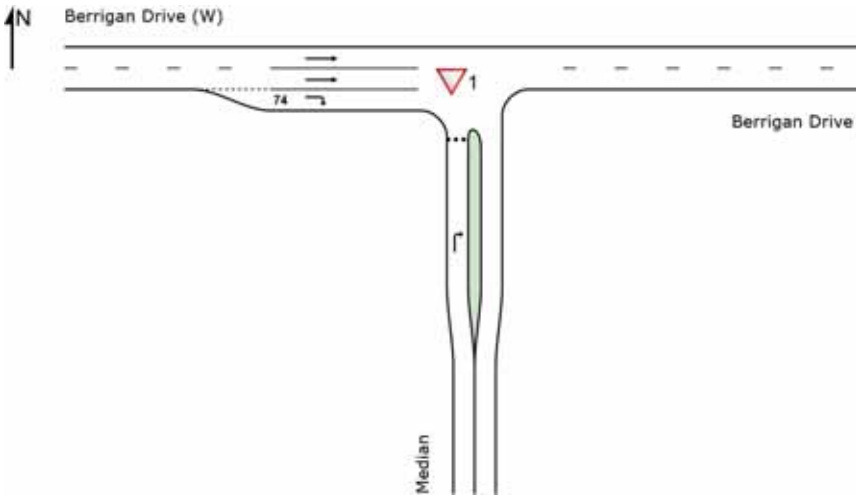
	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Princep Road (S)															
Lane 1	452	3.5	452	3.5	278	1.622	100	582.2	LOS F	46.4	354.5	Full	200	-45.8[N7]	100.0
Approach	452	3.5	452	3.5		1.622		582.2	LOS F	46.4	354.5				
East: Berrigan Drive (E)															
Lane 1	34	12.1	34	12.1	1643	0.020	100	5.7	LOS A	0.0	0.0	Short	71	0.0	NA
Lane 2	822	3.1	822	3.1	1888	0.436	100	0.0	LOS A	0.0	0.0	Full	135	0.0	0.0
Lane 3	822	3.1	822	3.1	1888	0.436	100	0.0	LOS A	0.0	0.0	Full	135	0.0	0.0
Approach	1678	3.3	1678	3.3		0.436		0.2	NA	0.0	0.0				
North: Median															
Lane 1	167	7.5	167	7.5	184	0.908	100	78.9	LOS F	0.9[N4]	7.0[N4]	Full	7	0.0	49.9
Approach	167	7.5	167	7.5		0.908		78.9	LOS F	0.9	7.0				
Intersection	2297	3.6	2297	3.6		1.622		120.3	NA	46.4	354.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N4 Average back of queue has been restricted to the available queue storage space.
N7 The capacity reduction has been determined from the queue blockage probability of a Site further downstream due to intermediate continuous lanes.

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Median															
Lane 1	69	1.5	49	1.5	175	0.279	100	13.2	LOS B	0.2	1.6	Full	7	-50.0 N3	0.0
Approach	69	1.5	49 N1	1.5		0.279		13.2	LOS B	0.2	1.6				
West: Berrigan Drive (W)															
Lane 1	518	1.8	518	1.8	1908	0.271	100	0.0	LOS A	0.0	0.0	Full	190	0.0	0.0
Lane 2	518	1.8	518	1.8	1908	0.271	100	0.0	LOS A	1.8 N5	13.3 N5	Full	190	0.0	0.0
Lane 3	167	7.5	167	7.5	1709	0.098	100	5.8	LOS A	2.3 N5	18.0 N5	Short	74	0.0	NA
Approach	1203	2.6	1203	2.6		0.271		0.8	NA	2.3	18.0				
Intersection	1273	2.5	1252 N 1	2.6		0.279		1.3	NA	2.3	18.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.
N5 Continuous Lane results determined by Back of Queue values of downstream lanes (proportional to lane movement flows).

Site: LM01173 [Berrigan Drive_Jandakot Road_PM 2033 (Site Folder: Proposed - 2033)]

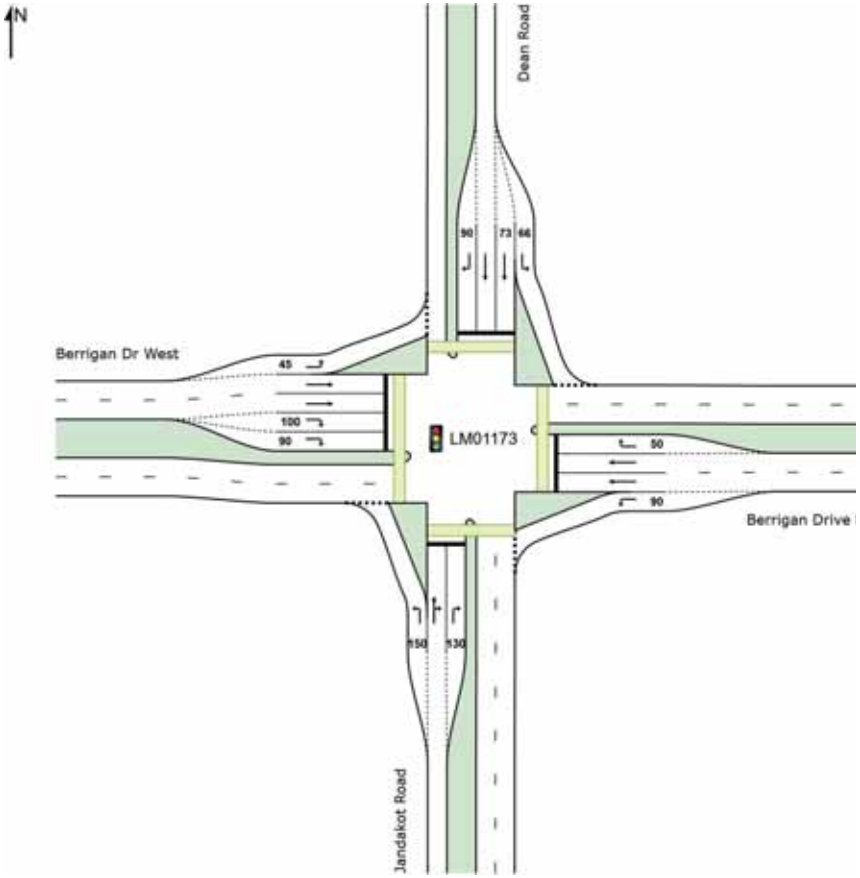
Network: 4 [TCS - 2033 PM (Network Folder: Proposed Option - 2033)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 132 seconds (Network User-Given Cycle Time)

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: Variable Phasing
Reference Phase: Phase E
Input Phase Sequence: A, B, C, D, E
Output Phase Sequence: A, B, C, D, E

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



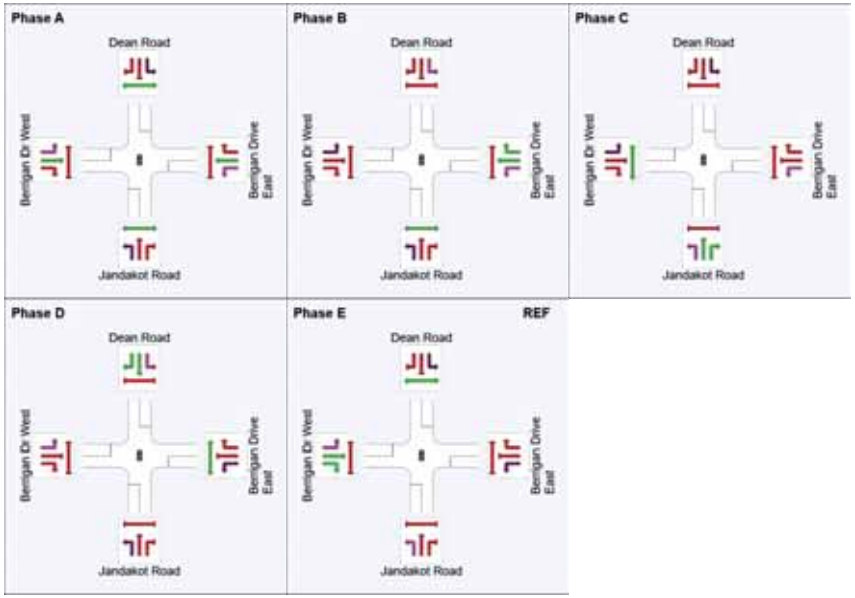
Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Jandakot Road															
Lane 1	637	5.5	637	5.5	952	0.669	100	21.2	LOS C	15.1	112.4	Short	150	0.0	NA
Lane 2	137	1.8	137	1.8	266	0.515	100	58.2	LOS E	5.1	36.6	Full	230	0.0	0.0
Lane 3	97	5.5	97	5.5	246	0.393	76[5]	62.8	LOS E	3.6	26.5	Short	130	0.0	NA
Approach	871	4.9	871	4.9		0.669		31.6	LOS C	15.1	112.4				
East: Berrigan Drive East															
Lane 1	495	4.3	495	4.3	1231	0.402	100	11.9	LOS B	7.0	51.7	Short	90	0.0	NA
Lane 2	436	4.3	436	4.3	460[1]	0.947	100	73.0	LOS E	20.3	149.4	Full	125	0.0	66.9
Lane 3	523	4.3	523	4.3	553[1]	0.947	100	72.4	LOS E	25.1	184.1	Full	125	0.0	87.3
Lane 4	79	1.8	79	1.8	393	0.201	100	51.7	LOS D	2.6	18.3	Short	50	0.0	NA
Approach	1533	4.2	1533	4.2		0.947		52.0	LOS D	25.1	184.1				
North: Dean Road															
Lane 1	46	3.2	46	3.2	672	0.069	100	21.0	LOS C	0.9	6.2	Short	66	0.0	NA
Lane 2	15	3.2	15	3.2	219	0.067	100	56.8	LOS E	0.5	3.8	Short	73	0.0	NA
Lane 3	15	3.2	15	3.2	219	0.067	100	56.8	LOS E	0.5	3.8	Full	110	0.0	0.0
Lane 4	96	0.0	96	0.0	213	0.449	100	66.1	LOS E	3.6	25.4	Short	90	0.0	NA
Approach	172	1.4	172	1.4		0.449		52.3	LOS D	3.6	25.4				
West: Berrigan Dr West															
Lane 1	97	0.0	95	0.0	1327	0.072	100	7.5	LOS A	0.6	4.2	Short	45	0.0	NA
Lane 2	137	1.4	135	1.4	651	0.207	100	33.5	LOS C	3.8	26.7	Full	135	0.0	0.0
Lane 3	137	1.4	135	1.4	651	0.207	100	33.5	LOS C	3.8	26.7	Full	135	0.0	43.4[8]
Lane 4	397	1.4	390	1.4	424[1]	0.920	100	75.8	LOS E	17.7	125.7	Short	100	10.0[N2]	NA
Lane 5	397	1.4	390	1.4	424[1]	0.920	100	75.8	LOS E	17.7	125.7	Short	90	10.0[N2]	NA
Approach	1164	1.3	1145[N1]	1.3		0.920		60.2	LOS E	17.7	125.7				
Intersection	3739	3.3	3720[N1]	3.3		0.947		49.8	LOS D	25.1	184.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
5 Lane under-utilisation found by the program
8 Probability of Blockage has been set on the basis of a queue that overflows from a short lane.
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N2 Capacity Adjustment specified by user.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

Site: 101 [Berrigan Drive / Turnbury Park Dr / Access - PM 2033 - TCS (Site Folder: Proposed - 2033)]

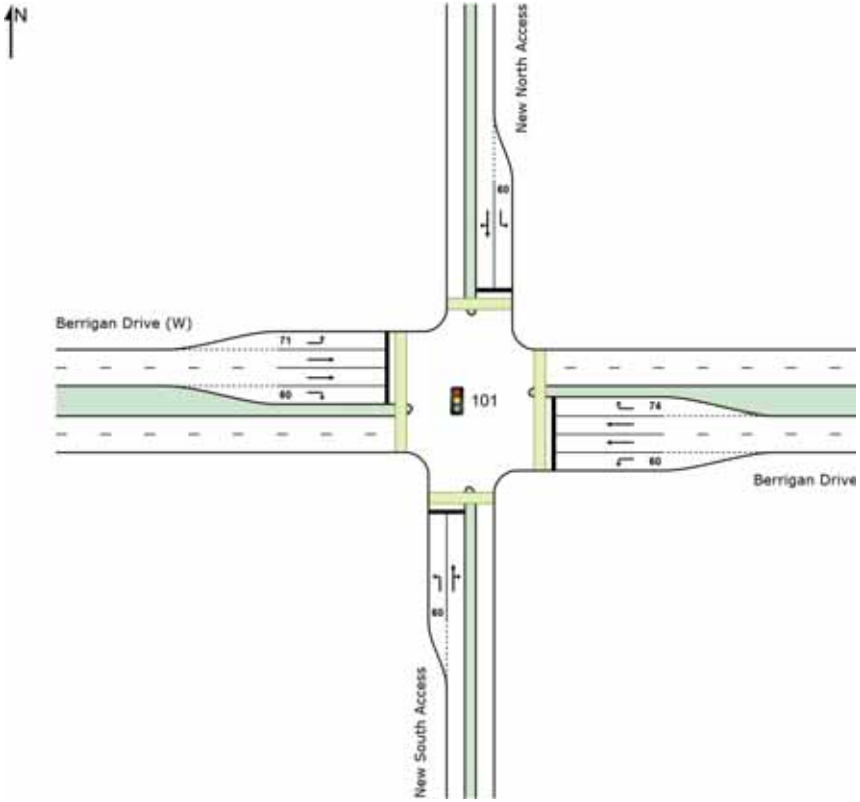
Network: 4 [TCS - 2033 PM (Network Folder: Proposed Option - 2033)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, C1*, C2*
Output Phase Sequence: A, B, C, C2*
(* Variable Phase)

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



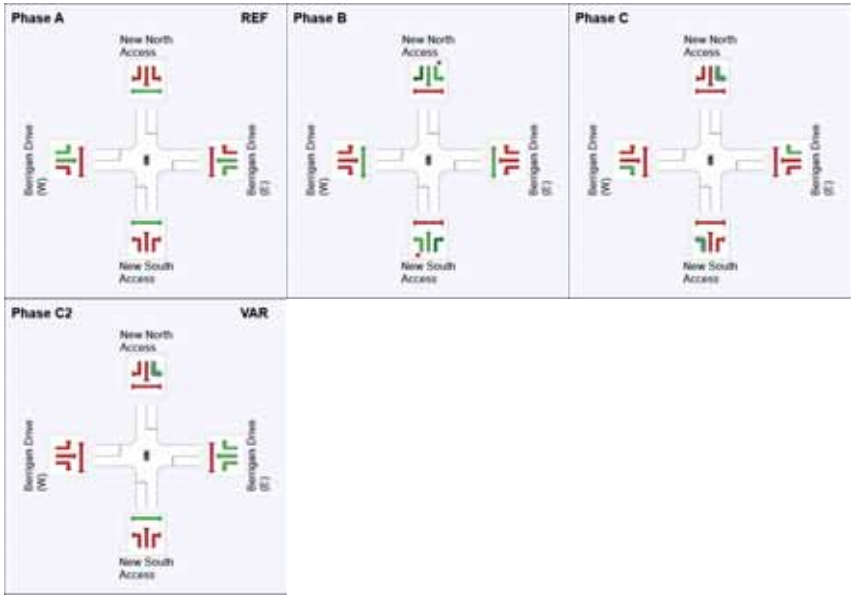
Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: New South Access															
Lane 1	15	0.0	15	0.0	118	0.125	100	66.3	LOS E	0.6	4.2	Short	60	-50.0 N3	NA
Lane 2	22	2.1	22	2.1	114	0.193	100	76.9	LOS E	1.0	7.0	Full	500	0.0	0.0
Approach	37	1.3	37	1.3		0.193		72.6	LOS E	1.0	7.0				
East: Berrigan Drive (E)															
Lane 1	46	1.8	44	1.8	1382	0.032	100	10.4	LOS B	0.5	3.4	Short	60	0.0	NA
Lane 2	858	2.0	813	2.0	711 1	1.144	100	200.1	LOS F	26.5 N4	190.0 N4	Full	190	-50.0 N3	50.0
Lane 3	1112	2.0	1053	2.0	921 1	1.144	100	192.6	LOS F	26.5 N4	190.0 N4	Full	190	-33.4 N3	50.0
Lane 4	107	1.8	102	1.8	208	0.489	100	74.3	LOS E	4.4	31.3	Short	74	0.0	NA
Approach	2124	2.0	2012 N 1	2.0		1.144		185.7	LOS F	26.5	190.0				
North: New North Access															
Lane 1	60	3.2	60	3.2	363	0.165	100	55.5	LOS E	2.2	15.8	Short	60	0.0	NA
Lane 2	94	0.0	94	0.0	84	1.114	100	203.1	LOS F	7.6	53.0	Full	500	-32.9 N3	0.0
Approach	154	1.2	154	1.2		1.114		145.5	LOS F	7.6	53.0				
West: Berrigan Drive (W)															
Lane 1	148	0.0	148	0.0	1263	0.118	100	14.2	LOS B	2.2	15.7	Short	71	0.0	NA
Lane 2	621	2.5	621	2.5	1239 1	0.501	100	11.9	LOS B	12.8	92.4	Full	300	0.0	0.0
Lane 3	598	2.5	598	2.5	1193 1	0.501	100	11.7	LOS B	12.1	87.4	Full	300	0.0	0.0
Lane 4	65	0.0	65	0.0	74	0.879	100	95.2	LOS F	3.3	23.1	Short	60	0.0	NA
Approach	1433	2.1	1433	2.1		0.879		15.9	LOS B	12.8	92.4				
Intersection	3747	2.0	3635 N 1	2.1		1.144		115.9	LOS F	26.5	190.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.
N4 Average back of queue has been restricted to the available queue storage space.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

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Organisation: STANTEC NEW ZEALAND | Licence: NETWORK / Enterprise | Created: Monday, 13 September 2021 1:39:19 PM
Project: P:\W19100-19199\W191120 Glen Iris Golf Course Re-Develop\Modelling\210824_W191120_Berrigan Drive - TSAP_Gate_1.sip9

USER REPORT FOR NETWORK SITE

All Movement Classes

Project: 210824_W191120_Berrigan Drive - TSAP_Gate_1 **Template: Default Site User Report**

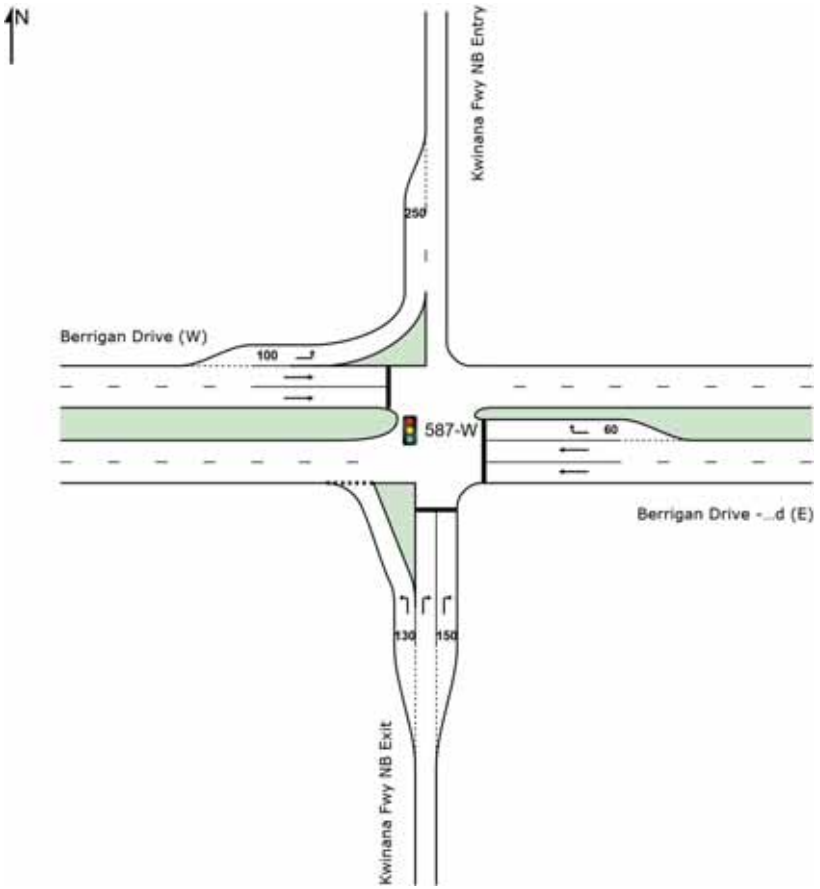
Site: 587-W [Kwinana Freeway / Berrigan West - AM 2033 (Site Folder: Proposed - 2033)] **Network: 5 [Roundabout - 2033 AM (Network Folder: Proposed Option - 2033)]**

2036 AM Peak (Report Option 1)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 138 seconds (Network User-Given Cycle Time)
Common Control Group: CCG1 [Fwy]

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, F
Output Phase Sequence: A, B, C, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



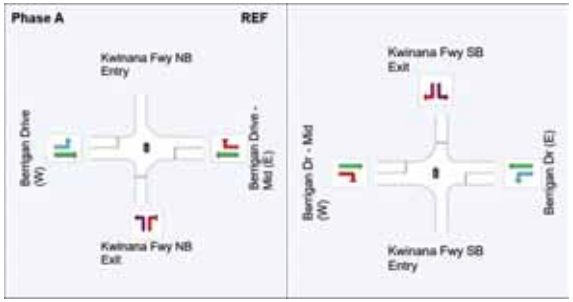
Lane Use and Performance (CCG)

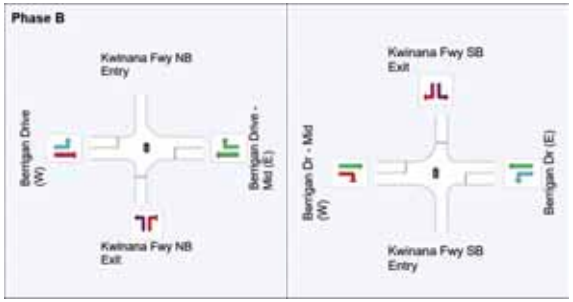
	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
Site: 587-W [Kwinana Freeway / Berrigan West - AM 2033]															
South: Kwinana Fwy NB Exit															
Lane 1	89	3.6	89	3.6	483	0.185	100	6.3	LOS A	0.3	2.5	Short	130	0.0	NA
Lane 2	125	6.4	125	6.4	114	1.089	100	172.6	LOS F	8.8	68.6	Full	500	0.0	0.0
Lane 3	125	6.4	125	6.4	114	1.089	100	172.6	LOS F	8.8	68.6	Short	150	0.0	NA
Approach	339	5.7	339	5.7		1.089		128.7	LOS F	8.8	68.6				
East: Berrigan Drive - Mid (E)															
Lane 1	1019	7.5	799	8.2	1453	0.550	100	0.5	LOS A	1.4	11.1	Full	120	0.0	0.0
Lane 2	560	7.5	439	8.2	1453	0.302	55[7]	0.4	LOS A	0.5	4.0	Full	120	0.0	50.0[8]
Lane 3	917	3.9	716	4.3	730[1]	0.981	100	46.3	LOS D	15.7[N4]	120.0[N4]	Short	60	35.0[N2]	NA
Approach	2496	6.2	1954[N1]	6.8		0.981		17.3	LOS B	15.7	120.0				
West: Berrigan Drive (W)															
Lane 1	928	5.5	928	5.5	1772	0.524	100	14.8	LOS B	0.0	0.0	Short	100	0.0	NA
Lane 2	308	5.6	308	5.6	406	0.759	100	36.2	LOS D	9.3	72.1	Full	500	0.0	0.0
Lane 3	308	5.6	308	5.6	406	0.759	100	36.2	LOS D	9.3	72.1	Full	500	0.0	0.0
Approach	1544	5.5	1544	5.5		0.759		23.3	LOS C	9.3	72.1				
Intersection	4379	5.9	3837[N1]	6.7		1.089		29.5	LOS C	15.7	120.0				
Site: 587-E [Kwinana Freeway / Berrigan East - AM 2033]															
East: Berrigan Dr (E)															
Lane 1	1312	4.9	1076	5.3	881	1.222	100	261.5	LOS F	38.7[N4]	300.0[N4]	Full	300	0.0	50.0
Lane 2	630	4.4	516	4.8	422	1.222	100	274.5	LOS F	38.9[N4]	300.0[N4]	Full	300	-50.0[N3]	50.0
Approach	1942	4.7	1592[N1]	5.1		1.222		265.7	LOS F	38.9	300.0				
North: Kwinana Fwy SB Exit															
Lane 1	460	5.0	460	5.0	964	0.477	100	6.4	LOS A	2.5	19.1	Short	115	0.0	NA
Lane 2	463	10.5	463	10.5	386[1]	1.198	100	256.6	LOS F	42.2	344.1	Full	500	0.0	15.5
Lane 3	241	10.5	241	10.5	202	1.198	100	266.2	LOS F	22.8	185.6	Short	130	-50.0[N3]	NA
Approach	1164	8.3	1164	8.3		1.198		159.8	LOS F	42.2	344.1				
West: Berrigan Dr - Mid (W)															
Lane 1	382	6.5	374	6.5	1154	0.324	100	0.7	LOS A	0.4	3.5	Full	120	0.0	0.0
Lane 2	382	6.5	374	6.5	1154	0.324	100	0.7	LOS A	0.4	3.5	Full	120	0.0	0.0
Lane 3	165	3.3	162	3.3	184	0.879	100	73.5	LOS E	7.1	53.8	Short	50	0.0	NA
Approach	929	5.9	909[N1]	5.9		0.879		13.6	LOS B	7.1	53.8				
Intersection	4036	6.0	3666[N1]	6.6		1.222		169.6	LOS F	42.2	344.1				

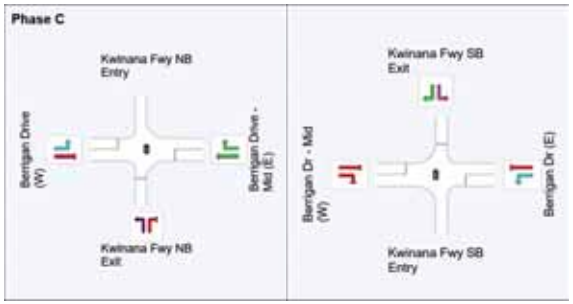
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

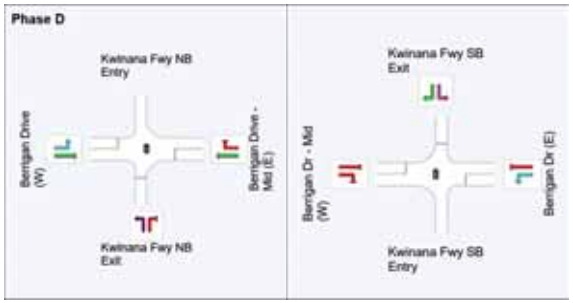
1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
7 Lane under-utilisation specified by the user

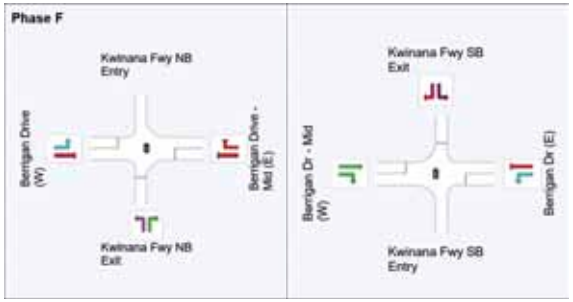
Output Phase Sequence (CCG)



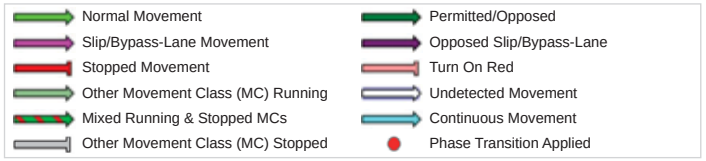








REF: Reference Phase
VAR: Variable Phase



Site: 587-E [Kwinana Freeway / Berrigan East - AM 2033 (Site Folder: Proposed - 2033)]

Network: 5 [Roundabout - 2033 AM (Network Folder: Proposed Option - 2033)]

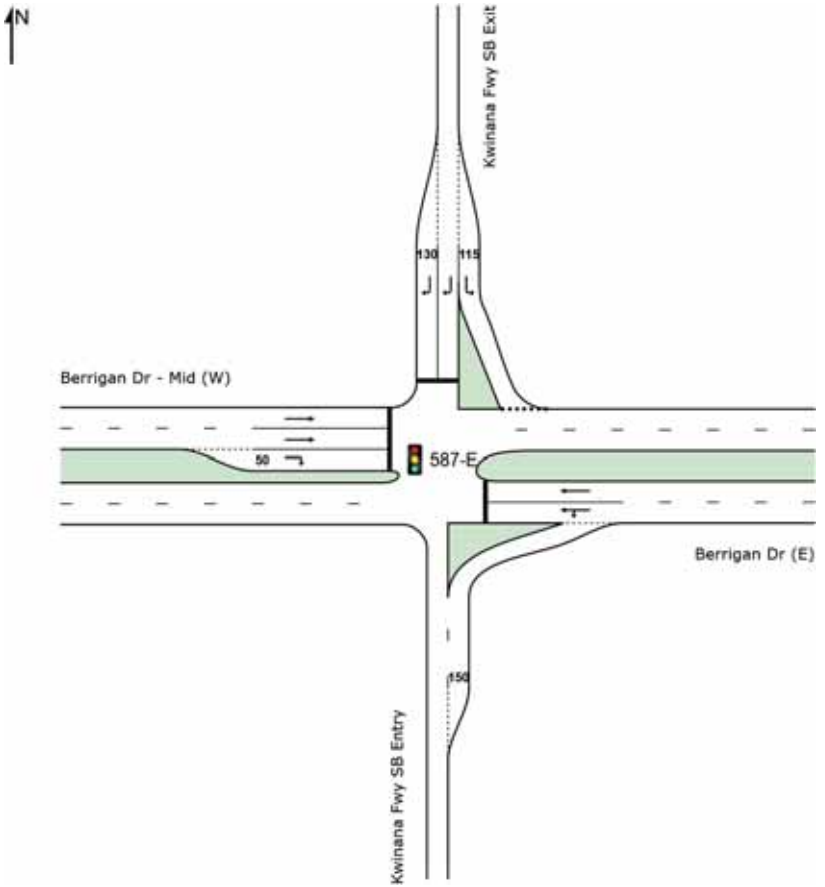
Glen Iris
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 138 seconds (Network User-Given Cycle Time)
Common Control Group: CCG1 [Fwy]

Timings based on settings in the Network Timing dialog
Phase Times determined by the program
Downstream lane blockage effects included in determining phase times
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, F
Output Phase Sequence: A, B, C, D, F

Some CCG output elements have been omitted as they have already been included under other Sites belonging to the same CCG.

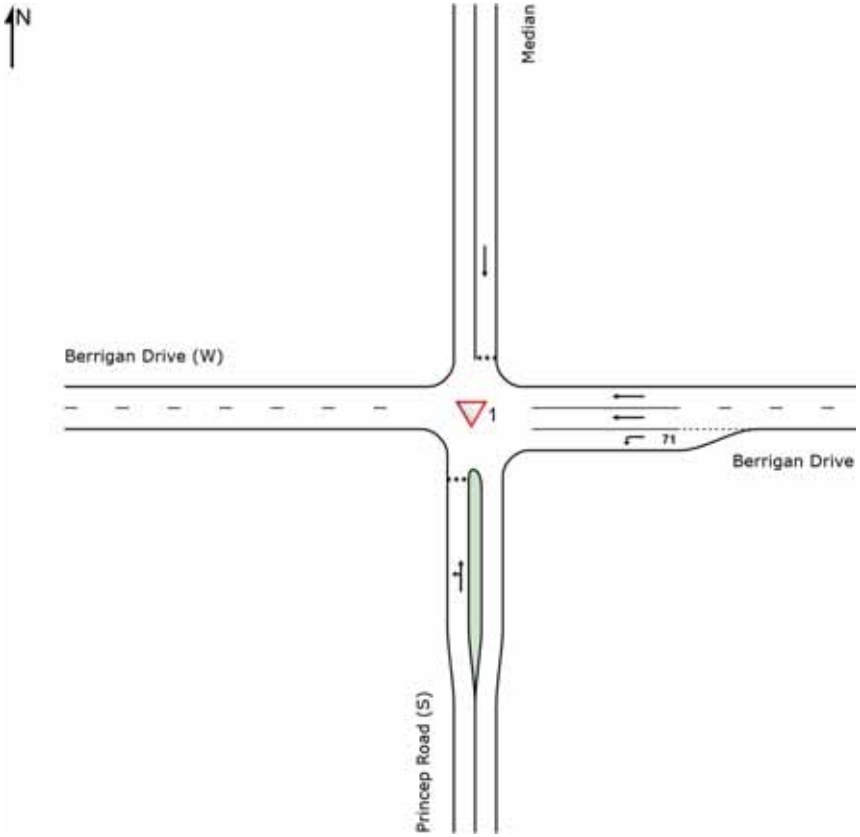
Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

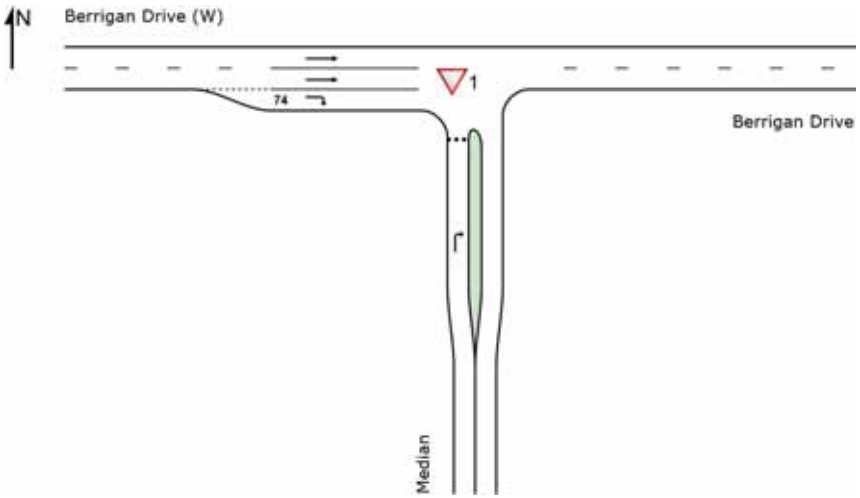
	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Princep Road (S)															
Lane 1	208	28.3	208	28.3	392	0.532	100	13.5	LOS B	0.9	8.5	Full	200	-46.7 [N7]	0.0
Approach	208	28.3	208	28.3		0.532		13.5	LOS B	0.9	8.5				
East: Berrigan Drive (E)															
Lane 1	82	8.9	64	9.9	1611	0.040	100	5.7	LOS A	0.0	0.0	Short	71	0.0	NA
Lane 2	532	4.2	411	4.6	919	0.447	100	0.1	LOS A	0.0	0.0	Full	135	-49.9 [N7]	0.0
Lane 3	1000	4.2	773	4.6	1728	0.447	100	0.1	LOS A	0.0	0.0	Full	135	-5.9 [N7]	0.0
Approach	1614	4.4	1248 [N 1]	4.9		0.447		0.4	NA	0.0	0.0				
North: Median															
Lane 1	221	9.0	219	9.0	306	0.714	100	29.5	LOS D	0.8 [N4]	7.0 [N4]	Full	7	0.0	49.9
Approach	221	9.0	219 [N1]	9.0		0.714		29.5	LOS D	0.8	7.0				
Intersection	2043	7.4	1675 [N 1]	9.0		0.714		5.8	NA	0.9	8.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N4 Average back of queue has been restricted to the available queue storage space.
N7 The capacity reduction has been determined from the queue blockage probability of a Site further downstream due to intermediate continuous lanes.

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Median															
Lane 1	25	33.3	25	33.3	171	0.148	100	23.0	LOS C	0.2	1.9	Full	7	0.0	0.0
Approach	25	33.3	25	33.3		0.148		23.0	LOS C	0.2	1.9				
West: Berrigan Drive (W)															
Lane 1	509	5.5	503	5.5	1802	0.279	100	0.0	LOS A	0.0	0.0	Full	190	0.0	0.0
Lane 2	509	5.5	503	5.5	1802	0.279	100	0.0	LOS A	0.0	0.0	Full	190	0.0	0.0
Lane 3	221	9.0	219	9.0	1600	0.137	100	5.9	LOS A	1.0 N5	8.6 N5	Short	74	0.0	NA
Approach	1239	6.1	1225 N 1	6.1		0.279		1.1	NA	1.0	8.6				
Intersection	1264	6.7	1250 N 1	6.7		0.279		1.5	NA	1.0	8.6				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N5 Continuous Lane results determined by Back of Queue values of downstream lanes (proportional to lane movement flows).

Site: LM01173 [Berrigan Drive_Jandakot Road_AM 2033 (Site Folder: Proposed - 2033)]

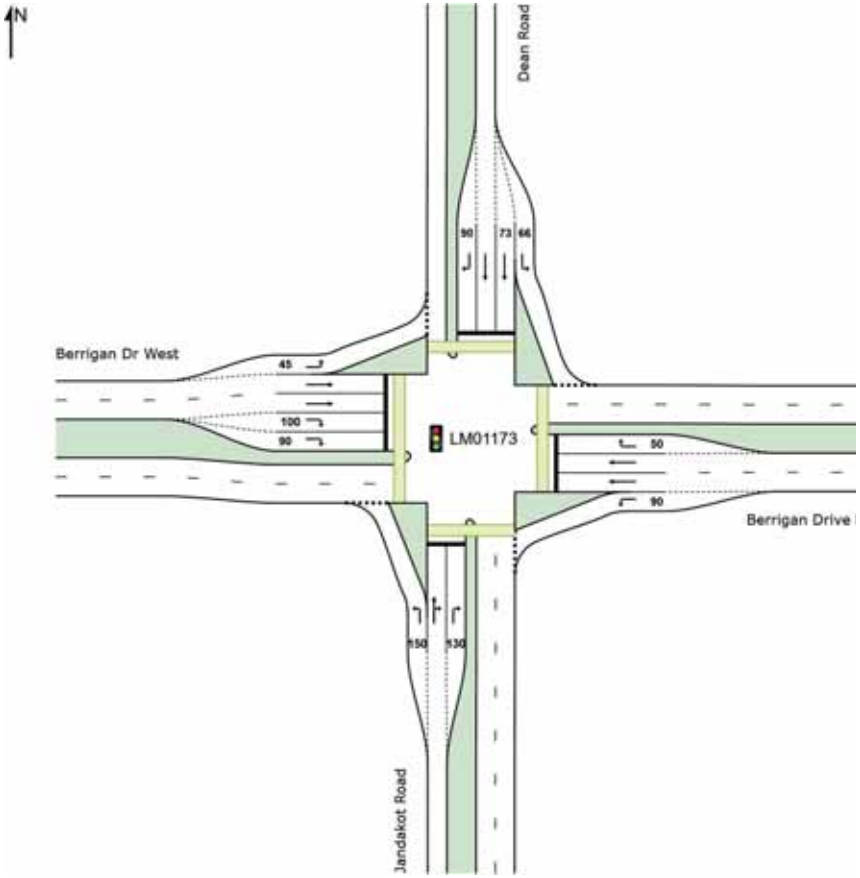
Network: 5 [Roundabout - 2033 AM (Network Folder: Proposed Option - 2033)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 109 seconds (Site User-Given Phase Times)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times specified by the user
Phase Sequence: Variable Phasing
Reference Phase: Phase E
Input Phase Sequence: A, B, C, D, E
Output Phase Sequence: A, B, C, D, E

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



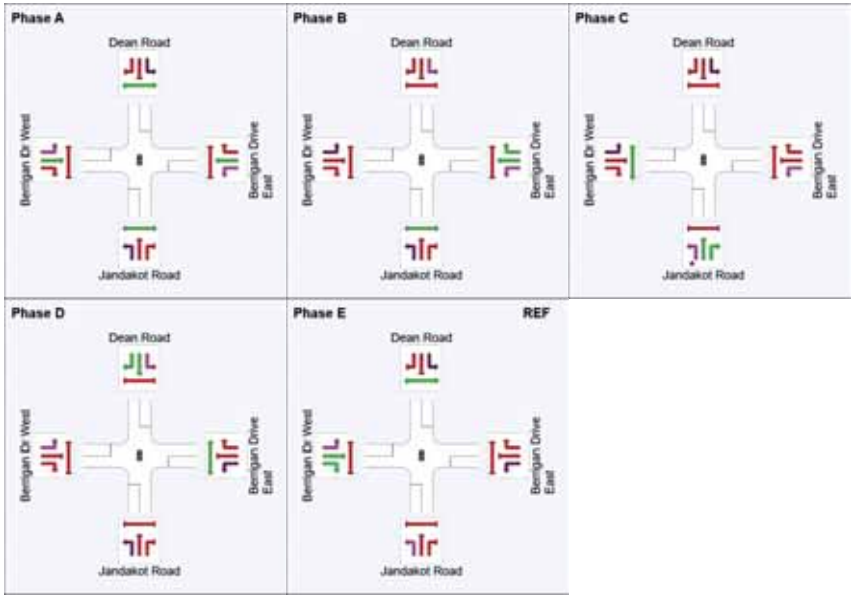
Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Jandakot Road															
Lane 1	1351	5.2	1351	5.2	1124[1]	1.201	100	229.1	LOS F	100.7	746.4	Short	150	0.0	NA
Lane 2	258	4.9	258	4.9	357	0.724	100	50.0	LOS D	8.3	61.0	Full	230	0.0	100.0[8]
Lane 3	252	5.2	252	5.2	349	0.724	100	52.5	LOS D	8.1	59.9	Short	130	0.0	NA
Approach	1861	5.2	1861	5.2		1.201		180.3	LOS F	100.7	746.4				
East: Berrigan Drive East															
Lane 1	161	23.3	161	23.3	1149	0.140	100	8.9	LOS A	1.2	10.9	Short	90	0.0	NA
Lane 2	90	23.3	90	23.3	518	0.174	100	30.1	LOS C	2.2	19.1	Full	125	0.0	0.0
Lane 3	90	23.3	90	23.3	518	0.174	100	30.1	LOS C	2.2	19.1	Full	125	0.0	0.0
Lane 4	14	4.5	14	4.5	50	0.273	100	67.9	LOS E	0.5	3.6	Short	50	0.0	NA
Approach	355	22.6	355	22.6		0.273		21.9	LOS C	2.2	19.1				
North: Dean Road															
Lane 1	102	5.2	102	5.2	775	0.132	100	10.2	LOS B	1.0	7.1	Short	66	0.0	NA
Lane 2	23	5.2	23	5.2	245	0.092	100	45.8	LOS D	0.7	4.9	Short	73	0.0	NA
Lane 3	23	5.2	23	5.2	245	0.092	100	45.8	LOS D	0.7	4.9	Full	110	0.0	0.0
Lane 4	147	0.0	147	0.0	241	0.611	100	55.8	LOS E	4.7	33.0	Short	90	0.0	NA
Approach	295	2.6	295	2.6		0.611		38.5	LOS D	4.7	33.0				
West: Berrigan Dr West															
Lane 1	27	4.5	27	4.5	1420	0.019	100	6.6	LOS A	0.1	0.8	Short	45	0.0	NA
Lane 2	276	4.6	273	4.6	860	0.317	100	20.5	LOS C	5.6	41.6	Full	135	0.0	0.0
Lane 3	276	4.6	273	4.6	860	0.317	100	20.5	LOS C	5.6	41.6	Full	135	0.0	0.0
Lane 4	257	4.6	255	4.6	317	0.804	100	57.6	LOS E	8.7	64.0	Short	100	0.0	NA
Lane 5	257	4.6	255	4.6	317	0.804	100	57.6	LOS E	8.7	64.0	Short	90	0.0	NA
Approach	1094	4.6	1082[N1]	4.6		0.804		37.6	LOS D	8.7	64.0				
Intersection	3604	6.5	3593[N1]	6.5		1.201		110.1	LOS F	100.7	746.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
8 Probability of Blockage has been set on the basis of a queue that overflows from a short lane.
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

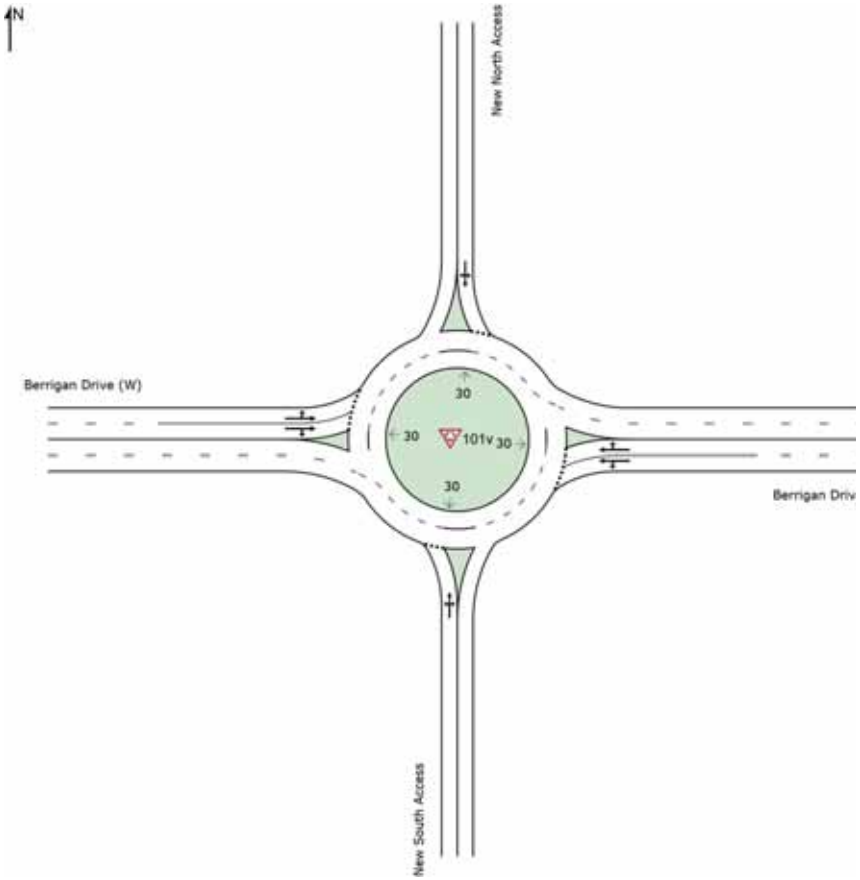
Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: New South Access															
Lane 1[d]	66	2.1	66	2.1	280	0.237	100	11.5	LOS B	2.0[N5]	14.1[N5]	Full	500	-30.8[N3]	0.0
Approach	66	2.1	66	2.1		0.237		11.5	LOS B	2.0	14.1				
East: Berrigan Drive (E)															
Lane 1[d]	970	6.1	765	7.1	675	1.133	100	134.5	LOS F	25.1[N6]	189.9[N6]	Full	190	-47.6[N3]	49.9
Lane 2	836	7.2	659	8.3	582	1.133	100	137.0	LOS F	7.7[N5]	59.3[N5]	Full	190	-48.4[N3]	0.0
Approach	1806	6.6	1424[N] 1	7.7		1.133		135.7	LOS F	25.1	189.9				
North: New North Access															
Lane 1[d]	318	2.4	318	2.4	400	0.796	100	21.1	LOS C	2.4[N5]	17.2[N5]	Full	500	-34.8[N3]	0.0
Approach	318	2.4	318	2.4		0.796		21.1	LOS C	2.4	17.2				
West: Berrigan Drive (W)															
Lane 1[d]	656	3.8	648	3.8	1507	0.430	100	4.0	LOS A	1.4	9.9	Full	300	0.0	0.0
Lane 2	583	3.7	575	3.7	1338	0.430	100	4.3	LOS A	1.3	9.8	Full	300	0.0	0.0
Approach	1239	3.7	1223[N] 1	3.7		0.430		4.1	LOS A	1.4	9.9				
Intersection	3429	5.1	3031[N] 1	5.8		1.133		67.9	LOS E	25.1	189.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.
N5 Continuous Lane results determined by Back of Queue values of downstream lanes (proportional to lane movement flows).
N6 Continuous Lane results determined by Back of Queue values of downstream lanes (proportional to lane movement flows) but average back of queue has been restricted to the available queue storage space.

Appendix C WAPC Guidelines Checklist

Item	Provided	Comments/Proposals
Summary	✓	
Introduction/Background	✓	
Structure plan proposal	✓	
regional context	✓	
proposed land uses	✓	
table of land uses and quantities	✓	
major attractors/generators	✓	
specific issues	✓	
Existing situation		
existing land uses within structure plan	✓	
existing land uses within 800 metres of structure plan area	✓	
existing road network within structure plan area	✓	
existing pedestrian/cycle networks within structure plan area	✓	
existing public transport services within structure plan area	✓	
existing road network within 2 (or 5) km of structure plan area	✓	
traffic flows on roads within structure plan area (PM and/or AM peak hours)	✓	
traffic flows on roads within 2 (or 5) km of structure plan area (AM and/ or PM peak hours)	✓	
existing pedestrian/cycle networks within 800m of structure plan area	✓	
existing public transport services within 800m of structure plan area	✓	
Proposed internal transport networks		
changes/additions to existing road network or proposed new road network	✓	
road reservation widths	✓	
road cross-sections & speed limits	✓	
intersection controls	✓	
pedestrian/cycle networks and crossing facilities	✓	
public transport routes	✓	
Changes to external transport networks		
road network	✓	
intersection controls	✓	
pedestrian/cycle networks and crossing facilities	✓	
public transport services	✓	

Integration with surrounding area		
trip attractors/generators within 800 metres	✓	
proposed changes to land uses within 800 metres	✓	
travel desire lines from structure plan to these attractors/generators	✓	
adequacy of external transport networks	✓	
deficiencies in external transport networks	✓	
remedial measures to address deficiencies	✓	
Analysis of internal transport networks		
assessment year(s) and time period(s)	✓	
structure plan generated traffic	✓	
extraneous (through) traffic	✓	
design traffic flows (that is, total traffic)	✓	
road cross-sections	✓	
intersection controls	✓	
access strategy	✓	
pedestrian/cycle networks	✓	
safe routes to schools	✓	
pedestrian permeability & efficiency	✓	
access to public transport	✓	
Analysis of external transport networks		
extent of analysis	✓	
base flows for assessment year(s)	✓	
total traffic flows	✓	
road cross-sections	✓	
intersection layouts & controls	✓	
pedestrian/cycle networks	✓	
Conclusions		

Proponent's Name: Sam Gill

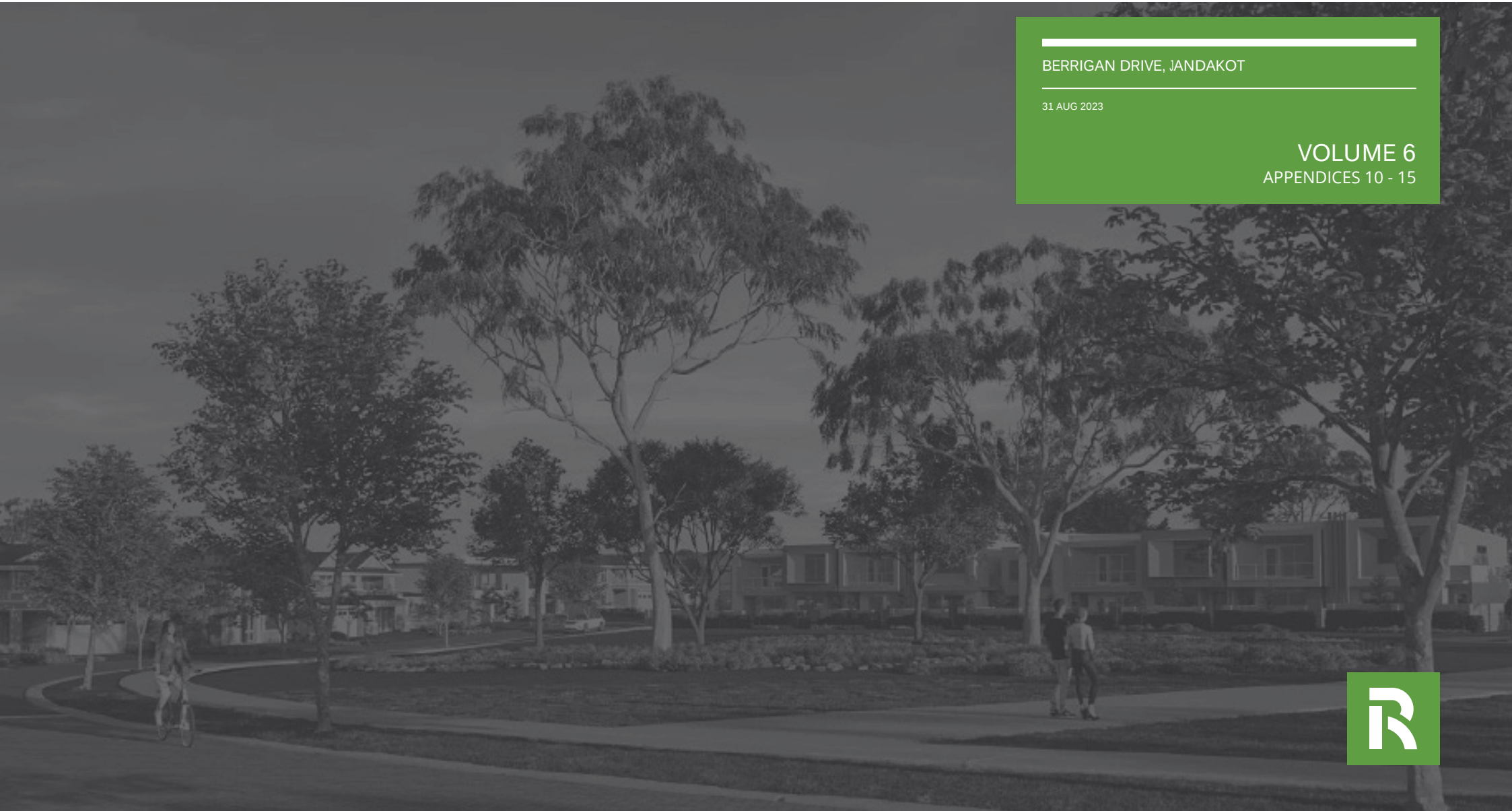
Company: Eastcourt Property Group Date: 07/08/2023

Transport Assessor's Name: Rodney Ding Date: 07/08/2023

Company: PJA

GLEN IRIS ESTATE

STRUCTURE PLAN



BERRIGAN DRIVE, JANDAKOT

31 AUG 2023

VOLUME 6
APPENDICES 10 - 15

GLEN IRIS ESTATE

APPENDIX 10
LOCAL WATER MANAGEMENT STRATEGY

Glen Iris, Jandakot

Local Water Management Strategy

August 2023

Client: ECP Acquisitions 6 Pty Ltd

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Disclaimer

This document is published in accordance with and subject to an agreement between Hyd2o and the Client for whom it has been prepared, and is restricted to those issues that have been raised by the Client in its engagement of Hyd2o. It has been prepared using the skill and care ordinarily exercised by hydrologists in the preparation of such documents.

Hyd2o recognise site conditions change and contain varying degrees of non-uniformity that cannot be fully defined by field investigation. Measurements and values obtained from sampling and testing in this document are indicative within a limited timeframe, and unless otherwise specified, should not be accepted as conditions on site beyond that timeframe.

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Executive Summary

Hyd2o was commissioned by ECP Acquisitions 6 Pty Ltd to prepare this Local Water Management Strategy (LWMS) to support the proposed local structure plan (LSP) for land within former Glen Iris golf course (herein referred to as the site).

The LSP area is approximately 54 ha in size and located approximately 20 km south of the Perth central business district within the City of Cockburn. The proposed urban development consists of residential lots, roads, public open space, and commercial area.

This LWMS addresses stormwater management of the site including areas outside of the LSP area which currently discharge stormwater within the site. This document provides a comprehensive overall assessment of the existing water management system of the area and how it will be modified and integrated with the new development to improve water sensitive urban design outcomes as a result of the proposed land use change.

Understanding key hydrological considerations has informed the development of the LWMS for the site. The site has been a golf course since 1995, and is generally characterised as having high permeability soils, good clearance to groundwater, and low Acid Sulphate Soil (ASS) risk across the site. It contains a number of existing stormwater storages which accept flow from external council stormwater systems whose function will need to be maintained post development.

This document has been prepared in accordance with the principles and objectives of Better Urban Water Management (Western Australian Planning Commission, 2008). Key agencies ultimately involved with its implementation including the City of Cockburn, (CoC) and Department of Water and Environmental Regulation (DWER), have been consulted during this process.

Implementation of the strategy will be undertaken in accordance with Better Urban Water Management through the development and implementation of Urban Water Management Plans for individual stages of development within the site.

The Better Urban Water Management LWMS checklist is included as Appendix A.

Local Water Management Strategy Summary

Water Use Sustainability	
Water Efficiency	• Promotion of 6 star building standards (water efficient fixtures and fittings). • Mandatory use of water-wise plantings in POS and landscape rehabilitation areas. • Landscaping and LSP design to retain significant trees • Re-use of groundwater / infiltrated stormwater for POS irrigation. • Water efficient measures to be adopted during the construction phase.
Water Supply	• Lots: Water Corporation IWSS and rainwater tanks (encouraged). • POS: Groundwater via existing DWER licence. • Construction: Groundwater via existing DWER licence.
Wastewater	• Water Corporation reticulated sewerage.
Stormwater	
Design & Management Principles	• Water quality to be managed through biofiltration treatment of runoff generated by first 15mm of rainfall prior to infiltration. • Stormwater management for larger events to be via infiltration in distributed road reserves and POS areas within the site, for both new developed areas and existing areas outside the site which currently flow into the site. • Development levels to have suitable clearance above groundwater and 1% AEP flood levels.
Lot Scale Measures	• Soakwells sized to retain and infiltrate first 15 mm rainfall on site within lots. • Rainwater tanks (optional). • Water-wise landscaping to retain stormwater and minimise runoff
Street Scale Measures	• Biofiltration areas in specified locations, with additional areas identified at UWMP scale as necessary if required • Piped drainage minimised, with maximised use of opportunities for localised swales and/or underground storage within wider road reserves. • GPT's / trash racks where appropriate.
Estate Scale Measures	• Water quality treatment areas in POS for treatment of runoff from first 15mm rainfall via biolfitration. • Flood management storage areas within POS areas to infiltrate flows in accordance with agency requirements. • Post development groundwater, surface water, and system performance monitoring and annual reporting.
Groundwater	
Fill & Subsoil	• Use of cut/ fill across the site to to minimise import fill and establish levels to meet design criteria of clearance above groundwater and the 1% AEP level in POS infiltration areas. • Subsoil drainage unlikely to be required.
Acid Sulphate Soils	• Site has moderate to low risk of ASS. Acid sulphate soils will however be investigated as a separate process if required.
Implementation	
Process	• Predevelopment groundwater and stormwater monitoring program in progress to be completed end of winter 2021. Final results to develop water quality targets. • Future stages of planning consistent with BUWM including preparation of UWMP's. • Staging of stormwater to be detailed in the relevant UWMP's and implemented to ensure key hydrological performance criteria are maintained during transition.

1. Introduction

Hyd2o was commissioned by ECP Acquisitions 6 Pty Ltd to prepare this Local Water Management Strategy (LWMS) to support the proposed local structure plan (LSP) for land within former Glen Iris golf course (herein referred to as the site).

The LSP area is approximately 54 ha in size and located approximately 20 km south of the Perth central business district within the City of Cockburn (Figure 1). The proposed urban development consists of residential lots, roads, public open space, and commercial areas.

This LWMS addresses stormwater management of the site including areas outside of the LSP area which currently discharge stormwater within the site. This document provides a comprehensive overall assessment of the existing water management system of the area and how it will be modified and integrated with the new development to improve water sensitive urban design outcomes as a result of the proposed land use change.

This LWMS provides a total water cycle management approach to development and has been prepared in accordance with the principles and objectives of Better Urban Water Management (Western Australian Planning Commission, 2008). It provides the outcomes of detailed site specific analysis relating to groundwater and stormwater and provides a clear vision in terms of adopting best management practices to achieve water sensitive design.

A copy of the Better Urban Water Management (WAPC, 2008) LWMS Checklist for Developers is included as Appendix A to assist the Department of Water and Environmental Regulation (DWER) in review of this document.

Key stakeholders involved with its implementation of this strategy including the City of Cockburn and Department of Water and Environmental Regulation (DWER), have been consulted during this process. Given the size of the site and its likely development timeframe, ongoing consultation with these stakeholders will continue as planning progresses for the site.

1.1 Planning Background

Better Urban Water Management (Western Australian Planning Commission (WAPC), 2008) provides guidance on the implementation of State Planning Policy 2.9 Water Resources (Government of WA, 2003).

The site is currently zoned Urban under the Metropolitan Region Scheme (2021). This LWMS supports the preparation of a local structure plan for the site for residential development. The urban water management planning process for the site is shown in Table 1.

Table 1: Integrated Planning and Urban Water Management Process

Planning Phase	Planning Document	Urban Water Management Documents
Local Structure Plan	Local Structure Plan	Glen Iris Local Water Management Strategy THIS DOCUMENT
Subdivision	Subdivision Application	Urban Water Management Plan FUTURE PREPARATION

1.2 Key Documents and Previous Studies

The requirements for water protection and urban water management for the site are established in a range of publications including State Planning Policy 2.3 Jandakot Groundwater Protection (WAPC, 2017) and State Planning Policy 2.9 Water Resources (WAPC, 2006). Given the site's location within the Jandakot Ground Water Protection Area, these documents are used to guide the establishment of minimum development requirements and best practice water management.

This LWMS also uses the following additional documents to define its key principles, criteria, objectives, and implementation responsibilities:

- Decision Process for Stormwater Management in WA (DWER, 2017)
- Better Urban Water Management (WAPC, 2008)
- Stormwater Management Manual for WA (Department of Water, 2007)
- Land Use Compatibility Tables for Public Drinking Water Source Areas (Department of Water (2016)

2. Proposed Development

The local structure plan for the site is shown in Figure 2, providing a unique opportunity for urban infill in close proximity to the Perth Central Business District.

The LSP area covers approximately 54 ha, with the proposed development consisting of residential lots, roads, linear connected public open space, grouped housing, and a commercial area adjoining Berrigan Drive.

The development will provide a vibrant and diverse residential community with a variety of housing choice and local amenities. The structure plan design aims to create better and safer transport routes for existing residents and introduce new landscaped areas for public recreation.

From a stormwater management perspective, the development will seek to provide significant improvements in management for existing and new systems, both from a water quality and public amenity viewpoint.

The development will also provide an opportunity to improve local environmental outcomes via a reduction in nutrient application and export and reduction in irrigation abstraction from the local superficial aquifer.

3. Existing Environment

3.1 Site Conditions

The site is located in the suburb of Jandakot in the City of Cockburn.

The site is the former Glen Iris Golf Course and is bound by existing urban development in most directions. The site straddles Berrigan Driver and has the Kwinana Freeway in close proximity to its western boundary (Figure 1).

Figure 3 shows an aerial photograph with existing land use and topography. In the area south of Berrigan Drive, with the exception of some excavated groundwater table lakes and sumps, site topography typically ranges between 27 mAHD and 31m AHD. In the area north of Berrigan Drive, topography typically ranges between 26 mAHD and 43 m AHD.

3.2 Geotechnical

According to the Perth Metropolitan Region 1:50 000 Environmental Geology Series Fremantle Pt Sheet 2033 I and 2o33 IV (Gozzard 1983), the site is characterised as Bassendean Sand (S8), described as very light grey at surface, yellow at depth, fine to medium grained, sub-rounded quartz, moderately well sorted, of eolian origin.

A geotechnical investigation for the site was undertaken by CMW Geosciences in November/December 2020.

The geotechnical report is included as Appendix B. This investigation included excavation of 55 test pits and 8 hand augered boreholes for infiltration testing. A Perth Sand Penetrometer (PSP) test was also undertaken at each test pit location. Test locations are shown on Figure 4 and Appendix B.

Based on the history of the site and surrounding land levels, some superficial depths of fill were anticipated. The ground conditions encountered and inferred from the investigation were considered to be generally consistent with the published geology for the area.

The typical soil profile as described by CMW Geosciences (2020) is as follows:

- TOPSOIL: SAND / CLAYEY SAND dark grey, brown, fine to medium grained, subangular to subrounded sand with trace fines (>12% in TP48); trace organics; trace roots and rootlets; trace branches; trace vegetation, overlying;
- FILL: SAND (UNCONTROLLED) loose to very dense, fine to medium grained, subangular to subrounded; grey/pale yellow and orange-brown; trace fine grained limestone gravel (TP04, TP20); trace fines; trace organics; trace roots and rootlets; trace branches. Uncontrolled fill in the form of old reticulation pipe and bricks were found in TP04, TP18, TP28 and TP34. The reticulation pipe uncovered in TP28 and TP34 contained potential asbestos between depth of 0.5 and 1.6 mbgl, overlying;
- SAND (SP) loose to very dense, fine to medium grained, subangular to subrounded; grey/orange/yellow and white; trace fines; trace roots and rootlets, overlying;
- COFFEE ROCK very dense, fine to medium grained, subangular to subrounded, dark brown/black; weakly cemented. (Only found in TP03 TP06, TP12 and TP52). The coffee rock was typically found in or around low energy zones (lakes) located across the site where groundwater may be present.

During the investigation, which was completed in early-summer conditions, groundwater was not encountered within any of the investigation locations.

The site was classified as Class A in accordance with AS2870-2011, and considered suitable for stormwater infiltration at both lot and estate scale.

3.2.1 Permeability Testing

CMW Geosciences (2020) undertook eight in situ permeability tests within the site. Test locations are shown in Figure 4. The tests were performed using the falling head method within a hand augered borehole at a depth of approximately 1.4 m below ground surface. Results of the testing as analysed by CMW Geosciences (2020) are provided in Table 2.

Hyd2o also conducted permeability testing at the site in November/December 2020 and April 2021 to provide estimates of the field saturated hydraulic conductivity of the soils and assess their suitability for stormwater infiltration. Sixteen permeability tests were undertaken based on a constant head test at and adjacent to existing stormwater storage locations receiving flow from external catchments into the site. Test locations are shown in Figure 4 and results from the permeability tests are presented in Appendix C.

An average field saturated hydraulic conductivity rate of 40 m/day was observed by the Hyd2o testing with values ranging from approximately 4 to 139 m/day. Testing by CMW Geosciences (2020) was within a similar range.

Based on these results CMW Geosciences (2020) recommended a hydraulic conductivity of 5 m/day be used for modelling. This is considered a conservatively low value over much of the site even when applying a 50% reduction factor to account for long term clogging.

3.2.2 Acid Sulphate Soils

Acid Sulphate Soil (ASS) is the common name given to naturally occurring soil and sediment containing iron sulfides. These naturally occurring iron sulfides are generally found in a layer of waterlogged soil or sediment and are benign in their natural state.

When disturbed and exposed to air, however, they oxidise and produce sulfuric acid, iron precipitates, and concentrations of dissolved heavy metals such as aluminium, iron and arsenic. Release of acid and metals as a result of the disturbance of ASS can cause significant harm to the environment and infrastructure.

WAPC's Bulletin 64 (WAPC, 2003) ASS risk mapping for the site indicates that the whole site is classified as having a moderate to low risk of ASS across the site less than 3 m from the surface.

3.2.3 Contaminated Sites

The site is not registered as a contaminated site on DWER's online Contaminated Sites Database.

CMW Geosciences (2020), indicated some asbestos may be present within the site following previous demolition of old infrastructure along the western site boundary near Hartwell Parade. During bulk earthworks any asbestos will need to be appropriately managed by a competent environmental consultant.

Table 2: Permeability Test Results

Test Site	Tested By	Test Depth Below Surface (m)	Permeability K_s m/day
GIGC1	Hyd2o	0.7	28.4
GIGC2	Hyd2o	0.7	3.7
GIGC3	Hyd2o	0.7	23.5
GIGC4	Hyd2o	0.7	53.9
GIGC5	Hyd2o	0.7	5.9
GIGC6	Hyd2o	0.7	51.1
GIGC7	Hyd2o	0.7	10.6
GIGC8	Hyd2o	0.7	121.3
GIGC9	Hyd2o	0.7	34.2
GIGC10	Hyd2o	0.7	9.7
GIGC11	Hyd2o	0.7	42.2
GIGC12	Hyd2o	0.7	40.9
GIGC13	Hyd2o	0.7	138.6
GIGC14	Hyd2o	0.7	24.0
GIGC15	Hyd2o	0.7	36.1
GIGC16	Hyd2o	0.7	15.2
Perm1	CMW Geoscieces	1.36	5.6-27.2
Perm2	CMW Geoscieces	1.42	25.8-105.0
Perm3	CMW Geoscieces	1.35	16.0-58.2
Perm4	CMW Geoscieces	1.38	8.7-36.8
Perm5	CMW Geoscieces	1.40	17.2-71.4
Perm6	CMW Geoscieces	1.40	14.5-43.6
Perm7	CMW Geoscieces	1.41	6.8-30.6
Perm8	CMW Geoscieces	1.41	16.1-71.9

CMW Geosciences Permeabilites based on two methods : CIRIA Method (higher value)and Horslev Method (lower value)

3.3 Wetlands

There are no conservation category wetlands, resource enhancement wetlands, multiple use wetlands, or natural waterways within the site (Figure 5).

There are a number of existing open water bodies previously within the site associated with the sites previous use as a golf course. Most of these water bodies are lined and ornamental while one in the south of the site is an excavation into the regional groundwater table. Some of the water bodies in the area north of Berrigan Drive also serve an existing drainage function.

3.4 Jandakot Drinking Water Supply Area

Part of the site is currently classified as a Priority 3 Groundwater Protection Area as shown on Figure 5, however this does not preclude residential development. The Department of Water (2016) Land Use Compatibility Tables for Public Drinking Water Source Areas Water Quality Protection Note No 25, detail urban residential as an acceptable land use within a Priority 3 area.

Three Water Corporation Jandakot Mound production bores are located adjacent to the eastern boundary of the site as shown in Figure 5.

Water Corporation bores have a 300 m radius wellhead protection zone (WPZ) in Public Drinking Water Source Area (PDWSA) Priority 2 and Priority 3 areas. All three bores have WPZs which extend within the site. A fourth Water Corporation bore which is located near the clubhouse is no longer used, however a WPZ also still exists for this disused bore.

Advice from DWER indicates urban development within WPZ areas is permitted consistent with underlying Priority 3 classification, although some restrictions/exclusions may apply such as locating a sewer pump station or petrol station in these areas.

3.5 Surface Water

3.5.1 Existing Stormwater Management

There is no overarching DWER regional or district stormwater strategy which covers the site. The site does not have a connection to any arterial drainage scheme and all stormwater that is generated on site is infiltrated.

The site currently provides stormwater storage and infiltration areas for adjacent externally developed areas. According to the City of Cockburn Intramaps system, there are currently 18 bubble up pit outlets from externally developed areas which drain into the site discharging into 15 separate drainage areas. These drainage areas range from wet basins to shallow informal depressions to fenced steep sided deep sumps.

Outlet locations and storages are shown in Figure 6, with plates contained as Appendix D. These locations provide a constraint to the future development layout of the site and post development the site will be required to continue to provide stormwater storage for the external catchment. Typically this would be provided in broadly similar locations, though some movement may be possible based on engineering design considerations.

Based on topographic mapping and drainage detail via the City of Cockburn Intramaps system, the contributing external catchment has been mapped at approximately 57 ha, broadly similar to the site area itself (54 ha).

External subcatchment areas contributing flow to each outlet in the site are shown in Figure 6. As the total external contributing catchment area of 57 ha is broadly similar to the site area, the area required for stormwater management within the site as a result of the external catchment is likely to be considerably more than would be otherwise required for the site itself.

Outlet locations and associated catchments have been used to inform the LSP for the site and its POS and stormwater infiltration area locations. This is further discussed in Section 6.

A details survey of all the outlet locations and existing storage volumes was conducted by MNG. Survey details are contained as Appendix E.

3.5.2 Surface Water Quality

Hyd2o commenced an 18 month pre development surface water quality monitoring program in June 2020. Sampling was undertaken at the outlets of the existing stormwater system into the site. Locations are shown in Appendix F.

Physical parameters (temperature, electrical conductivity, and pH) were measured in situ. Samples were sent to the NATA approved MPL Laboratory for total nitrogen, ammonia, nitrate, nitrite, total phosphorus, filterable reactive phosphorus, and heavy metals (arsenic, cadmium, chromium, copper, nickel, lead, mercury, and zinc).

Surface water quality results are summarised in Table 3 compared to ANZECC (2000) guideline trigger values. Full monitoring results are contained in Appendix F.

Key results are summarised as follows:

- Mean pH at all sites are within the ANZECC guideline range (6.5 – 8.0).
- Mean values for Electric Conductivity (EC) for each site ranged from 82 µS/cm to 252 µS/cm. All values fell within or below the ANZECC guideline range (120-300 µS/cm).
- Mean total nitrogen (TN) for all sites ranged from 0.13 to 0.70 mg/L, within the ANZECC 95% guideline limit (1.2 mg/L). The mean TN across all sites was 0.37 mg/L.
- Mean total phosphorus (TP) ranged from 0.05 to 0.26 mg/L with values ranging from below the ANZECC 95% guideline limit (0.065 mg/L) primarily in the northern areas of the site to exceeding the limit in the south. The mean TP across all sites was 0.09 mg/L.

With respect to metals, mean results were as follows relative to ANZECC guideline values:

- Arsenic, Cadmium, Mercury, Chromium, Lead, and Nickel were all within the 95% protection limit across all sites.
- Copper was within the 95% protection limit across all sites except SW5, SW15 and SW16, which fell within the 90% protection limit, and SW2, SW4 and SW13, which fell below the 80% protection limit, with only SW1 falling below the 80% protection limit.
- Zinc was highly variable across the sites, ranging from within the ANZECC 95% protection limit at SW3, SW5, SW6, SW7 and SW8, to below the 80% protection limit at SW10, SW12, SW13, SW14, SW15 and SW16.

Table 3: Existing Surface Water Quality

Surface Water Sample	Mean for Sampled Parameters							
	EC (µS/cm)	pH	TN (mg/L)	Ammonia (mg/L)	Nitrate (mg/L)	Nitrite (mg/L)	TP (mg/L)	FRP (mg/L)
ANZECC	120-300	6.5-8.0	1.2	0.32 – 2.3 (99% - 80% protection)	0.017 – 17 (99% - 80% protection)	-	0.065	0.04
SW1	209	6.85	0.26	0.01	0.04	0.01	0.05	0.02
SW2	96	7.51	0.20	0.01	0.01	0.01	0.05	0.01
SW3	82	6.90	0.30	0.02	0.02	0.01	0.05	0.03
SW4	142	6.79	0.32	0.03	0.02	0.01	0.08	0.04
SW5	140	7.11	0.25	0.01	0.02	0.01	0.09	0.01
SW6	92	7.12	0.13	0.01	0.02	0.01	0.05	0.01
SW7	89	6.67	0.20	0.03	0.05	0.01	0.08	0.01
SW8	108	6.59	0.30	0.02	0.03	0.01	0.06	0.01
SW9	123	6.73	0.58	0.01	0.01	0.01	0.09	0.02
SW10	133	6.67	0.33	0.01	0.03	0.01	0.12	0.01
SW11	252	6.91	0.70	0.04	0.03	0.01	0.26	0.01
SW12	107	6.84	0.34	0.02	0.06	0.01	0.05	0.01
SW13	147	6.56	0.50	0.02	0.01	0.01	0.10	0.01
SW14	124	6.61	0.46	0.04	0.02	0.01	0.12	0.05
SW15	150	6.51	0.44	0.07	0.02	0.01	0.14	0.04
SW16	141	6.72	0.45	0.04	0.04	0.01	0.06	0.02
All Sites	138	6.76	0.37	0.03	0.03	0.01	0.09	0.02

3.6 Groundwater

3.6.1 Groundwater Levels

The Department of Water and Environmental Regulation's (DWER) online Perth Groundwater Map, shows that groundwater levels across the site range from approximately 21 mAHD to 23 mAHD with groundwater flow to the west toward the freeway and away from Water Corporation public water supply bores (Figure 7).

These groundwater levels are contoured May 2003 readings, and represent a typical minimum groundwater level at the end of summer. The Perth Groundwater Map also provides estimated historical maximum groundwater level contours which range from 23 mAHD to 26 mAHD across the site.

In the area south of Berrigan Drive, with the exception of some excavated groundwater table lakes and sumps, site topography typically ranges between 27mAHD and 31mAHD with an existing natural surface clearance above the historical maximum contours ranging from approximately 1.5 to 6 m. In the area north of Berrigan Drive, topography typically ranges between 26 mAHD and 43 mAHD with the existing natural surface clearance above the historical maximum contours ranging from 1.5 to 19 m.

To refine groundwater mapping at the site Hyd2o installed 9 bores within the site in June 2020, which are currently being monitored monthly for water levels and quarterly for water quality. Lithological logs are including in Appendix G.

The estimated average annual maximum groundwater levels (AAMGL) for the site based on these bores and collected data are shown in Figure 7. Hyd2o have calculated the AAMGL by adjusting levels at site bores based on the recorded level in DWER bores JM12, JM2, JM45A and J310 on 23 September 2020 referenced to their long-term historical data (Table 4). Long-term hydrographs for DWER bores JM12, JM2, JM45A and J310 are provided in Appendix H. The data considered for the calculation is from the year 2000, considered representative of current climate conditions.

The AAMGL for each groundwater bore based on this analysis is shown in Table 5.

AAMGL's across the site range from 22 mAHD at the northern end to 23.6 mAHD at the southern end while MGL's across the site range from 22.7 mAHD at the northern end to 24.3 mAHD at the southern end. Depth to the AAMGL across the site typically ranges from a minimum of approximately 2 m in southern of the site to more than 18 m in the north.

It is important to note the LWMS uses the terminology AAMGL to represent a valid statistical property of groundwater in the area, and not as a concept as per previous DWER policies. This LWMS presents details of the groundwater's seasonal variation, AAMGL, and its MGL all as measures of its seasonal, annual, and interannual behaviour.

Only presenting an MGL value is not considered adequate to represent the groundwater characteristics and behaviour of the site.

Table 4: AAMGL for DWER Bores

Bore	Period of Record Used	Groundwater Level (mAHD) 23/09/2020	AAMGL 2000-2020 (mAHD)	Correction Factor (m)	MGL (mAHD)	Correction Factor (m)
JM12	2000 – 2020	21.87	21.88	0.01	22.39	0.52
JM2	2000 – 2020	22.40	22.46	0.06	23.43	1.03
JM45A	2000 – 2020	24.39	24.36	-0.03	25.24	0.85
J310	2000 – 2020	24.05	24.13	0.08	24.64	0.59
Correction Factors for Site Bores				+0.03		+0.75

Table 5: AAMGL for Site Bores

Bore	Natural Surface (mAHD)	Groundwater Level (mAHD) 23/09/2020	AAMGL (mAHD)	MaxGL (mAHD)	Depth to AAMGL Below Natural Surface (m)
MW1	30.93	23.15	23.18	23.90	7.75
MW2	27.22	22.74	22.77	23.49	4.45
MW3	28.73	22.11	22.14	22.86	7.59
MW4	25.67	22.42	22.45	23.17	3.22
MW5	26.84	23.22	23.25	23.97	3.59
MW6	28.56	23.13	23.16	23.88	5.40
MW7	27.70	23.16	23.19	23.91	4.51
MW8	26.12	23.66	23.69	24.41	2.43
MW9	27.83	23.21	23.24	23.96	4.59

3.6.2 Groundwater Quality

Groundwater quality was monitored quarterly at the 9 onsite groundwater bores by Hyd2o from June 2020 to December 2021. Bore locations in the site are shown in Figure 7 and Appendix F.

Physical parameters (temperature, electrical conductivity, and pH) were measured in situ. Samples were sent to the NATA approved MPL Laboratory for total nitrogen, ammonia, nitrate, nitrite, total phosphorus, filterable reactive phosphorus, and heavy metals (arsenic, cadmium, chromium, copper, nickel, lead, mercury, and zinc).

Groundwater water quality results are outlined in Table 6 compared to ANZECC (2000) guideline trigger values. Full results are contained in Appendix F.

Results are summarised as follows:

- Mean pH across the groundwater bores ranged between 4.41 and 6.26, all sites fell below the lower limit of the ANZECC guideline range (6.5 – 8.0).
- The mean EC across the groundwater bores ranged between 288 µS/cm and 844 µS/cm. All groundwater sites except MW8 exceeded the upper limit of the ANZECC guideline range (120-300 µS/cm). It is important to note that While EC values are above the ANZECC guideline range, the predevelopment EC levels recorded are a natural baseline condition of the aquifer in the area rather than a land use outcome.
- Mean TN values ranged from 0.78 mg/L to 4.72 mg/L, with the majority of bores exceeding the ANZECC guideline limit (1.2 mg/L). The bores within the limit included MW4 and MW8. The mean TN across all sites was 1.83 mg/L. TN groundwater concentrations were high than that of stormwater possibly due to fertiliser application on the golf course.
- Mean TP was within the ANZECC guideline limit of 0.065 mg/L across almost all sites. MW6 was the only exceedance with a mean value of 0.07 mg/L. The mean TP across all sites was 0.05 mg/L, lower than the TP level in stormwater.

With respect to metals, mean results were as follows relative to ANZECC guideline values:

- Arsenic, Cadmium, Nickel, Lead, and Mercury were within the 95% protection limit across all bores.
- Chromium was within the 95% protection limit across all bores except for MW6 and MW7 which fell within the 90% protection limit.
- Copper was within the 95% protection limit across all bores except for MW1, MW7, and MW9. MW7 fell within the 90% protection limit, while MW1 and MW9 fell below the 80% protection limit.
- Zinc was within the 95% protection limit across all bores except for MW1 which fell below the 80% protection limit.

Table 6: Existing Groundwater Quality

Groundwater Bore	Mean for Sampled Parameters							
	EC (µS/cm)	pH	TN (mg/L)	Ammonia (mg/L)	Nitrate (mg/L)	Nitrite (mg/L)	TP (mg/L)	FRP (mg/L)
ANZECC	120-300	6.5-8.0	1.2	0.32 – 2.3 (99% - 80% protection)	0.017 – 17 (99% - 80% protection)	-	0.065	0.04
MW1	680	6.26	1.55	0.04	1.10	0.01	0.05	0.01
MW2	844	6.00	2.10	0.02	1.80	0.01	0.05	0.01
MW3	549	5.68	2.15	0.01	1.88	0.01	0.05	0.01
MW4	649	5.85	0.78	0.20	0.02	0.01	0.05	0.01
MW5	760	4.41	1.33	0.40	0.13	0.01	0.05	0.01
MW6	556	4.75	4.72	0.21	3.26	0.08	0.07	0.01
MW7	601	5.52	1.65	0.07	0.48	0.01	0.05	0.01
MW8	288	5.74	0.97	0.14	0.02	0.01	0.05	0.01
MW9	504	5.12	1.22	0.62	0.01	0.01	0.05	0.01
All Sites	603	5.48	1.83	0.19	0.97	0.02	0.05	0.01

3.7 Nutrient Input Assessment

The Urban Nutrient Decision Outcomes (UNDO) model is a conceptual decision support tool developed by DWER that evaluates nutrient reduction decisions for urban developments on the Swan Coastal Plain in south-west Western Australia. It is designed for ease-of-use by urban development proponents and for assessment by local and state government authorities.

The tool was developed to assess the nutrient impacts of urban development on the Swan Coastal Plain in a consistent and scientifically rigorous manner, and improve scientific understanding relating to nutrient issues, and efficiencies in the investment to manage nutrients.

The tool is web-based, and provides users with the ability to implement a range of structural or non-structural design options to evaluate and reduce nutrients exported from an urban development.

Modelling of the historical land use of the site as a golf course is detailed in Appendix I.

The results indicate nutrient inputs of 8704 kg/yr for TN and 368 kg/yr TP to the environment based on typical nutrient application rate estimates. The resultant nutrient export was 715 kg/yr of TN and 2.5 kg/yr of TP. This export estimate considers soil types, groundwater gradient and depth to groundwater in its calculations.

Post development nutrient input and export rates are addressed in Section 6.2.

3.8 Constraints and Opportunities

Based on the sites existing environment, the following key constraints and opportunities are identified to guide the development of the water management strategy and proactive management practices detailed in later sections of this report:

- The site has good clearance to groundwater and highly permeable soils suitable for infiltration of stormwater. All stormwater that is currently generated on site is infiltrated.
- The site provides stormwater storage for 57 ha of external development. There are 18 outlets which currently drain into the site into 15 drainage areas. The site will be required to continue to provide storage for the external catchment post development.
- Opportunities exist to improve the existing stormwater management and water quality treatment outcomes for these areas.
- There are no conservation category wetlands, resource enhancement wetlands, multiple use wetlands, or natural waterways within the site.
- Part of the site is currently classified as a PDWSA Priority 3 area, however this does not preclude residential development. Four Water Corporation bores have wellhead protection zones (WPZ) which extend into the site, however urban development within the WPZs will be permitted consistent with their underlying Priority 3 classification.

4. Design Criteria & Objectives

Key design principles and criteria for the site are shown in Table 7 and have been established consistent with the key reference documents previously detailed in Section 1.2, and reflect the site constraints and opportunities identified in Section 3.

These principles and criteria are used to formulate the water management strategy for the site to remain within the identified constraints and opportunities of the existing environment.

Table 7: Design Principles & Criteria

Strategy Elements	Method & Approach
Water Use Sustainability	
Water Efficiency	• Water efficiency implementation to be consistent with Building Codes of Australia requirements • Aim for less than 100 kL/person/year water use • Establish "Waterwise" Public Open Space • Maximise at source infiltration of stormwater
Water Supply	• Minimise overall use of scheme water for non-drinking purposes • Water Corporation IWSS for lots plus use of rainwater tanks (non mandated) • Irrigation of POS via existing groundwater licence
Wastewater	• Water Corporation reticulated sewerage
Stormwater	
Ecological Protection	• Lot soakwells (15mm event infiltration on site) • Establishment of distributed biofiltration areas within road reserves and POS areas for treatment of first 15mm road runoff.
Serviceability	• Minimise use of piped drainage systems • Piped drainage system (where required) sized to convey 20% AEP event
Flood Protection	• Overland flow paths within road reserves for safe conveyance of flows exceeding pipe drainage system capacity • Provide storage infiltration areas within POS for management of flows from both within and external to the site for events of to 1% AEP event • Establish minimum habitable floor levels at 0.5m above the 1% AEP flood level of infiltration areas
Groundwater	
Fill Requirement & Subsoil Drainage	• Development levels to establish an acceptable clearance to groundwater using cut to fill across the site and minimising imported fill (if required).
Acid Sulphate Soils & Contamination	• Management of Acid Sulphate Soils and any contamination to be handled as a separate process if required consistent with DoE (2004) requirements.

5. Water Use Sustainability

5.1 Water Efficiency Measures

The development of the site will lead to an overall increased demand for potable water and for irrigation of gardens and POS areas. Water conservation measures will be implemented to reduce scheme water consumption within the development will be consistent with Water Corporation's "Waterwise" land development criteria including:

- Promotion of use of waterwise practices including water efficient fixtures and fittings (taps, showerheads, toilets, rainwater tanks, waterwise landscaping).
- All houses to be built to 6 star building standards (water efficient fixtures and fittings).
- Mandatory use of water wise plantings in POS areas.
- Maximising on site retention and infiltration of stormwater.
- Use of high density residential zoning to reduce garden (ex-house) use of water and minimise fertiliser nutrient inputs.

5.2 Water Supply

The Water Corporation's Integrated Water Supply System (IWSS) will supply potable water to future homes on the site.

Rainwater tanks will not be implemented/mandated at estate scale to supplement the domestic water supply scheme however will be encouraged together with house design to allow for retrofitted tanks. Residents who wish to supplement scheme water supply with rainwater tanks will be provided for by individual builders during the building application process.

The site is located within the Jandakot Groundwater Area Airport Subarea in which the superficial aquifer is fully allocated.

The site has an existing licence for 325,000 kL/yr via the superficial aquifer, with the licence valid to 2023, which was transferred on purchase of the property. A copy of the irrigation licence is include as Appendix J. This volume represents an irrigation allocation of approximately 6000 kL/yr/ha across the total site area, which is more than adequate for the irrigation of future public open space.

Landscape masterplanning for the site prepared by Emerge is contained as Appendix K.

Preparation and agency approval of final landscape plans will be undertaken at UMWP stage based on final stormwater design requirements. The UWMP will also include detailed irrigation usage tables demonstrating water use and distribution at local scale.

Note the stormwater areas shown in Appendix K should be considered indicative only, with the final form of these areas undertaken at UWMP stage based on refined stormwater modelling and landscape design.

5.3 Wastewater Management

Wastewater will be reticulated sewerage with management by the Water Corporation.

6. Stormwater Management Strategy

This LWMS proposes a pro-active treatment train approach to achieve exemplary water quality management for the site through the adoption of both non- structural and structural control measures.

Stormwater management at the site has been designed in accordance with Better Urban Water Management (WAPC, 2008), City of Cockburn principles for water quality and quantity management, DWER requirements, and Stormwater Management Manual for Western Australia (DoW, 2007).

The system will consist of a series of lot soakwells, road drainage pits, piped drainage, overland flows paths, swales, and distributed bioretention and flood storages areas within POS and road reserves for water quality treatment and major event management.

A key element of the system will be the minimisation of pipe networks and the use of many small scale local catchments to treat and infiltrate stormwater runoff at source.

In some areas, underground storages may be required due to the constraints provided via the level of existing pipe inverts entering the site from external catchments, and the desire to achieve useable POS outcomes and tree retention.

Where appropriate additional local scale management measures such as tree pits, pervious paving, and rain gardens will be considered during more detailed local planning and engineering design and appropriately documented in UWMP's.

6.1 Stormwater Event Modelling

Stormwater modelling of proposed stormwater management areas was undertaken by Hyd2o using the PONDS shallow water table infiltration model. PONDS is a program specifically designed for modelling groundwater/surface water interactions for the design of stormwater infiltration areas based on the finite difference computer program MODFLOW developed by the US Geological Survey.

The design storms modelled by PONDS were calculated with reference to the methodology in Australian Rainfall and Runoff (ARR) and the Bureau of Meteorology Computerised Design IFD Rainfall System (CDIRS). The rainfall temporal pattern was assumed to be spatially uniform across the catchment. Storm durations modelled ranged from 1 hour to 72 hours.

To support an at-source approach to stormwater management, the site was delineated into many small catchments based on existing external catchments and flow paths, proposed earthworks, and the location of the proposed POS areas. All individual catchments are shown in Figure 8.

Various runoff coefficients applied to different land uses for each of the AEP's modelled were determined using Hyd2o's CUURV runoff rate calculator as detailed in Appendix L. These rates were then used to determine the equivalent impervious areas (EIA's) for each individual catchment. These EIA's are also detailed in Appendix L.

Note that for LWMS modelling purposes group housing sites have been assumed to contribute runoff to the catchment stormwater storages in which they are located, with the exception of two early stage catchments where on site storage is proposed.

Opportunities for onsite stormwater retention of these areas will be examined at later stages of planning, particularly where this may lead to better POS outcomes and enhanced tree retention. Similarly for larger lots, opportunities for increased lot retention of runoff will be explored to achieve increased at source infiltration and reduce downstream storage requirements.

Key modelling parameters for individual catchments are provided in Appendix M and the basis for the values used summarised as follows:

- A groundwater level equivalent to the AAMGL at the location of the proposed storage was adopted a baseline condition for the start of modelling. This is considered a conservative assumption as groundwater levels will be lower than the AAMGL at most times of the year.
- A maximum inundation depth of 0.3 m for biofiltration areas and management of the 15mm event.
- Batter side slopes of 1 in 6 for both biofiltration and major event flood storage area in POS and road reserves. Vertical side slopes were adopted for underground storages.
- A maximum storage depth of 1.2 m adopted for above ground storages in POS and a maximum depth of 0.8m for swales located adjacent to road reserves.
- Variable hydraulic conductivity adopted at individual storages based on local field permeability testing with allowance for long term clogging and considering acceptable City of Cockburn upper limits for design use. Note that for biofiltration areas a rate of 5 m/d for filter media was adopted, with a 50% clogging allowance.

Individual storage details and inverts are shown in Appendix M relative to the AAMGL and MGL at each storage location. These inverts should be considered indicative only, subject to detailed future earthworks design.

It is important to note that at a few locations with lesser clearances to groundwater, this occurs due to the storage invert levels being dictated by the existing stormwater infrastructure levels from external catchments to current storages. Opportunities to raising these existing outlet levels will be further examined in consultation with the City of Cockburn in due course however this will need to ensure the stormwater function of existing piped systems outside of the site are not compromised.

The proposed stormwater management system post development is shown in Figures 9a, 9b, and 9c showing key storage locations, volumes, and areas based on modelling outcomes using PONDS for various AEP events. A full set of modelling results including details of all parameters and results for each individual catchment is provided in Appendix M, with an overlay of the stormwater management areas in relation to the landscape masterplan contained in Appendix N. Modelling results in Appendix M include levels, areas and volumes for all storage for small (15mm), minor (20% AEP) and major (1% AEP events).

Table 9 provides a summary of the overall areas for stormwater management for the site to inform planning considerations:

- With respect to the 15mm (1 EY) event the total volume required within the site to manage this event is estimated as 1,444 m^3, with an area of 6,934 m^2 (based on ~0.3 m deep storage and 1:6 side slopes). Note that this area calculation excludes likely the likely area associated with underground storage for this event as this will not affect POS usability. The area equates to approximately 1.4 % of the total site area, which is larger than would normally be expected due to runoff from external catchments into the site.
- With respect to the 20% AEP event the total volume required within the site to manage this event is estimated as 6,076 m^3, with an area of 13,672 m^2 (inclusive of the 15mm / 1 EY event storage. This area excludes any potential underground storage. The area equates to approximately 2.5 % of the total site area.
- With respect to the 1% AEP event the total volume required within the site to manage this event is estimated as 12,897 m^3, with an area of 18,849 m^2 (inclusive of the 15mm / 1 EY event storage. This area equates to approximately 3.5 % of the total site area.

Note that the extent of inundation of POS areas shown in Figure 9 for various flood management events are shown to scale. The storage shapes and locations however should be considered indicative only for determination of area space requirements and the representation of storage areas required in relation to POS areas allocated in the local structure plan.

With respect to the existing stormwater storage areas, it should be noted that the sizing of the future stormwater management areas was not done by simply accepting and replicating the volume of the existing areas but was based on updated catchment mapping, local infiltration testing, and detailed modelling of each subcatchment. This is important as Hyd2o understand the City have previously experienced some flooding issues with some the existing storage areas.

Storage volumes shown in the LWMS therefore represent updated volumes for each catchment based on achieving current design guidelines and best practice outcomes. Continued liaison with the City of Cockburn over the development timeframe will ensure additional anecdotal information regarding performance is included and informs future detailed design.

The final flood attenuation area configuration (side slopes etc), locations, and elevations will be documented in future UWMPs and will be dependent on the refined final earthworks, drainage, and road design levels for the development.

Minor refinements to catchment areas shown in this report are considered likely to occur as detailed design proceeds, and stormwater modelling will be updated accordingly during the UWMP process.

The disaggregation of the site into 38 small scale local stormwater areas represents best practice in at-source control of stormwater, particular given the size of the site. Notwithstanding it is recognised that further opportunities with the site for at source controls still exist and can be further explored as detailed planning progresses. Potential locations for further disaggregation of stormwater are identified on Figures 9 a, b, and c, and will be examined at Urban Water Management Planning (UWMP) stage. Such measures will include further implementing swales, treepits, and local raingardens where possible. A key consideration of the implementation of these measures will be the retention of trees and existing vegetation which are a key objective of the development.

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Table 8: Post Development Stormwater Management Summary

	Site	External
Residential Lots R20 (ha)	23.1	40.4
Residential Lots R30 (ha)	0.9	-
Group Housing (ha)	5.3	-
Commercial (ha)	0.7	-
POS/Conservation/Landscape Interface (ha)	11.1	1.0
Road Reserve (ha)	11.3	15.2
Total Area (ha)	52.4	56.6
Equiv Imp Area (15mm event) (ha)	7.8	10.5
Equiv Imp Area (20% AEP/1% AEP) (ha)	16.3	20.3
Storages (refer Appendix M for specific details and results for each individual storage)		
Total Number of Catchments	33	17
Total Combined Catchments/Storages	38	
Underground Storages (no.)	6	
POS Storages (no.)	17	
Swales (no.)	15	
Water Quality: 15mm Bioretention		
Total Volume (m^3)	1,444	
Top Water Level Area (m^2)	6,934	
Flood Storage: 20% AEP		
Total Volume (m^3) – inc Biofilters & Underground	6,076	
Top Water Level Area (m^2) - inc Biofilters & Underground	13,672	
Top Water Level Area (m^2) - inc Biofilters, excl Underground	11,983	
Flood Storage: 1% AEP		
Total Volume (m^3) – inc Biofilters & Underground	12,897	
Top Water Level Area (m^2) - inc Biofilters & Underground	18,849	
Top Water Level Area (m^2) - inc Biofilters, excl Underground	17,160	

6.2 Ecological Protection

Water quality management for the site will include non- structural as well as structural control measures:

- Non-Structural Controls
  Planning: POS and linear green space network, lot product, and subdivision layout.
  Maintenance: regular stormwater system maintenance including POS biofilter areas.
  Monitoring: Post development program and performance review.
- Structural Controls
  Catchment Scale Infrastructure: Bioretention areas, swales and storages (above and below ground) in POS areas and road reserves
  Local Scale Infrastructure: Soakwells
  Landscape: Maintaining existing mature trees, native plantings.

Measures adopted represent known best management practice as detailed in the Stormwater Management Manual for Western Australia (DoW, 2007). Table 9 details a summary from the Stormwater Management Manual for Western Australia (DoW, 2007) of expected pollutant removal efficiencies for various WSUD measures in relation to water quality design criteria. While DoW (2007) does not provide expected pollutant removal efficiencies for all BMP's, application of a treatment train approach using a combination of the non-structural and structural measures will achieve the design objectives for water quality treatment as detailed in Better Urban Water Management (WAPC, 2008).

Storm volumes for ecological protection based on water quality treatment of the 15mm event are provided in Table 8 and Figure 9. Appendix N provides typical storage cross sections showing biofilters in relation flood storage within POS, linear POS, and road reserve arrangements. Biofilters will be designed at UWMP stage consistent with the Adoption Guidelines for Stormwater Biofiltration Systems (CRC for Water Sensitive Cities, 2015).

Post development UNDO modelling of the site is detailed in Appendix I. The results indicate nutrient inputs of 3617 kg/yr for TN and 754 kg/yr TP post development. This indicates a 5088 kg/yr reduction in TN and 386 kg/yr increase in TP. The resultant nutrient export was 261 kg/hr/yr of TN and 6.2 kg/yr export of TP following development. This represents a 454 kg/yr reduction in TN and 3.7 kg/yr TP increase compared to existing. Note that these results exclude the additional benefit the new stormwater storages also provide in treating stormwater from the external catchment.

Table 9: BMP Water Quality Performance In Relation to Design Criteria

Parameter	Design Criteria via (WAPC, 2008) (required removal as compared to a development with no WSUD)	Structural Controls Nutrient Output Reduction (DoW,2007) [1]	
		Vegetated Swales/ Bioretention Systems	Infiltration Storages
Total Suspended Solids	80%	60-80%	65-99%
Total Phosphorus	60%	30-50%	40-80%
Total Nitrogen	45%	25-40%	50-70%
Gross Pollutants	70%	-	>90%

7. Groundwater Management Strategy

7.1 Earthworks, Fill and Subsoil Drainage

Development levels within the site are generally not dominated by fill requirements to achieve adequate separation to regional groundwater, given the proximity of groundwater levels to natural surface over much of the site.

It is envisaged that the site will broadly be a cut to fill operation with minimal imported fill required. No subsoil drainage will be needed.

Preliminary earthwork levels for the site prepared by JDSi are detailed in Appendix O. These earthwork levels have informed the establishment of catchment boundaries for the stormwater modelling detailed in Section 6.

Final design lot levels and fill specification are a detailed design issue to be addressed during the preparation of detailed engineering design drawings and preparation of the UWMP and will be ultimately submitted for council approval at that stage.

7.2 Acid Sulphate Soils

Acid sulphate soil mapping has been previously discussed in Section 3.2.1 as having moderate to low risk of ASS across the site less than 3 m from the surface.

If required, management of ASS will be addressed by a separate study by a suitably qualified environmental consultant, and any ASS management plan required will detail the actions to minimise and mitigate potential adverse environmental effects during the works.

All assessment and management of ASS will be conducted in accordance with the Acid Sulphate Soil Guideline Series Identification and Investigation of Acid Sulphate Soils (DoE, 2004). This will be conducted appropriately as a separate process to this LWMS.

8. Urban Water Management Plans

Consistent with processes defined in WAPC (2008), Urban Water Management Plans (UWMPs) will be developed and submitted to support subdivision applications for various stages of development within the site.

Preparation of the UWMP will be the responsibility of the developer. UWMPs will address:

- Demonstrated compliance with LWMS criteria and objectives to the satisfaction of the City of Cockburn and DWER.
- Agreed/approved measures to achieve water conservation and efficiencies of water use, including provision of POS irrigation water use distribution details.
- Detailed stormwater management design including the size, location and design of public open space areas, integrating major and minor flood management capability.
- Management of groundwater levels including proposed cut/fill levels.
- Specific structural and non-structural BMPs and treatment trains to be implemented including their function, location, maintenance requirements, expected performance and agreed ongoing management arrangements.
- Management of subdivisional works including development of a strategy for sediment control during construction.
- Implementation plan including roles, responsibilities, funding and maintenance arrangements.
- Specific monitoring and reporting to be undertaken for each UWMP area consistent with the monitoring program defined in the LWMS.
- Contingency plans (where necessary).

Further detail of the integration of stormwater within POS will be provided during the development of the relevant UWMP's covering those specific areas. This will include the refinement of stormwater modelling, preparation of detailed landscape plans (species selection and treatments), and detailed engineering design drawings.

Staging of stormwater changes will be detailed in the relevant UWMP's and implemented to ensure key hydrological performance criteria in relation to the receiving environment and key design objectives are maintained during the development process.

9. Monitoring

9.1 Pre Development

Baseline surface and groundwater monitoring of existing conditions was undertaken for 18 months inclusive of 2 winters periods from June 2020 to December 2021. Monthly groundwater levels and quarterly water quality were recorded in addition to sampling of existing stormwater quality discharging into the site from City of Cockburn drainage systems.

No further predevelopment monitoring is required to inform development of the site.

9.2 Post Development

Department of Water (2012) indicates a minimum of 3 years post development monitoring is required, and defines post development as "from completion of first subdivision to five years after 80 per cent of the development (by land area) has been completed".

The post development monitoring program is summarised in Table 10. Post development groundwater monitoring is proposed in 9 groundwater monitoring bores as shown in Figure 10, to provide suitable coverage of the site. Locations have been selected based on maintaining existing sampling locations where possible.

The following frequency of monitoring is proposed:

- Monthly groundwater level measurements.
- Quarterly groundwater quality measurements.

Groundwater levels will also be measured in three nearby DWER bores JM45, JM12, and JM2 consistent with pre development monitoring.

Groundwater quality will be monitored quarterly (typically January, April, July, October) for physical parameters (pH, electrical conductivity), nutrients (total nitrogen, total Kjeldahl nitrogen, ammonia, nitrate, nitrite, total phosphorus, and filterable reactive phosphorus) and heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, aluminium, manganese, arsenic and lead). All water quality samples will be analysed at a NATA approved laboratory.

Stormwater quality sampling of key stormwater infiltration and biofiltration areas within the site once constructed will also be undertaken via grab sampling on up to 4 occasions each winter. Sampling parameters will be the same as groundwater monitoring.

Visual assessment of each of these areas will also be undertaken on a quarterly basis via a standardised proforma, to assess performance in relation to design.

The monitoring schedule will be undertaken for a three year period consistent with usual DWER requirements. An annual report will be prepared summarising the results of the program, with results compared to predevelopment monitoring data.

The program may need to be modified as data is collected to increase or decrease the monitoring effort in a particular area, or to alter the scope of the program itself. This will require agreement of all parties.

If required, contingency actions will include a review of all monitoring data to determine the likely cause of any significant changes in water quality, consideration of additional monitoring required to assist a determination, and consideration of remedial actions.

A contingency plan is presented in Table 11, which will be refined during the development of individual UWMP's for the site. Post development monitoring results will be compared to both pre-development monitoring outcomes and ANZECC guideline data. This approach is required as the local baseline condition may naturally be outside the recommended ANZECC range for some parameters.

Implementation of the post development monitoring program is the responsibility of the developer. Where staging aspects require any specific additional monitoring to be conducted, this will be appropriately detailed at UWMP stage.

Table 10: Post Development Monitoring Program

Monitoring	Parameter	Location	Method	Frequency and Timing
Groundwater level	Water level (m AHD)	9 bores within site area and 3 DWER bores	Electrical depth probe or similar	Monthly (12 occasions annually)
Groundwater quality	Physical, nutrients and heavy metals	9 bores within site area	Pumped bore sample	Quarterly (4 occasions annually)
Stormwater quality	Physical, nutrients and heavy metals	Biofilters & Infiltration storages	Collected grab samples of outflow	Max four occasions during each winter monitoring period
Stormwater System performance	Profroma	Biofilters & Infiltration storages	Visual Assessment	Max four occasions during each winter monitoring period

Table 11: Contingency Planning

Type	Criteria for Assessment	Frequency	Process & Possible Actions
Water Quality	Surface and groundwater quality significantly worse than: a) predevelopment water quality; and/or b) typical urban stormwater quality on the Swan Coastal Plain (Martens et al 2005) TN : 1.1 mg/l TP : 0.21 mg/l with reference to ANZECC guidelines [1]	Ongoing assessment following monitoring with annual review	Process 1. Assess spatial extent of occurrence. 2. Determine if due to development or other 3. Perform appropriate action as required 4. Record and report any breach and action 5. If necessary inform residents of any works 6. Inform and provide data to DWER/ CoC Possible Actions 1. Resample to determine if a true reading 2. Identify & remove point sources of pollution 3. Review operation & maintenance practices 4. Consider alterations to POS areas including landscape regimes and soil amendment. 5. Consider stormwater system modifications 6. Consider community based projects.

1. ANZECC guidelines to be used as a reference point only. ANZECC guidelines state that guidelines values are not intended to be directly applied to stormwater quality, however are applicable where the stormwater system are regarded as having conservation value. ANZECC guideline values are derived for unmodified or slightly modified ecosystems. ANZECC recommends the values only be applied where site specific values do not exist, or site specific targets cannot be derived.

10. Implementation

Table 12 details the roles, responsibilities and funding to implement the LWMS.

Monitoring outcomes will be used in a continual improvement capacity to review the implemented WSUD within the site and inform the planning and design approaches and improvements for subsequent stages of development.

Details of construction and maintenance activities and responsibilities will be appropriately detailed at UWMP stage, and will include details of any specific staging considerations, and the need for ongoing management of subsoil drainage to ensure its ongoing performance in accordance with design.

Table 12: Implementation, Roles and Responsibilities

Implementation Action	Responsibility		
	Developer	DWER	City of Cockburn
Review and approval of LWMS		✓	✓
Preparation of a UWMP for individual development stages	✓		
Review and approval of UWMP		✓	✓
Construction of stormwater system and maintenance post construction until council handover	✓		
Long term stormwater system operation and maintenance			✓
Conduct post development monitoring program and annual reporting	✓		
Review of monitoring data and annual reports		✓	✓

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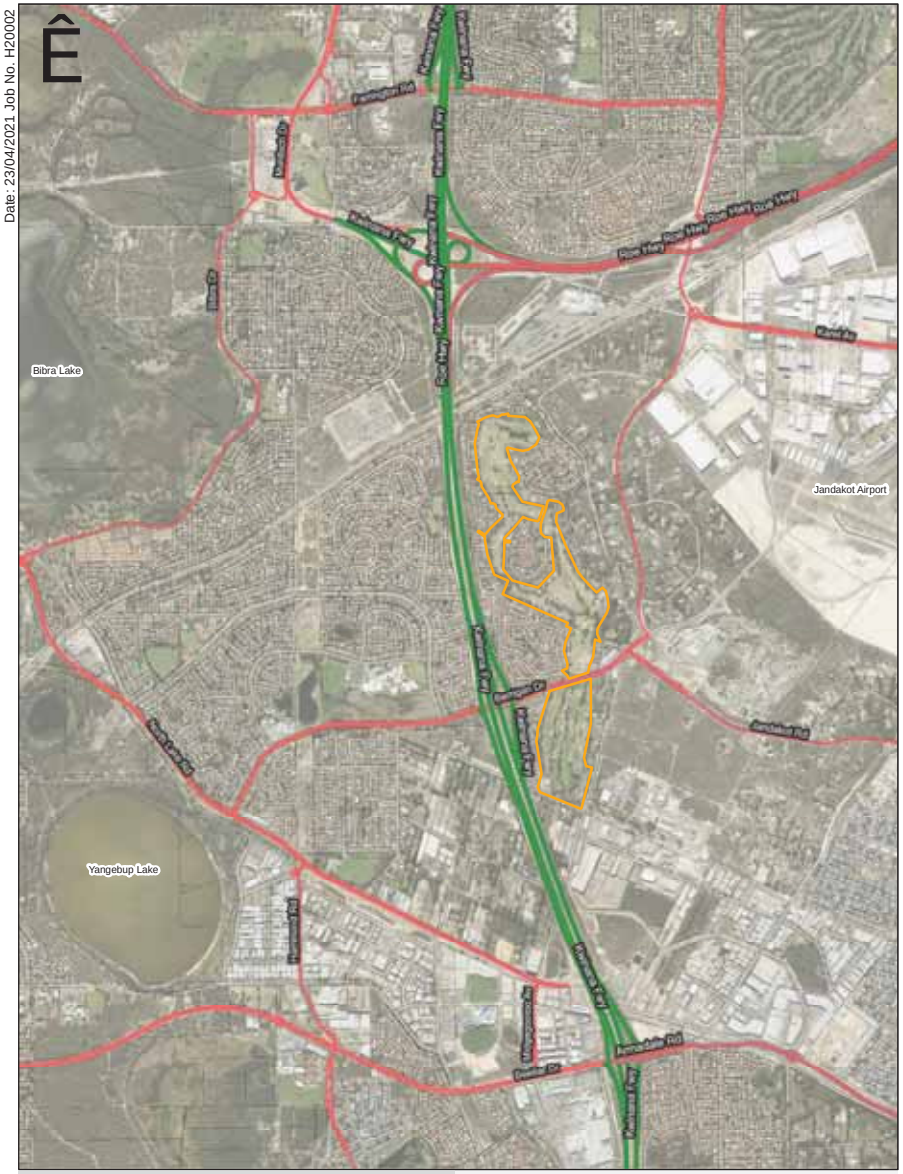
FIGURES

Date: 23/04/2021 Job No. H20002



hyd2o

Glen Iris Jandakot Local Water Management Strategy

Location Plan

Figure 1

Date: 24/08/2023 Job No H22046

Source: Rowe Group 2023

hyd2o

Glen Iris Jandakot Local Water Management Strategy

Local Structure Plan

Figure 2a

Date: 24/08/2023 Job No H22046

Source: Rowe Group 2023

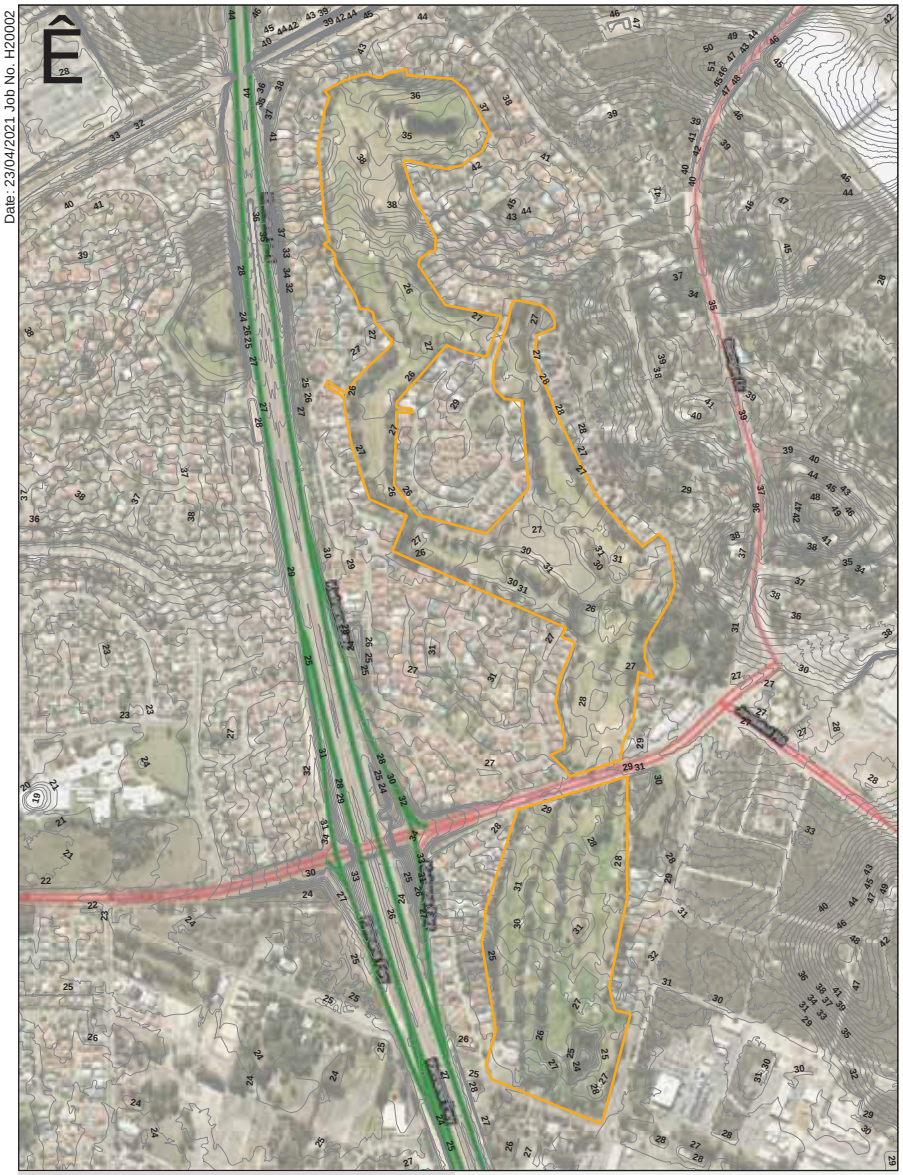
hyd2o

Glen Iris Jandakot Local Water Management Strategy

Indicative Subdivision Concept

Figure 2b

Date: 23/04/2021 Job No. H20002



Site Boundary

DWER LiDAR 1m Contours

0 90 180 270 360 Meters

hyd2o

Glen Iris Jandakot Local Water Management Strategy

Site Conditions Plan

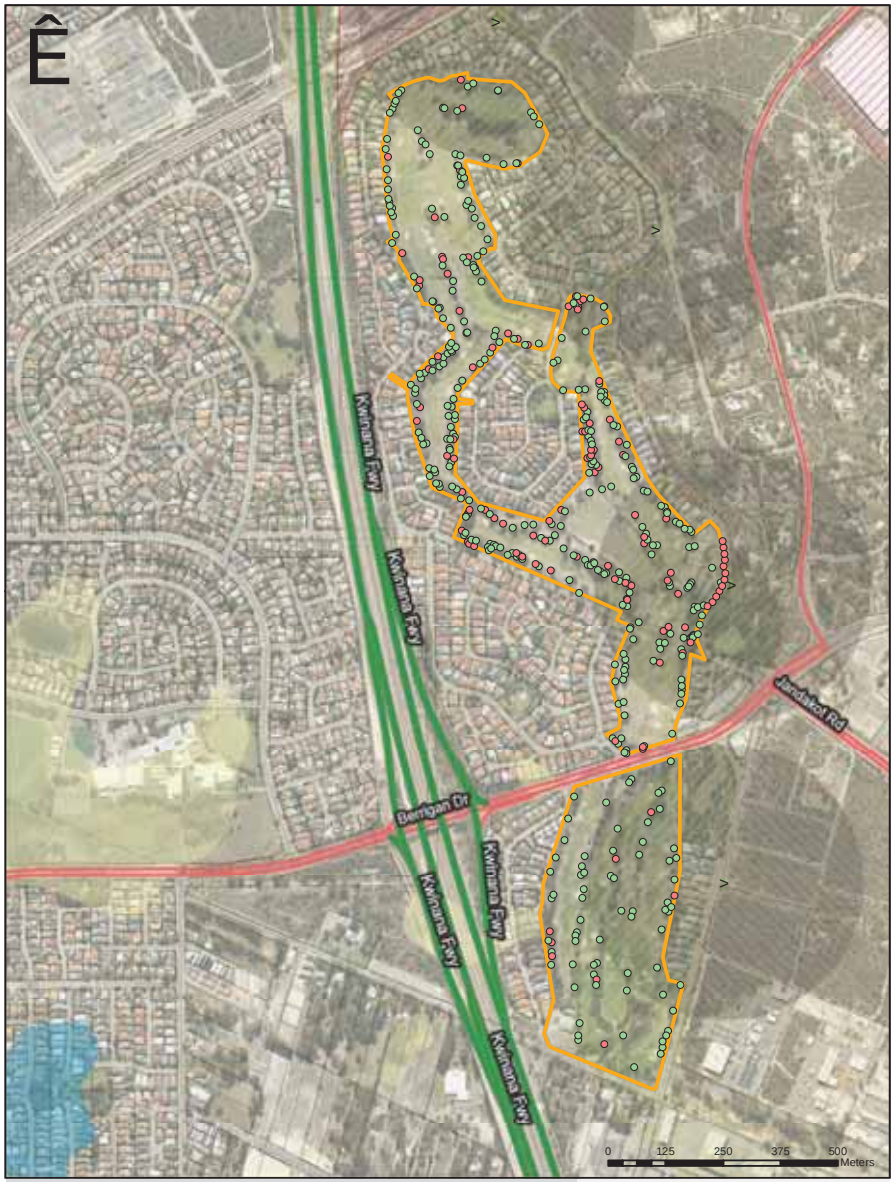
Figure 3

Date: 25/05/2021 Job No. H20002

Site Boundary
Ms5 : Sand Silt
S10 : Bassendean Sand over Guidford Formation
S8 : Bassendean Sand
ASS High to Moderate Risk
ASS Moderate to Low Risk
Hyd2o Permeability Sites (m/d)
CMW Permeability Sites (m/d)
CMW Geotech Pits

hyd2o
Glen Iris Jandakot Local Water Management Strategy
Geotechnical Plan
Figure 4

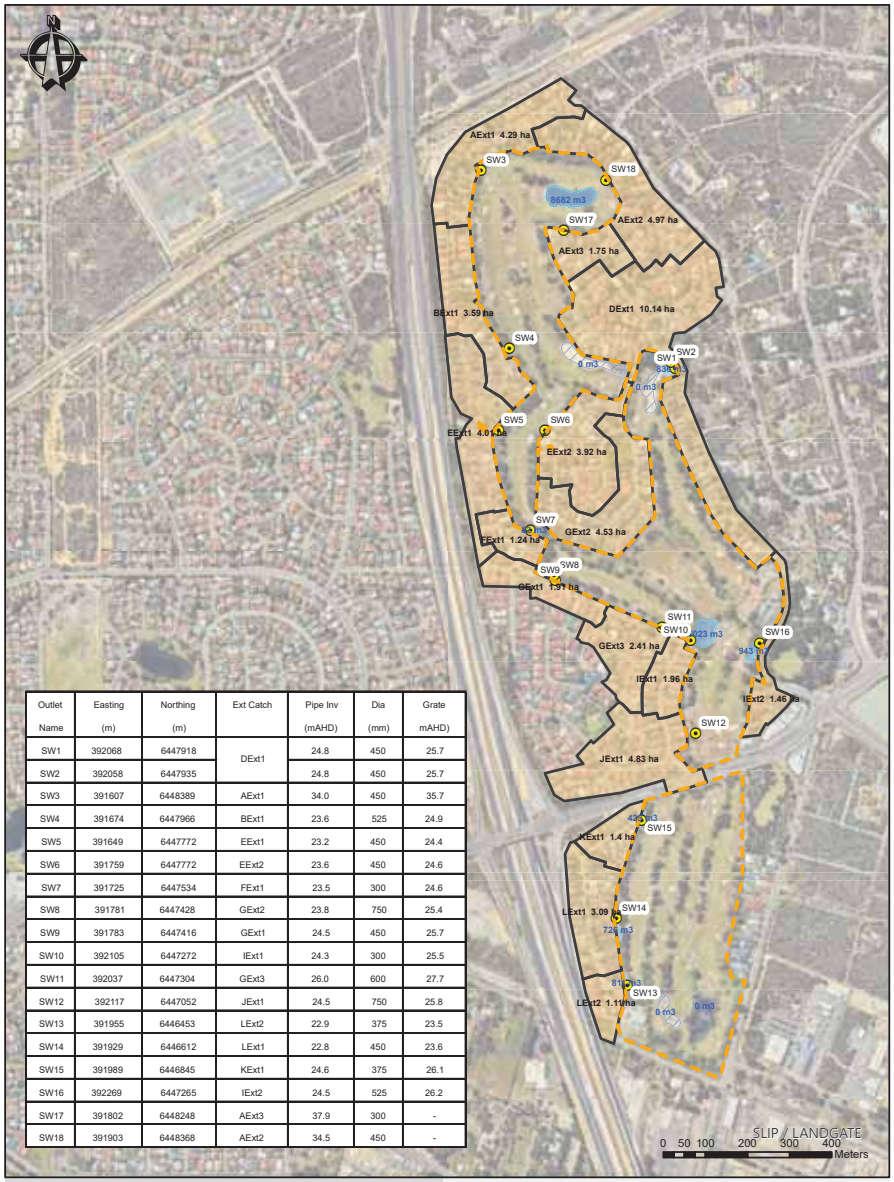
Date: 22/04/2021 Job No. P20002



Site Boundary
Conservation Wetland
Multiple Use Wetland
Resource Enhancement
Water Corp Bores
PDWSA's
P1
P2
P3
Wellhead Protection Zones
Tree Retention Priority
High
Medium

hyd2o
Glen Iris Jandakot LWMS
Environmental Plan
Figure 5

Date: 27/08/2023 Job No. H22046



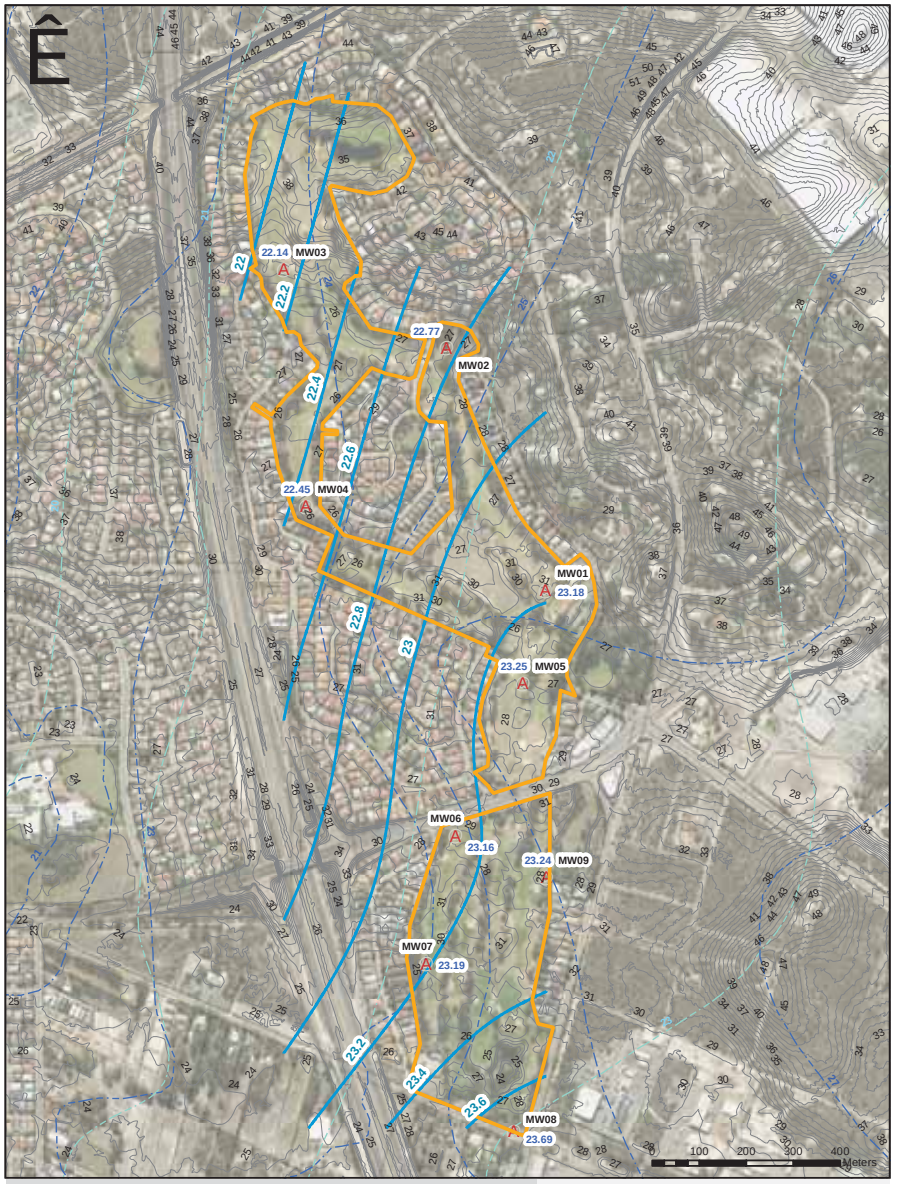
Outlet Name	Easting (m)	Northing (m)	Ext Catch	Pipe Inv (mAHD)	Dia (mm)	Grate mAHD)
SW1	392068	6447918	DExt1	24.8	450	25.7
SW2	392058	6447935		24.8	450	25.7
SW3	391607	6448389	AExt1	34.0	450	35.7
SW4	391674	6447966	BExt1	23.6	525	24.9
SW5	391649	6447772	EExt1	23.2	450	24.4
SW6	391759	6447772	EExt2	23.6	450	24.6
SW7	391725	6447534	FExt1	23.5	300	24.6
SW8	391781	6447428	GExt2	23.8	750	25.4
SW9	391783	6447416	GExt1	24.5	450	25.7
SW10	392105	6447272	IExt1	24.3	300	25.5
SW11	392037	6447304	GExt3	26.0	600	27.7
SW12	392117	6447052	JExt1	24.5	750	25.8
SW13	391955	6446453	LExt2	22.9	375	23.5
SW14	391929	6446612	LExt1	22.8	450	23.6
SW15	391989	6446845	KExt1	24.6	375	26.1
SW16	392269	6447265	IExt2	24.5	525	26.2
SW17	391802	6448248	AExt3	37.9	300	-
SW18	391903	6448368	AExt2	34.5	450	-

Site Boundary
Existing Outlets
External Subcatchments

Existing Storage Type
Other : Lined Lake
Other : Water Table Lake
Stormwater : Lined Storage
Stormwater : Shallow Depression
Stormwater : Sump

hyd2o
Glen Iris Jandakot Local Water Management Strategy
Surface Water Plan
Figure 6

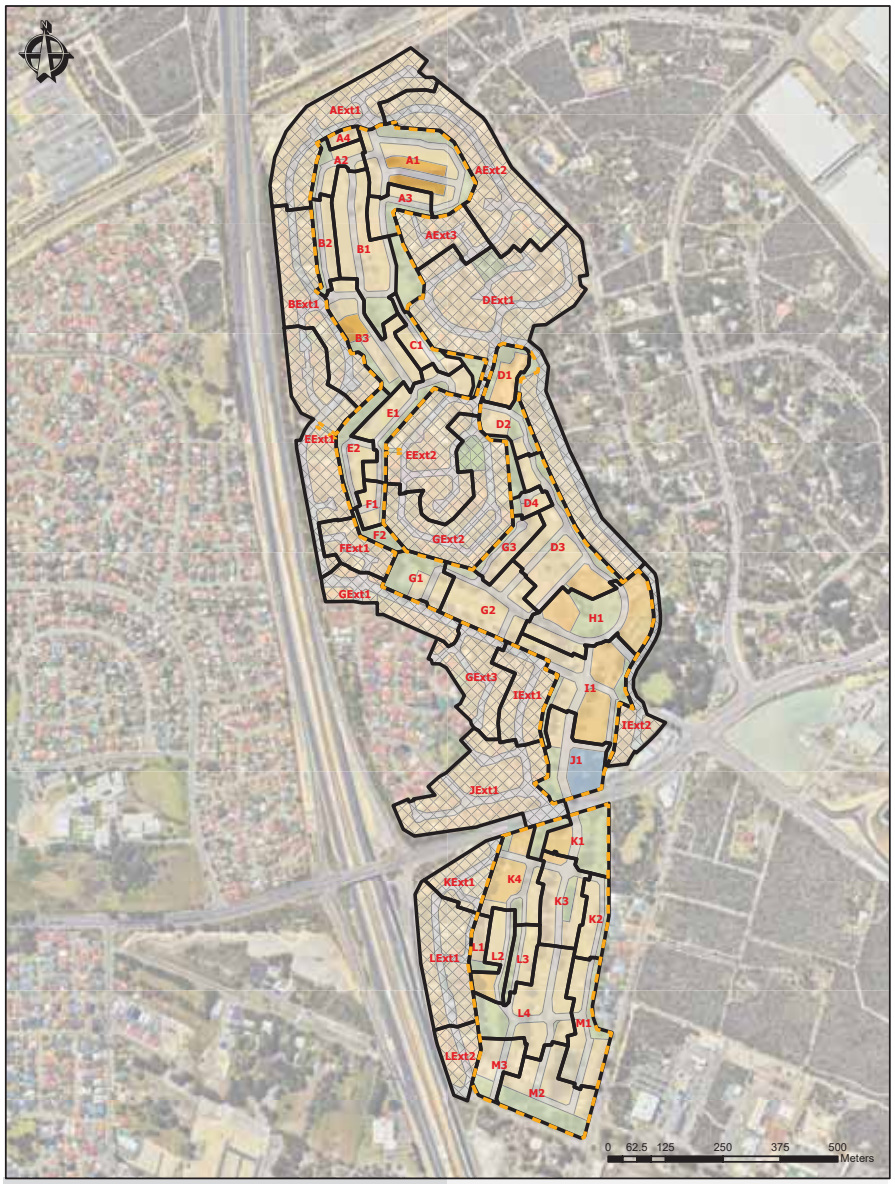
Date: 22/04/2021 Job No. P20002



Site Boundary
DWER LiDAR 1m Contours
AAMGL Contour (mAHD)
DWER Groundwater Historical Maximum (mAHD)
DWER Groundwater Historical Minimum (mAHD)
A Site Bores AAMGL (mAHD)

hyd2o
Glen Iris Jandakot LWMS
Groundwater Plan
Figure 7

Date: 24/08/2023 Job No. H22046



Site
Catchments
External Catchments
Lots R20
Lots R30
Grouped Housing
Commercial
POS/Conservation/Interface
Roads

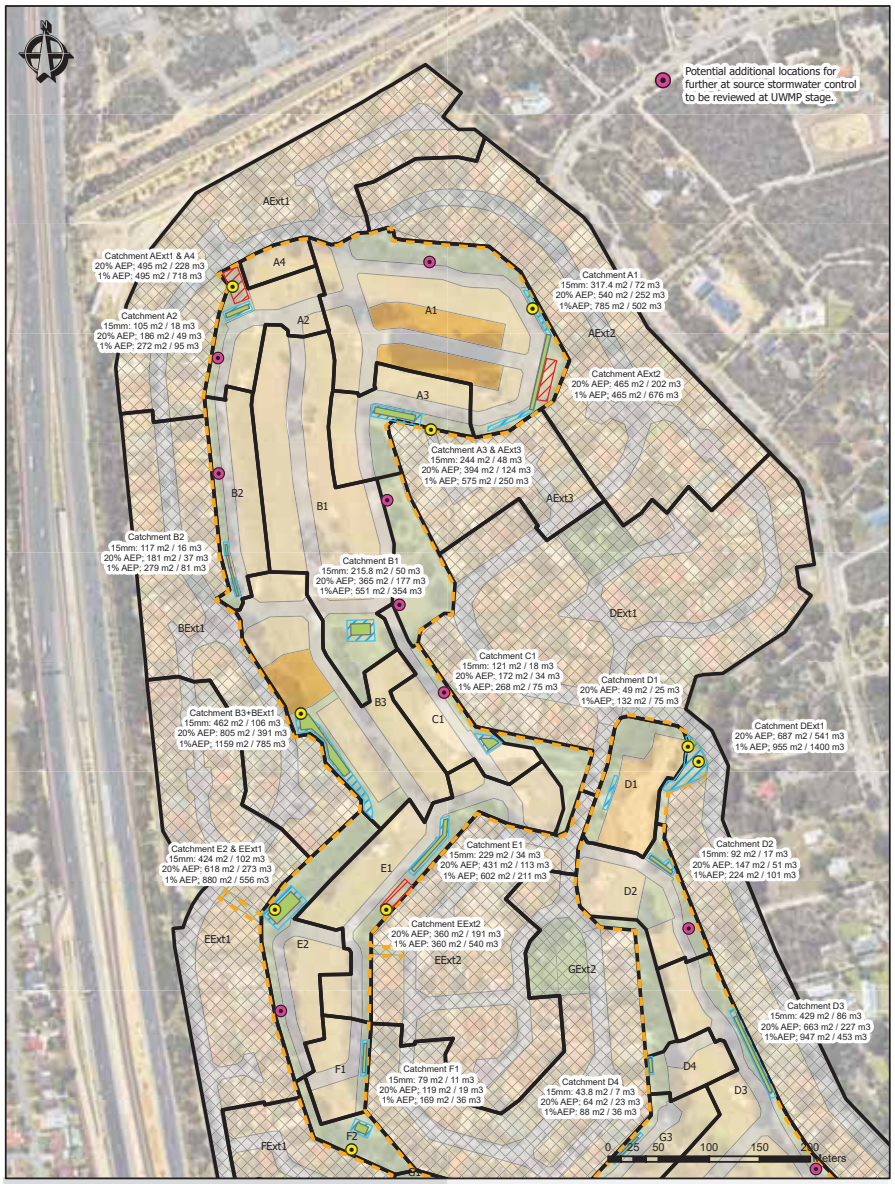
hyd2o

Glen Iris Jandakot Local Water Management Strategy

Post Development Stormwater Catchments

Figure 8

Date: 27/08/2023 Job No. H22046



Site
Catchments
External Catchments
Basin/Swale Flood Storage
Underground Storage
Biofiltration 15mm
Lots R20
Lots R30
Grouped Housing
Commercial
POS/Conservation/Interface
Roads

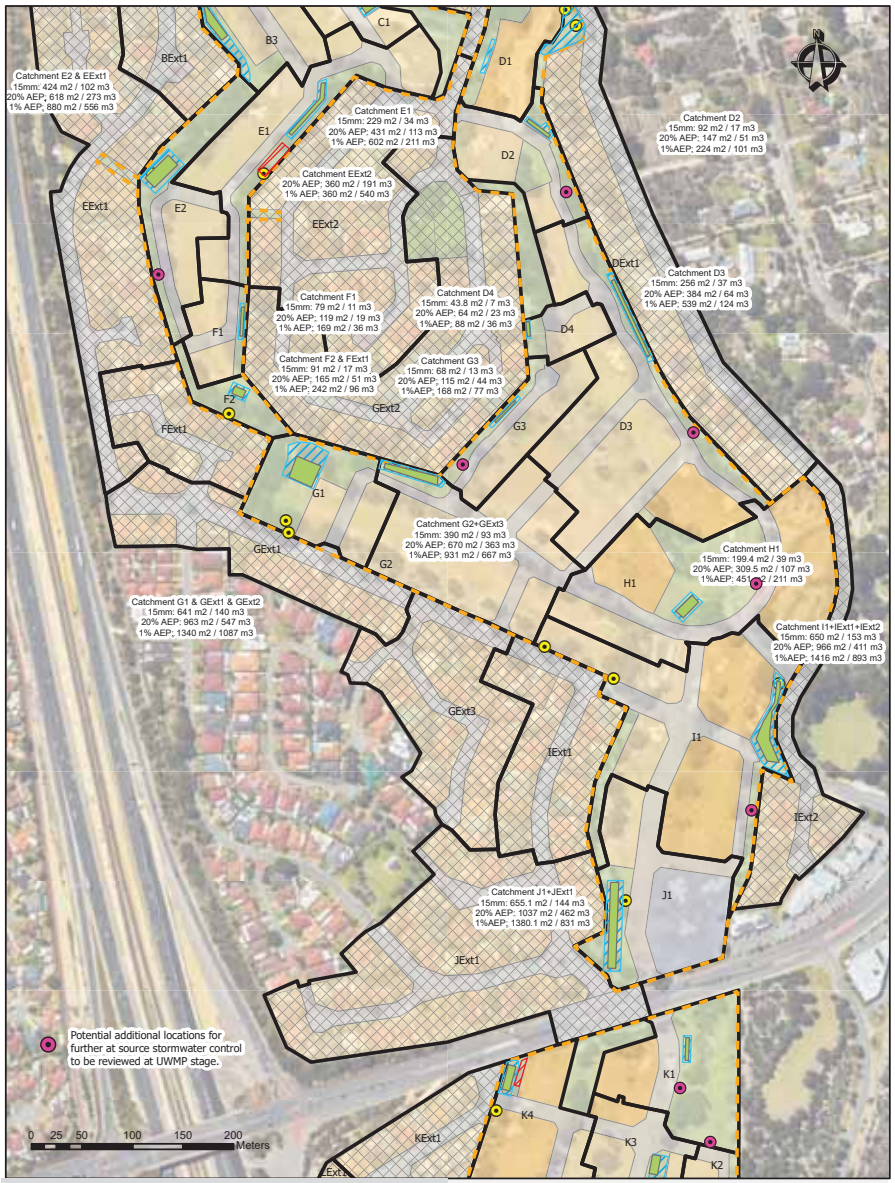
hyd2o

Glen Iris Jandakot Local Water Management Strategy

Stormwater Management Event Plan: North

Figure 9a

Date: 24/08/2023 Job No. H22046



Site
Catchments
External Catchments
Basin/Swale Flood Storage
Underground Storage
Biofiltration 15mm
Lots R20
Lots R30
Grouped Housing
Commercial
POS/Conservation/Interface
Roads

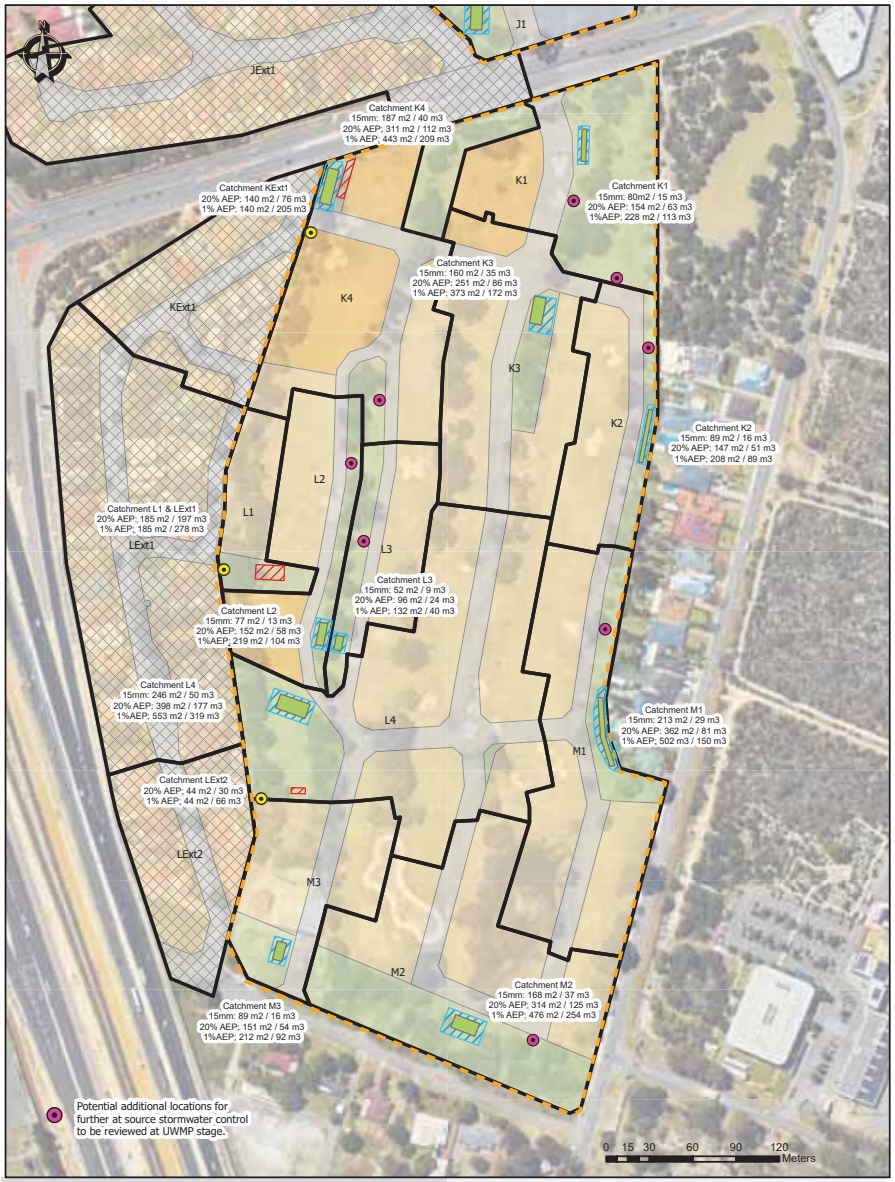
hyd2o

Glen Iris Jandakot Local Water Management Strategy

Stormwater Management Event Plan: Central

Figure 9b

Date: 28/08/2023 Job No. H22046



Site
Catchments
External Catchments
Basin/Swale Flood Storage
Underground Storage
Biofiltration 15mm
Lots R20
Lots R30
Grouped Housing
Commercial
POS/Conservation/Interface
Roads

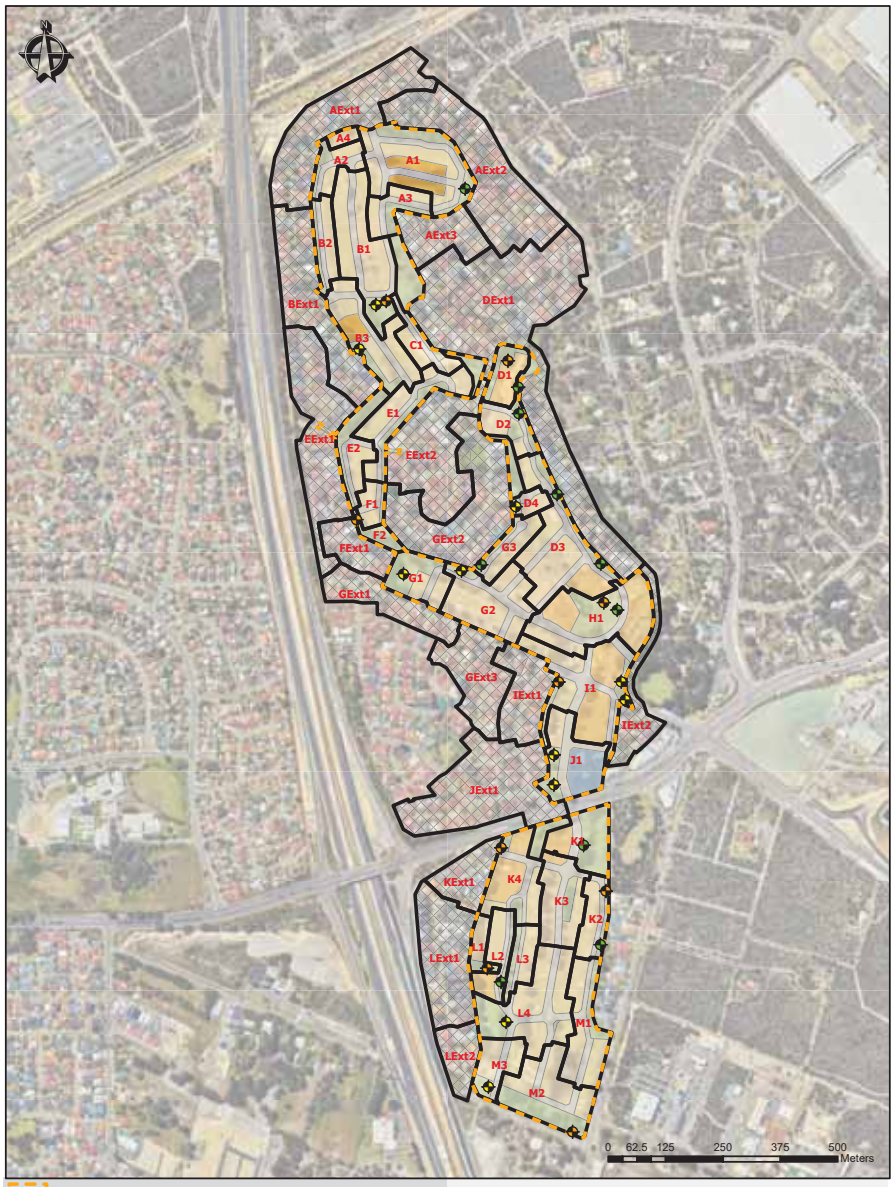
hyd2o

Glen Iris Jandakot Local Water Management Strategy

Stormwater Management Event Plan: South

Figure 9c

Date: 24/08/2023 Job No. H22046



Site
Catchments
External Catchments
Groundwater Bores
Stormwater Storages
Swales

hyd2o

Glen Iris Jandakot Local Water Management Strategy

Post Development Monitoring Sites

Figure 10

APPENDIX A
Better Urban Water Management Checklist

Better Urban Water Management LWMS Checklist

Local Water Management Strategy Item	Deliverable	✓	Comments
Executive summary			
Summary of the development design strategy, outlining how the design objectives are proposed to be met	Table 1: design elements and requirements for BMP's and critical control points	☑	Executive Summary
Introduction			
Total water cycle management - principles and objectives Planning background Previous studies		☑	Chapter 1, Figure 1
Proposed development			
Structure plan, zoning and land use Key landscape features Previous land use	Site Context Plan Structure Plan	☑	Section 1.1, Section 2, Figure 2
Landscape - proposed POS areas, POS credits, water source, bore(s), lake details (if applicable), irrigation areas	Landscape plan	☑	Section 5.2, Appendix J
Design criteria			
Agreed design objective and source of objective		☑	Section 4, Table 7
Pre-development environment			
Existing information and more detailed assessments (monitoring). How do the site characteristics affect the design?		☑	Section 3, Figures 3-7
Site conditions- existing topography/ contours, aerial photo underlay, major physical features	Site Condition plan	☑	Section 3.1, Figure 3
Geotechnical - topography, soils including acid sulfate soils and infiltration capacity, test pit locations	Geotechnical plan	☑	Section 3.2, Figure 4, Appendix B
Environmental- areas of significant flora and fauna, wetlands and buffers, waterways and buffers, contaminated sites	Environmental plan plus supporting data where appropriate	☑	Sections 3.3 & 3.4, Figures 5
Surface water- topography, 100 year floodways and flood fringe areas, water quality of flows entering and leaving (if applicable)	Surface water plan	☑	Section 3.5, Figure 6, Appendix D-F
Groundwater - topography, pre development groundwater levels and water quality, test bore locations	Groundwater plan plus details of groundwater monitoring and testing	☑	Section 3.6, Figure 7, Appendices F-H
Water use sustainability initiatives			
Water efficiency measures- private and public open spaces including method of enforcement		☑	Section 5.1
Water supply (fit- for-purpose strategy), agreed actions and implementation. If non-potable supply, support with water balance		☑	Section 5.2, Appendix I -J
Wastewater management		☑	Section 5.3
Stormwater management strategy			
Flood protection - peak flow rates, volumes and top water levels at control points, 100 year flow paths and 100 year detentions storage areas	100yr event plan Long section of critical points	☑	Section 6.1, Table 8, Figures 8 &9, Appendix K-M
Manage serviceability - storage and retention required for the critical 5 year ARI storm events Minor roads should be passable in the 5 year ARI event	5yr event plan	☑	Section 6.1, Table 8, Figures 8 & 9, Appendix K-M
Protect ecology - detention areas for the 1 yr 1 hr ARI event, areas for water quality treatment and types of (including indicative locations for) agreed structural and non-structural best management practices and treatment trains. Protection of waterways, wetlands (and their buffers), remnant vegetation and ecological linkages	1 yr event plan Typical cross sections	☑	Section 6.1, 6.2 Table 8 & 9, Figure 9, Appendix M

Local Water Management Strategy Item	Deliverable	✓	Comments
Groundwater management strategy			
Post development groundwater levels, fill requirements (including existing and likely final surface levels), outlet controls, and subsoil areas/exclusion zones	Groundwater/subsoil plan	☑	Section 7.1 Appendix N
Actions to address acid sulphate soils or contamination		☑	Section 7.2
The next stage - subdivision and urban water management plans			
Content and coverage of future urban water management plans to be completed at subdivision. Include areas where further investigations are required prior to detailed design		☑	Section 8
Monitoring			
Recommended future monitoring plan including timing, frequency, locations and parameters, together with arrangements for ongoing actions		☑	Section 9, Figure 10, Table 10 & 11
Implementation			
Developer commitments		☑	Section 10, Table 12
Roles, responsibilities, funding for implementation		☑	Section 10, Table 12
Review		☑	Section 10, Table 12

APPENDIX B
Geotechnical Report

23 December 2020

PROPOSED RESIDENTIAL SUBDIVISON GLEN IRIS GOLF COURSE, JANDAKOT, WA GEOTECHNICAL INVESTIGATION REPORT

Eastcourt Property Group

Ref. PER2020-0452AB Rev 0

PER2020-0452AB		
Date	Revision	Comments
23 December 2020	0	FINAL GEOTECHNICAL REPORT

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Appendix B – Permeability Test Results

Appendix C – Laboratory Test Results

GLEN IRIS ESTATE SUBDIVISON, JANDAKOT, WA – GEOTECHNICAL INVESTIGATION 23 DECEMBER 2020

1 INTRODUCTION

CMW Geosciences Pty Ltd (CMW) was authorised by Mitch Dodson of Acumends Development Solutions on behalf of Eastcourt Property Group to carry out a geotechnical investigation of a proposed residential subdivision development site located at the Glen Iris Public Golf Course on Dean Road, Jandakot WA by way of email authorisation dated 16 November 2020. The scope of work and associated terms and conditions of our engagement were detailed in our services proposal referenced *PER2020-0452AA, Rev 0*, dated 28 October 2020.

The purpose of this report is to describe the investigation completed, the ground conditions encountered and to provide recommendations with respect to geotechnical aspects of the proposed development including site preparation and earthworks, site classification, suitable foundation parameters, drainage, and the identification of geohazards and risks to the proposed development.

2 SITE DESCRIPTION

The proposed development site is approximately 53ha and will be located at the previous location of the Glen Iris Public Golf Course along Dean Road, Jandakot WA which has since been closed (refer to attached Site Investigation Plan – Figure No. 01).

For better understanding, the site has been split into three distinctive areas as seen in Figure 01. The first area, the most northern precinct is bound to the north, east and west by existing residential developments along Glen Iris Drive, and to the south by residential developments along Portsea Gardens and Twin Waterers Pass. Surface levels obtained from an imagery survey conducted by MNG (Ref. *102160-OPM-007-A*) on 09 April 2019 indicates this area is relatively steeply sloping from RL 43m AHD along the northern most boundary to RL 27m AHD along the southern boundary. The southeastern area also slopes gradually towards the centre of the northernmost lake (RL 34m AHD).

The central precinct is bound to the east by existing residential developments along Dean Road and Par Cresent which is further south, to the south by Berrigan Drive and to the west by residential developments along Hartwell Parade, Glacier Way, Eadie Cresent and Glen Iris Drive. In the centre of the precinct there are a large number of further residential developments linked by an array of roads and accessways connected to Twins Waters Pass. Near the southwestern corner of the area an existing single storey clubhouse development is located with associated carparking. Surface levels obtained from an imagery survey conducted by MNG indicates this area is relatively consistent, gently sloping from RL 27m along the northern boundary to RL 28m AHD along the southern boundary.

The southernmost precinct is bound to the north by Berrigan Drive, to the east by Prinsep Park and Prinsep Road, to the south by Imlah Cresent and to the west by residential dwellings along The Lakes Boulevard and The Fairway. In the southwestern most corner, there is two single story maintenance workshops with associated paved accessways. Surface levels obtained from an imagery survey conducted by MNG indicates this area is gently sloping from RL 26m AHD along the southern boundary to RL 29m along the northern boundary.

Surface levels are only indicative as there are numerous undulations, swales and isolated elevated areas, bunkers and fairways that mould the topographical profile of the entire site.

The site was previously used as a public golf course therefore the site contains relatively cleared areas. Vegetation cover comprises grass with some small to large sized trees lining the outsides of the fairways. There are also six manmade lakes located across the site.

It is believed the existing developments on the golf course will be demolished prior to the bulk earthworks for the proposed subdivision.

Aerial imagery from Landgate show that prior to the development of the golf course in 1965 the site was previously in use as agricultural lands. The surrounding areas have undergone significant land development and subdivision that appears to have affected the current golf course. In addition, the golf course layout has largely been man-made by earthworking. Because of this, there may be uncontrolled fill, very loose sands, buried topsoil or other unsuitable material present in areas of the site. In addition, there could be unsuitable material in the lake beds.

3 PROPOSED DEVELOPMENT

The plans supplied depict the area of approximately 53ha will be divided into approximately 600 to 800 residential lots with Public Open Space (POS), drainage basins plus associated accessways and roadways. At present, however, no specific engineering details of the proposed land development have been provided.

We anticipate that significant cut to fill earthworks will be required in order to form finished ground levels. The magnitude of the cut to fills assume the lots will be stepped from east to west. It is also understood that retaining walls will be constructed to assist with the development of the lots.

4 FIELD INVESTIGATION

The field investigation was carried out from 30 November 2020 to 02 December 2020, following a dial before you dig search. All fieldwork was carried out under the direction of CMW Geosciences Pty Ltd in general accordance with AS1726 (2017), Geotechnical Site Investigations. The scope of fieldwork completed was as follows:

- A walkover survey of the site to assess the general landform, site conditions and adjacent structures;
- 55 test pits, denoted TP01 to TP55, were excavated to depths of up to 2.2m using a JCB 8.5 tonne backhoe fitted with a 450mm wide toothed bucket to investigate the underlying soil conditions, facilitate sampling for laboratory testing and to assess excavatability and earthworks recommendations. Engineering logs of the test pits and photographs are presented in Appendix A;
- Perth Sand Penetrometer (PSP) tests were carried out adjacent to each test pit, in general accordance with AS1289.6.3.3, to depths of up to 2.1m to provide soil density/consistency profiles and to provide a subgrade CBR value for pavement design purposes. Graphical results of the PSP plots are presented on the test pit logs in Appendix A;
- 8 hand auger boreholes were drilled with a 100mm diameter auger to a depth of up to 1.42m to facilitate infiltration testing. Results of the permeability test are presented in Appendix B.

The approximate locations of the respective investigation sites referred to above are shown on the attached Site Investigation Plan (Figure No. 01). Test locations were selected by CMW with input from Steve Foley (JDSi) on specific areas to target/stay clear of during the investigation. Test locations were measured using a hand-held GPS to an accuracy of ±5m. Elevations were inferred from the imagery survey conducted by MNG (Ref. *102160-OPM-007-A*) on 09 April 2019.

5 LABORATORY TESTING

A small program of soil laboratory testing was carried out on representative soil samples generally in accordance with the requirements of the latest edition of AS1289 (where applicable).

Testing was carried out on samples selected by CMW and carried out by Western Geotechnical & Laboratory Services Pty Ltd (WGL), a NATA registered laboratory.

The following laboratory tests were carried out:

- 8 Organic Content Test (Loss on Ignition).

The laboratory test results, and associated certificates are provided in Appendix C.

6 GROUND MODEL

6.1 Geology

Published geological maps (Ref. Perth Metropolitan Region 1:50,000 Environmental Geology Series: Fremantle) and the CMW investigation database for the area depict the land as being underlain by Bassendean Sand overlying clayey and silty material of the Guildford Formation at depth.

Based on the known history of the site and surrounding land levels, some superficial depths of fill were also anticipated because of the previous agricultural use of the land.

6.2 Subsurface Conditions

The ground conditions encountered and inferred from the investigation were considered to be generally consistent with the published geology for the area and can be generalised according to the following subsurface sequence:

TOPSOIL: SAND / CLAYEY SAND	dark grey, brown, fine to medium grained, subangular to subrounded sand with trace fines (>12% in TP48); trace organics; trace roots and rootlets; trace branches; trace vegetation, overlying;
FILL: SAND (UNCONTROLLED)	loose to very dense, fine to medium grained, subangular to subrounded; grey/pale yellow and orange-brown; trace fine grained limestone gravel (TP04, TP20); trace fines; trace organics; trace roots and rootlets; trace branches. Uncontrolled fill in the form of old reticulation pipe and bricks were found in TP04, TP18, TP28 and TP34. The reticulation pipe uncovered in TP28 and TP34 contained potential asbestos between depth of 0.5 and 1.6 mbgl, overlying;
SAND (SP)	loose to very dense, fine to medium grained, subangular to subrounded; grey/orange/yellow and white; trace fines; trace roots and rootlets, overlying;
COFFEE ROCK	very dense, fine to medium grained, subangular to subrounded, dark brown/black; weakly cemented. (Only found in TP03 TP06, TP12 and TP52). The coffee rock was typically found in or around low energy zones (lakes) located across the site where groundwater may be present.

Of the six manmade lakes located across the site, only TP48 was able to excavate the base of the lake due to the lake being empty. A green plastic liner was found approximately 0.5m below the base of the lake overlying the natural sand. It is assumed this liner is present at the base of all the other lakes at a similar depth. The liner was also found to be extending to the banks of the lakes evident in test pits TP34, TP44 and TP52 where the same plastic liner was uncovered just below the surface.

The distribution of the above units is summarised in Table 1 below:

Table 1: Summary of Soil Stratigraphy			
Description	**Depth to top of layer (m)**		
	Minimum	**Maximum**	**Average**
TOPSOIL: SAND / CLAYEY SAND	0.00		
FILL: SAND (UNCONTROLLED)	0.02	0.20	0.11
SAND (SP)	0.10	1.90	1.00
COFFEE ROCK	>2.05		

6.3 Groundwater

A review of the Perth Groundwater Atlas indicates that groundwater levels are likely to be between RL 21m AHD and 26m AHD below existing ground levels. These levels equate to depths of approximately <1m below the lowest existing ground contours along the southern boundary of site.

During the investigation, which was completed in early-summer conditions (Nov/Dec 2020), groundwater was not encountered within any of the investigation locations.

6.4 Permeability

Tabulated results of the 8 in-situ falling head permeability tests carried out was used to estimate the soil coefficient of permeability in accordance with the methods described in Horslev (1951) (falling head test) and CIRIA Report No. 113 (falling head test).

Table summarises the results obtained. Complete results of the in-situ falling head tests are presented in Appendix B.

Table 2: Summary of Falling Head Permeability Tests					
Standpipe ID	**Bottom of Test Hole (mbgl)**	**Approximate Permeability**			
		CIRIA (m/sec)	**CIRIA (m/day)**	**Horslev (m/sec)**	**Horslev (m/day)**
Perm 1	1.36	$3.15x10^{-04}$	27.22	$6.50x10^{-05}$	5.61
Perm 2	1.42	$1.22x10^{-03}$	105.00	$2.99x10^{-04}$	25.84
Perm 3	1.35	$6.73x10^{-04}$	58.18	$1.85x10^{-04}$	16.00
Perm 4	1.38	$4.25x10^{-04}$	36.75	$1.01x10^{-04}$	8.69
Perm 5	1.40	$8.26x10^{-04}$	71.39	$1.99x10^{-04}$	17.16
Perm 6	1.40	$5.05x10^{-04}$	43.61	$1.69x10^{-04}$	14.46
Perm 7	1.41	$3.54x10^{-04}$	30.55	$7.82x10^{-05}$	6.75
Perm 8	1.41	$8.32x10^{-04}$	71.89	$1.87x10^{-04}$	16.13

7 LABORATORY TEST RESULTS

The soil organic content laboratory test results are summarised in Table 3 below.

Table 3: Soil Organic Content Laboratory Results			
Sample ID	**Depth To and From (mbgl)**	**Ash Content (%)**	**Organic Content (%)**
TP04	0.0 – 0.1	95.8	4.2
TP14	0.0 – 0.1	94.7	5.3
TP29	0.0 – 0.1	96.0	4.0
TP41	0.0 – 0.1	91.4	8.6
TP46	0.0 – 0.1	95.6	4.4
TP48	0.0 – 0.1	74.5	25.5
TP23	0.0 – 0.1	94.6	5.4
TP15	0.0 – 0.1	96.7	3.3
Note: TP48 was located at the base of a previous lake which may explain the abnormally high organic content.			

8 GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS

8.1 General

Following our understanding of the preliminary development plans and our interpreted ground model, we consider that the site is suitable for supporting the proposed residential development, subject to the requirements of AS 2870-2011 and our specific earthworks recommendations detailed in Section 8.2 below.

8.2 Earthworks

Natural and uncontrolled fill sand is expected to be encountered throughout the full depth range of excavations (<1m depth) We anticipate that major cut to fill bulk earthworks will be required to form finished ground levels. This activity is considered appropriate for the site subject to the earthworks construction recommendations described below.

We note earthworks must be carried out in accordance with the recommendations provided in this report and AS3798-2007 *Guidelines on Earthworks for Commercial and Residential Developments*.

8.2.1 Topsoil Strip and Subgrade Preparation

- All vegetation must be stripped and removed from site;
- A 100mm topsoil strip should be considered appropriate for most of the site, however where thick root mats or otherwise unsuitable material is present to a greater depth then this should be removed and cut to waste or reused as fill within the POS areas;
- Existing trees must be removed and their root systems must be completely grubbed out. The soil beneath the root system must be proof rolled and backfilled to the specifications described below;

- Following the topsoil strip, the top 400mm of the soil profile should be tyned to bring any waste / uncontrolled fill to the surface. In some instances, the Earthworks Contractor may be required to excavate deeper to remove all waste / uncontrolled fill. Any organic (tree roots / stumps) or manmade waste observed should be removed from site. Alternatively, the fill material should be stockpiled for reuse as sand fill material following an inspection by a suitably qualified geotechnical engineer; and
- The upper 300mm of the exposed subgrade must be moisture conditioned with a water cart and compacted with a suitable roller to achieve at least 7 blows per 300mm penetration with a Perth Sand Penetrometer (PSP) excluding the top 150mm, which is equivalent to a dry density ratio of at least 95% based on Modified Compaction (AS1289 5.1.1). Any loose, soft, organic or manmade waste materials observed during this proof roll shall be removed and replaced with compacted clean sand fill.

8.2.2 Bulk Earthworks

We recommend the following during bulk earthworks:

- Material must be moisture conditioned with a water cart and compacted in layers not exceeding 300mm with a suitable roller to achieve at least 7 blows per 300mm penetration with a PSP excluding the top 150mm, which is approximately equivalent to a dry density ratio of 95% based on Modified Compaction (AS1289 5.2.1);
- Site won material from proposed cut earthworks is considered suitable for use in bulk earthworks from a geotechnical perspective, subject to adequate placement and providing that similar and consistent fill materials are used for specific applications (i.e. entire fill pads are constructed of similar fill materials); and
- Imported sand bulk fill materials will need to be free of organic or deleterious inclusions with a fines content of less than 5% of the fill volume and a maximum particle size of 100mm. It must be moisture conditioned with a water cart and compacted in layers not exceeding 300mm to achieve at least 7 blows per 300mm penetration with a PSP, which is equivalent to a dry density ratio of 95% based on Modified Compaction (AS1289 5.2.1).

8.2.3 Retaining Wall Backfill

We recommend the following during retaining wall backfilling:

- Backfill layers should be placed in maximum 300mm thick loose layers, moisture conditioned to within ±3% of the optimum moisture content and compacted with a suitable vibrating plate compactor to achieve a dry density ratio of at least 95% based on Modified Compaction (AS1289 5.2.1).

The technical and control requirements for Engineered Fill, including site observation and compaction testing, are outlined in AS3798-2007. We recommend that this work is completed under the direction and control of a suitably experienced Geotechnical Engineer familiar with the contents of this report.

8.2.4 Excavatability

The loose to very dense natural sands and uncontrolled fill sand encountered across the site may be excavated using standard mechanical plant.

8.2.5 Earthworks Monitoring

Variations in ground conditions may occur between test locations. If conditions other than those described above are encountered, then further advice should be sought without delay. During earthworks, site visits should be made by a Geotechnical Engineer or Engineering Geologist who is familiar with the contents of this report to ensure that topsoil stripping is carried out adequately, proof

compaction and cut to fill earthworks are conducted in accordance with AS3798-2007, and to audit the compaction of earthworks. Earthworks control testing should be undertaken in accordance with the guidelines set out in AS3798-2007. CMW would be pleased to perform this function if required.

8.2.6 Lake Remediation and Backfilling

We recommend the following during lake remediation and backfilling:;

- Drain lakes to remove water. Note: Some lakes may require dewatering as the base of the lake is below groundwater;
- Remove all organics and fill material above the liner;
- Remove liner from base of lakes and along embankments; and
- Once the liner has been removed the lakes should be backfilled with clean sand fill or site won material as mentioned in 8.2.2 and compacted in layers not exceeding 300mm to achieve at least 7 blows per 300mm penetration with a PSP, which is equivalent to a dry density ratio of 95% based on Modified Compaction (AS1289 5.2.1). Each layer of fill that is placed should be keyed (fill over cut) into the lake embankments to ensure each layer extends into intact foundation materials.

8.3 Strip and Pad Foundations

The design of available foundation bearing pressures for isolated strip and pad footings with 0.5m or 1.0m embedment depth has been carried out using the Terzaghi bearing capacity equation. Subject to completing the earthworks and foundation preparation recommendations provided in section 8.2 above, shallow strip or pad footings founded within medium dense near surface soils (<1m) or compacted fill material may be designed on the basis of the maximum allowable bearing pressures provided in Table 4.

Table 4: Summary of Shallow Footing Design Bearing Pressure

Embedment Depth (m)	Footing Width (m)	Footing Length (m)	Allowable Bearing Pressure (kPa)	Estimated Settlement (mm)
0.5	0.5 Strip		170	<5
	1 Strip		220	10-15
	1	1	200	5-10
	2	2	290	10-15
1.0	0.5 Strip		280	5-10
	1 Strip		330	15-20
	1	1	310	5-10
	2	2	400	20-25

These values are based on a geotechnical strength reduction factor of 0.5 and an average load factor of 1.5 (Factor of Safety = 3.0). It should be noted that these bearing pressures assume isolated vertical, non-eccentric loads. The assessment has been undertaken based on a static load and does not consider any dynamic or cyclic loading effects. It also does not consider any interaction of closely spaced foundations.

Subject to the earthworks and foundation preparation works being undertaken as described herein, it has been calculated that the total settlements of the footing configurations and design pressures outlined in Table 4 above is unlikely to exceed approximately 20mm to 25mm. Differential settlements are unlikely to exceed approximately one half of these values.

8.4 Retaining Wall Design

Localised cut and fill earthworks will be required along proposed property boundaries for subdivision layout and drainage purposes. All retaining wall footings will be founded on either reworked *in situ* or engineered sand fill material to depths of at least 0.5m. Based on this, recommended retaining wall design parameters are summarised in Table 5 below:

Table 5: Retaining Wall Design Parameters

Soil Unit	Y (kN/m^3)	Ø' (deg)	K_0	E' (MPa)	No wall friction		Wall friction = 2/3Ø	
					K_a	K_p	K_a	K_p
ENGINEERED FILL: SAND (medium dense)	18	34	0.441	60	0.283	3.537	0.254	8.952
SAND (medium dense)	18	34	0.441	60	0.283	3.537	0.254	8.952

Notes:
1. Refer to Table 1 for definition of soil unit levels.
2. Y – soil unit weight; Ø' - angle of internal soil friction; K_0 - coefficient of earth pressure at rest, K_a - coefficient of active earth pressure, K_p - coefficient of passive earth pressure; E' – long term Young's modulus.
3. Values of K_0 are based on initial conditions following construction of the walls.
4. The retaining wall designer must adopt the above set of K_a and K_p parameters relevant to the actual construction method adopted.
5. The above parameters are based on the condition of a horizontal ground surface behind the retaining structure. Applicable surcharge loads behind the wall must also be considered in the design.

Retaining structures should be designed in accordance with AS 4678-2002 "*Earth Retaining Structures*" or an alternate approved factor of safety approach. Should any fill be placed against the permanent retaining walls after construction, it is expected that the compaction induced pressures will be much greater than the above active earth pressures. The compaction equipment used to compact backfill behind the wall must be carefully selected and preferably light-weight compaction equipment should be used. The load on the retaining wall due to compaction equipment may be estimated from Figure J5 in AS4678-2002 *"Earth Retaining Structures"*.

It is noted that some ground movement will occur behind temporary or permanent retaining walls. By definition, movement of the wall must occur to fully mobilise the active and passive earth pressure coefficients provided in Table 5 above. The extent of this movement is dependent on the height of retaining wall, type of wall selected and construction methodology. This must be considered during the design and construction of the retaining walls to ensure adjacent facilities are not adversely affected.

Any ground anchors associated with retaining wall construction should be designed on the basis of the above effective stress soil parameters and using appropriate design standards such as BS8081.

8.5 Site Classification

A site classification of CLASS A in accordance with AS2870-2011 is recommended subject to the foundation preparation recommendations provided in Section 8.2 above.

8.6 Environmental

The National Acid Sulfate Soils Map shows that the site is located in a "low to moderate risk area for ASS occurring within 3m of natural surface".

After discussions with Steve Foley (JDSi) during our site walkover, it was mentioned some asbestos may be present across the site following the demolition of old infrastructure. The area in question was along the western boundary of the central precinct by Hartwell Parade. Potential asbestos in the form of an old, fractured pipe was found in the upper 0.5m of this area in TP28 (pictured in the test pit photographs). The same pipe was also found in the upper 1.6m of TP34, on the edge of lake in the southeastern portion of the northern precinct.

During bulk earthworks asbestos will need to be appropriately managed by a competent environmental consultant.

8.7 Pavement CBR

Based on the field density testing undertaken using the PSP and our experience with similar materials, it is recommended that pavements be designed on the basis of a subgrade CBR value of 12% due to the sandy nature of the soils.

This design CBR value is subject to the exposed subgrade being moisture conditioned and compacted in accordance with the recommendations provided in Section 8.2 above. It is recommended that appropriate QA / QC testing be undertaken on subgrade and pavement materials during construction.

8.8 Drainage

It is recommended that soakwells and drainage basins be designed on the basis of a saturated soil coefficient of permeability of 5 m/day subject to them being located a distance of at least 3m away from any structure foundations. This does not allow for any clogging, silting or other design aspects of the soakwells.

9 CLOSURE

The findings contained within this report are the result of limited discrete investigations conducted in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, can it be considered that these findings represent the actual state of the ground conditions away from our investigation locations.

If the ground conditions encountered during construction are significantly different from those described in this report and on which the conclusions and recommendations were based, then we must be notified immediately.

This report has been prepared for use by Eastcourt Property Group in relation to the proposed Glen Iris Estate residential subdivision project in accordance with generally accepted consulting practice. No other warranty, expressed or implied, is made as to the professional advice included in this report. Use of this report by parties other than Eastcourt Property Group and their respective consultants and contractors is at their risk as it may not contain sufficient information for any other purposes.

For and on behalf of
CMW Geosciences Pty Ltd

Reviewed by:

Mitchell Owen
Engineering Geologist

Alex Petty
Principal Geotechnical Engineer

Distribution: 1 copy to Eastcourt Property Group (electronic)
Original held by CMW Geosciences Pty Ltd

GLEN IRIS ESTATE SUBDIVISON, JANDAKOT, WA – GEOTECHNICAL INVESTIGATION 23 DECEMBER 2020

10 REFERENCES

- Appendix 4, Control of Groundwater for Temporary Works (CIRIA Report No. 113)
- AS 1170, *Structural design actions,* Standards Australia, Sydney, 2007
- AS 1289, *Methods of testing soils for engineering purposes,* Standards Australia, Sydney
- AS 1726, *Geotechnical Site Investigations,* Standards Australia, Sydney, 2017
- AS 2870, *Residential slabs and footings,* Standards Australia, Sydney, 2011
- AS 3798 (inc. amendment 1), *Guidelines on earthworks for commercial and residential developments,* Standards Australia, Sydney, 2007
- AS 4678 (inc amendments 1 & 2), *Earth retaining structures,* Standards Australia, Sydney, 2002
- BS 1377-9:1990 Methods for test for soils for civil engineering purposes. In-situ tests.
- Department of Environment and Conservation (DEC), 2011, Treatment and management of soils and water in acid sulfate soil landscapes, Acid Sulfate Soils Guideline Series.
- *Guide to Residential Slabs and Footings in Saline Environments (CCAA T56),* Cement Concrete & Aggregates Australia, 2005
- Hvorslev J M, *Time lag and soil permeability in ground-water observations,* Bull. 36, 50 pp., U.S. Corps of Eng., Waterways Exp. Sta., Vicksburg, Miss., 1951
- *Perth Groundwater Atlas,* Second Edition, Perth: Department of Environment, 2004
- *Fremantle, Sheet 2033 I & 2033 IV,* Perth Metropolitan Region Environmental Geology Series, Geological Survey of Western Australia, 1986
- Schmertmann, 1970 and Schmertmann et al, 1978.
- Terzaghi, K. (1943). Theoretical soil mechanics. 1st ed. New York: J. Wiley and Sons, Inc.
- WA Online Atlas, Shared Land Information Platform – ASS Risk Map, https://www2.landgate.wa.gov.au/bmvf/app/waatlas/.

CMW Geosciences Pty Ltd
Ref. PER2020-0452AB Rev 0

Figure

LEGEND:

- TP01 TEST PIT LOCATION
- PSP01 PERMEABILITY TEST LOCATION

NOTES:

1. AERIAL FROM NEARMAP 20.11.20

CMW Geosciences

CLIENT: JDSi CONSULTING ENGINEERS		DRAWN: DE	PROJECT: PER2020-0452
PROJECT: GLEN IRIS ESTATE JANDAKOT, WA		CHECKED: MO	DRAWING: 01
		REVISION: A	SCALE: 1:7500
TITLE: SITE INVESTIGATION PLAN		DATE: 22.12.20	SHEET: A3 P

Appendix A

Test Pit Logs, PSP Plots and Photos

TEST PIT LOG - TP01

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392145m N.6446295m
Elevation: 28 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			27.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				
						SP: SAND: fine to medium grained, subangular to subrounded; dark grey; trace fines; trace rootlets.		MD to D	6, 6, 6, 5, 6, 6	
				1			D to M			1.05m: PSP conducted within base of test pit
						... from 1.40m to 1.70m, trace branches		L to MD	1, 1, 3, 2, 3	
			26.0	2		Test pit terminated at 2.00 m			3	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP02

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392135m N.6446325m
Elevation: 28 m

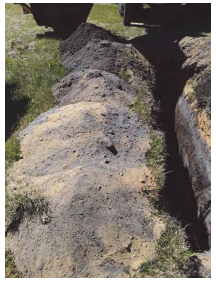
Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			27.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located behind retaining wall of lake
						FILL: SAND: fine to medium grained, subangular to subrounded; dark grey; trace fines; trace rootlets.			3, 4, 4	
						... at 0.20m, becoming pale yellow				
			27.6			SP: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets.		L to MD	3, 2, 3	
						... at 0.60m, becoming grey brown with orange				
				1			D to M			1.05m: PSP conducted within base of test pit
									2, 1, 3	
								MD to D	5, 6, 4	
			26.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.



TEST PIT LOG - TP03

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392058m N.6446394m
Elevation: 28 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			27.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located behind retaining wall of lake
			27.8			FILL: SAND: fine to medium grained, subangular to subrounded; grey brown; trace fines; trace rootlets; trace organics.		MD to D	5 7 5 6 7	
						FILL: SAND: fine to medium grained, subangular to subrounded; black with dark grey; trace fines; trace root and rootlets; trace coffee rock.				
						... at 0.90m, no longer rootlets				
			27.0	1		SP: SAND: fine to medium grained, subangular to subrounded; grey; trace fines.	D to M	VD	11	
			26.0	2		COFFEE ROCK: fine to medium grained, subangular to subrounded; dark brown; weakly cemented; trace fines.				
			26.0			Test pit terminated at 2.05 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP04

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391978m N.6446343m
Elevation: 26 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
	0.0 - 0.1	D	25.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.		MD	4	
			25.7			FILL: SAND: fine to medium grained, subangular to subrounded; orange grey; trace fines; trace rootlets; trace organics.			11	
						FILL: SAND: fine to medium grained, subangular to subrounded; trace gravel; pale yellow; trace fines; trace rootlets; trace cobbles; gravel and cobbles are limestone; trace uncontrolled fill (bricks, rubbish).			10	
								D to VD	8	
			25.2			SP: SAND: fine to medium grained, subangular to subrounded; black with dark grey; trace fines; trace rootlets.			7	
				1		*... at 1.10m, no longer rootlets*	D to M		10	1.05m: PSP conducted within base of test pit
									4	
									5	
								MD to D	5	
									4	
									4	
			24.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP05

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392208m N.6446432m
Elevation: 28 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			27.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.		D to VD	5, 7, 7, 9, 9, 10	
				1		SP: SAND: fine to medium grained, subangular to subrounded; dark grey; trace fines; trace rootlets.	D to M			1.05m: PSP conducted within base of test pit
						... at 1.30m, trace branches		D	5, 5, 6, 5, 5	
			26.0	2		Test pit terminated at 2.00 m			5	
				3						

Perth Sand Penetrometer (Blows/150mm) scale: 5, 10, 15

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP06

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392152m N.6446434m
Elevation: 26 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			25.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.		L	2, 3, 3	0.00m: test pit located next to lake
				1		SP: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets.	D to M	D to VD	5, 8, 8	1.05m: PSP conducted within base of test pit
						... at 0.30m, becoming pale grey			3, 5, 6	
			24.1			COFFEE ROCK: fine to medium grained, subangular to subrounded; black; weakly cemented; trace fines.		VD	10, 20	
			24.0	2		Test pit terminated at 2.00 m				
				3						

Perth Sand Penetrometer (Blows/150mm) scale: 5, 10, 15

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP07

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392068m N.6446510m
Elevation: 27 m

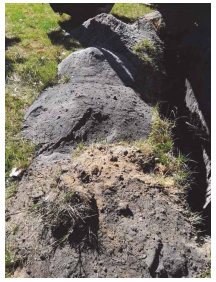
Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			26.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			6	
			26.7			FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets; trace organics.			4	
						... at 0.20m, becoming pale grey with orange		MD to D	5	
						SP: SAND: fine to medium grained, subangular to subrounded; black with dark grey; trace fines; trace root and rootlets; trace branches.			4	
						... at 0.50m, becoming grey			5	
				1			D to M		6	1.05m: PSP conducted within base of test pit
									3	
									3	
								L to MD	3	
									3	
									4	
			25.0	2		Test pit terminated at 2.00 m			4	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.



This report must be read in conjunction with accompanying notes and abbreviations.

TEST PIT LOG - TP08

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392172m N.6446593m
Elevation: 29 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			28.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			5	
						SP: SAND: fine to medium grained, subangular to subrounded; dark orange with brown; trace fines; trace rootlets.			5	
						... at 0.50m, becoming orange		D	6	
									5	
									6	
				1			D to M		5	1.05m: PSP conducted within base of test pit
									2	
									3	
								L to MD	3	
									3	
									4	
			27.0	2		Test pit terminated at 2.00 m			3	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

This report must be read in conjunction with accompanying notes and abbreviations.

TEST PIT LOG - TP09

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391961m N.6446622m
Elevation: 28 m

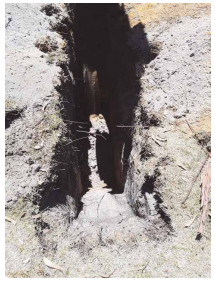
Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			27.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation and branches.			5	
						SP: SAND: fine to medium grained, subangular to subrounded; grey with black orange; trace fines; trace root and rootlets; trace branches.			6	
									6	
									5	
						... at 0.80m, no longer branches	D to M	D to VD		
				1						1.05m: PSP conducted within base of test pit
						... at 1.40m, becoming orange			4	
									7	
									8	
									8	
									8	
			26.0	2		Test pit terminated at 2.00 m			9	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.



TEST PIT LOG - TP10

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392112m N.6446693m
Elevation: 31 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			30.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			4	
						SP: SAND: fine to medium grained, subangular to subrounded; grey with black orange; trace fines; trace rootlets.			4	
						... at 0.20m, becoming pale grey		D to VD	7	
									10	
						... at 0.80m, becoming orange	D to M		9	
				1					8	1.05m: PSP conducted within base of test pit
									2	
									3	
								L to MD	4	
									4	
									5	
			29.0	2		Test pit terminated at 2.00 m			4	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP11

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392038m N.6446762m
Elevation: 31 m
Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting
Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			30.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on a mound
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace root and rootlets; trace branches.			3, 4, 5	
						... at 0.30m, becoming orange with grey		MD to D	5, 4	
			30.2			SP: SAND: fine to medium grained, subangular to subrounded; grey and orange; trace fines; trace root and rootlets.			4	
				1		*... at 0.90m, no longer roots and rootlets*	D to M			1.05m: PSP conducted within base of test pit
									5	
								VD	8, 14	
			29.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP12

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392037m N.6446878m
Elevation: 29 m
Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting
Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			29.0			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on a green
						FILL: SAND: fine to medium grained, subangular to subrounded; grey with orange; trace fines; trace rootlets.			5	
						... at 0.20m, becoming dark grey with black		D to VD	6	
			28.6			*... from 0.21m to 0.35m, coffee rock, only found in discrete area* SP: SAND: fine to medium grained, subangular to subrounded; orange with grey; trace fines.			11	
									20	
				1			D to M			1.05m: PSP conducted within base of test pit
			27.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP13

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392127m N.6446838m
Elevation: 28 m

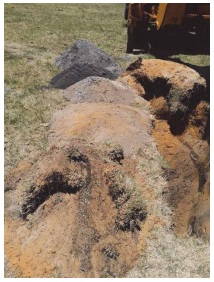
Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			27.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			6	
						SP: SAND: fine to medium grained, subangular to subrounded; orange with pale grey; trace fines; trace root and rootlets.			7	
						... at 0.40m, becoming grey with orange and black			6	
									8	
									10	
				1			D to M	D to VD	8	1.05m: PSP conducted within base of test pit
						... at 1.20m, becoming black with grey and orange			4	
									7	
									11	
									9	
									8	
			26.0	2		Test pit terminated at 2.00 m			8	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.



TEST PIT LOG - TP14

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392214m N.6446932m
Elevation: 31 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
	0.0 - 0.1	D	30.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			3	0.00m: test pit located on a tee box
						FILL: SAND: fine to medium grained, subangular to subrounded; dark grey with black; trace fines; trace root and rootlets.			4	
									4	
									5	
									4	
									4	
			30.0	1		SP: SAND: fine to medium grained, subangular to subrounded; pale grey with orange; trace fines; trace root and rootlets; trace branches.	D to M	MD to D	3	1.05m: PSP conducted within base of test pit
						... at 1.60m, no longer branches			4	
									6	
									5	
									6	
			29.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP15

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392112m N.6446995m
Elevation: 29 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
	0.0 - 0.1	D	28.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			6	0.00m: test pit located on tee box
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets.			11	
			28.5			SP: SAND: fine to medium grained, subangular to subrounded; yellow; trace fines.			12	
						... from 0.60m to 0.80m, becoming black			12	
						... at 0.80m, becoming yellow, no longer rootlets			10	
				1			D to M	D to VD	10	1.05m: PSP conducted within base of test pit
									4	
									5	
									10	
									22	
			27.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP16

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392205m N.6447054m
Elevation: 30 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			29.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			6	0.00m: test pit located on mound
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets.			7	
						... at 0.30m, becoming pale yellow		D to VD	7	
			29.3			SP: SAND: fine to medium grained, subangular to subrounded; yellow; trace fines.			7	
									8	
				1			D to M		7	1.05m: PSP conducted within base of test pit
								L	1	
									1	
									2	
									2	
									4	
			28.0	2		Test pit terminated at 2.00 m		D to VD	8	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP17

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392177m N.6447122m
Elevation: 30 m
Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting
Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
	0.0 - 0.1	D	29.8			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey black; trace fines; trace organics; trace roots and rootlets; trace vegetation.			3	0.00m: test pit located on mound
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets.			3	
						... at 0.50m, becoming white. Not a homogenous layer			3	
			29.3			SP: SAND: fine to medium grained, subangular to subrounded; yellow; trace fines.	D to M	MD to D	5	
				1					6	
									6	1.05m: PSP conducted within base of test pit
									3	
									3	
									4	
									5	
									6	
			28.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP18

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392132m N.6447199m
Elevation: 28 m
Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting
Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			27.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			5	
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets; trace branches; with some uncontrolled fill (old reticulation pipe, tree roots, bricks).			5	
									6	
								D to VD	5	
									5	
			27.1			SP: SAND: fine to medium grained, subangular to subrounded; yellow; trace fines; trace root.	D to M		7	
				1		*... at 1.10m, becoming grey*				1.05m: PSP conducted within base of test pit
									9	
									20	
			26.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP19

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392209m N.6447301m
Elevation: 29 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			28.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey brown; trace fines; trace organics; trace rootlets.			5	0.00m: test pit located on green
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow with grey; trace fines.			10 17	
			28.0	1		SP: SAND: fine to medium grained, subangular to subrounded; yellow; trace fines.	D to M	D to VD	6 8 10 12 16	1.05m: PSP conducted within base of test pit
			27.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP20

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392305m N.6447413m
Elevation: 30 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			29.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			6	
						FILL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey yellow; trace fines; trace rootlets; gravel is limestone.		D to VD	4 4 6	
			29.2	1		SP: SAND: fine to medium grained, subangular to subrounded; yellow; trace fines.	D to M		11 15	1.05m: PSP conducted within base of test pit
			28.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP21

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO | Position: E.392233m N.6447425m | Plant: JCB 8 tonne backhoe
Checked by:AP | Elevation: 31 m | Contractor: ANH Contracting | Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			30.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on mound
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow with black; trace fines; trace rootlets.		MD to D	4 5 5	
						... at 0.50m, no longer branches				
				1			D to M		2 2 2	1.05m: PSP conducted within base of test pit
								L	1 2 1 1 1 2 1	
			29.1			SP: SAND: fine to medium grained, subangular to subrounded; orange with grey.				
			29.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP22

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO | Position: E.392210m N.6447383m | Plant: JCB 8 tonne backhoe
Checked by:AP | Elevation: 31 m | Contractor: ANH Contracting | Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			30.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on mound
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow with grey; trace fines; trace rootlets.			4 4	
						... at 0.70m, no longer rootlets		MD to D	5 4 4 3	
				1			D to M			1.05m: PSP conducted within base of test pit
								L	1 1 1 1 1 1	
			29.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP23

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392132m N.6447358m
Elevation: 29 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			28.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on driving range
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets.		MD to D	4, 3, 7	
			28.4			SP: SAND: fine to medium grained, subangular to subrounded; pale grey white; trace fines.		VD	10, 12, 10	
				1			D to M			1.05m: PSP conducted within base of test pit
								MD to D	3, 4, 5, 5, 6	
			27.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP24

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392095m N.6447310m
Elevation: 30 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			29.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace branches; trace vegetation.				0.00m: test pit located on tee box
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow with grey; trace fines; trace rootlets.		MD to D	4, 6, 6	
				1		*... at 1.30m, becoming dark grey*	D to M		5, 6, 4	1.05m: PSP conducted within base of test pit
								D to VD	6, 9, 10, 7, 6	
			28.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP25

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392026m N.6447373m
Elevation: 32 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			31.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace branches; trace vegetation.				0.00m: test pit located on mound
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow with grey; trace fines; trace root and rootlets; trace branches.		D	5, 6, 6, 7, 7, 7	
						... at 0.45m, no longer branches				
				1			D to M			1.05m: PSP conducted within base of test pit
								MD to D	2, 4, 5, 4, 5	
			30.1			SP: SAND: fine to medium grained, subangular to subrounded; yellow.				
			30.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP26

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392008m N.6447494m
Elevation: 28 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			27.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on driving range
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets.		MD to D	3, 4, 5, 6, 6, 6	
			27.3			SP: SAND: fine to medium grained, subangular to subrounded; pale grey with black; trace fines; trace rootlets.				
				1		*... at 0.90m, no longer rootlets*	D to M			1.05m: PSP conducted within base of test pit
								L	1, 1, 1	
								MD	3, 3, 3, 4	
			25.8	2		*... at 2.10m, becoming pale brown*				
						Test pit terminated at 2.20 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP27

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391844m N.6447426m
Elevation: 27 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			26.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on mound
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace root and rootlets; trace branches.		D to VD	5, 4, 7, 9, 10, 10	
			26.5			SP: SAND: fine to medium grained, subangular to subrounded; pale grey; trace fines.	D to M			
				1						1.05m: PSP conducted within base of test pit
								MD to D	3, 5, 5, 5, 6	
			25.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP28

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391771m N.6447468m
Elevation: 28 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			27.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on green
						FILL: SAND: fine to medium grained, subangular to subrounded; grey with pale yellow; trace fines; trace root and rootlets; trace branches; with some uncontrolled fill (tree roots, potential asbestos at 0.5m).		D to VD	4, 6, 6, 4, 4, 4	
				1			D to M			1.05m: PSP conducted within base of test pit
								L	1, 1, 1, 1	
								MD to D	3, 7, 7	
			26.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP29

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391692m N.6447613m
Elevation: 27 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
	0.0 - 0.1	D	26.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on tee box
						SP: SAND: fine to medium grained, subangular to subrounded; grey with orange; trace fines; trace rootlets.		MD to D	3, 4, 4	
						... at 0.45m, becoming pale grey			7	
						... at 0.60m, no longer rootlets		VD	10, 9	
				1			D to M			1.05m: PSP conducted within base of test pit
								L to MD	2, 2, 3, 4, 4	
						... at 1.80m, becoming brown orange				
			25.0	2		Test pit terminated at 2.00 m			4	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP30

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391668m N.6447725m
Elevation: 26 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			25.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on a mound
						SP: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace root and rootlets.			7, 8, 7, 6, 6, 7	
								D to VD		
				1		... from 1.00m to 1.60m, high root content	D to M			1.05m: PSP conducted within base of test pit
									3, 8, 14	
			24.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP31

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391798m N.6447972m
Elevation: 26 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			25.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				
						SP: SAND: fine to medium grained, subangular to subrounded; dark grey with black; trace fines; trace root and rootlets; trace branches.		D	5 5 7 5 6 5	
						... at 0.40m, becoming pale grey				
						... at 0.90m, no longer roots, rootlets or branches	D to M			
				1						1.05m: PSP conducted within base of test pit
								L	2 2 3	
								MD to D	4 4 5	
			24.0	2		Test pit terminated at 1.80 m				
				3						

Termination Reason: Test pit walls collapsing

Remarks: Backfilled.

TEST PIT LOG - TP32

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391789m N.6447873m
Elevation: 27 m

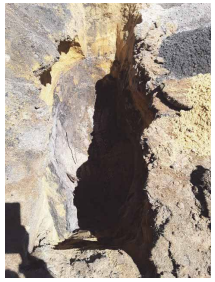
Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 1.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			27.0	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; with organics; trace rootlets; trace vegetation.				0.00m: test pit located on green
			26.9			FILL: SAND: fine to medium grained, subangular to subrounded; brown orange; trace fines; trace rootlets; trace organics.				
						SP: SAND: fine to medium grained, subangular to subrounded; orange.		D to VD	5 9 9 9 9 8	
						... at 0.60m, becoming black with grey				
						... at 1.00m, becoming grey with black	D to M			
				1						1.05m: PSP conducted within base of test pit
								L	2 4 6	
								MD to D	5 5 6	
			25.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.



TEST PIT LOG - TP33

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391914m N.6447886m
Elevation: 29 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 1.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			29.0	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; with organics; trace rootlets; trace vegetation.		MD to D	5, 7, 7, 4, 4, 5	0.00m: test pit located on green
			28.9			FILL: SAND: fine to medium grained, subangular to subrounded; brown orange; trace fines; trace root and rootlets; trace organics.				
						SP: SAND: fine to medium grained, subangular to subrounded; grey with orange.	D to M			
				1						1.05m: PSP conducted within base of test pit
								VD	5, 9, 10, 12, 11, 12	
			27.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP34

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391798m N.6447972m
Elevation: 27 m

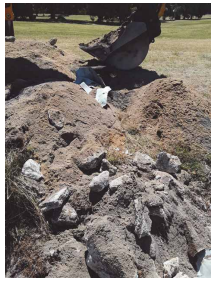
Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			26.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; with gravel, coarse grained, subangular to subrounded; with cobbles and boulders, subangular to subrounded (surface); dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation and branches.		MD to D	4, 5, 6, 6	0.00m: test pit located next to lake
						FILL: SAND: fine to medium grained, subangular to subrounded; orange brown with black; trace fines; trace rootlets.		VD	8, 10	0.20m: plastic liner
				1			D to M			1.05m: PSP conducted within base of test pit
						... at 1.40m, increasing black colouration		VL to L	1, 1, 3	
						... at 1.60m, potential asbestos pipe				
			25.2	2		Test pit terminated at 1.80 m		D to VD	5, 6, 8	
				3						

Termination Reason: Test pit walls collapsing

Remarks: Backfilled.



TEST PIT LOG - TP35

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391695m N.6447961m
Elevation: 26 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			25.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				
						SP: SAND: fine to medium grained, subangular to subrounded; dark grey; trace fines; trace root and rootlets.		D to VD	6, 8, 12, 17	
						... at 0.50m, becoming pale grey	D to M			
				1						
				2						
			23.8			Test pit terminated at 2.20 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP36

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391780m N.6448083m
Elevation: 33 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			33.0	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; with organics; trace fines; trace rootlets; trace vegetation.				0.00m: test pit located on green
			32.8			FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace root and rootlets; trace organics.				
						SP: SAND: fine to medium grained, subangular to subrounded; orange; trace fines.		D to VD	4, 7, 10, 10, 12, 14	
						... at 0.70m, becoming pale yellow with orange	D to M			
				1						1.05m: PSP conducted within base of test pit
			31.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP37

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391641m N.6448108m
Elevation: 31 m

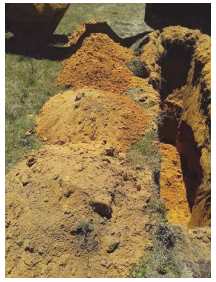
Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

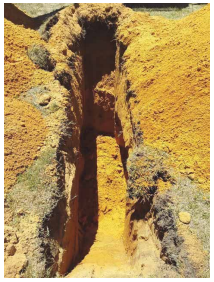
Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			30.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation and branches.				
						FILL: SAND: fine to medium grained, subangular to subrounded; pale grey orange; trace fines; trace rootlets.		VD	8, 9, 10, 11, 14	
			30.5			SP: SAND: fine to medium grained, subangular to subrounded; orange; trace fines; trace rootlets.	D to M			
				1						1.05m: PSP conducted within base of test pit
			29.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.





TEST PIT LOG - TP38

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391687m N.6448201m
Elevation: 40 m

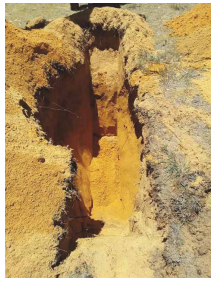
Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			39.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on a mound
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow; trace fines; trace root and rootlets.		L	3, 2, 3, 3	
			39.2			SP: SAND: fine to medium grained, subangular to subrounded; orange; trace fines; trace rootlets.	D to M	MD to D	4, 4	
				1						
								VD	6, 13	
			38.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.



TEST PIT LOG - TP39

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391604m N.6448263m
Elevation: 39 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			38.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation and branches.				0.00m: test pit located on a mound
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow; trace fines; trace rootlets.		D to VD	6, 7, 10	
			38.4			SP: SAND: fine to medium grained, subangular to subrounded; orange; trace fines.			12, 16	
				1			D to M			
			37.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP40

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391717m N.6448301m
Elevation: 37 m

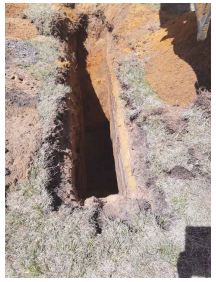
Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			36.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				
			36.7			FILL: SAND: fine to medium grained, subangular to subrounded; orange brown; trace fines; trace rootlets.			5	
						SP: SAND: fine to medium grained, subangular to subrounded; orange with black; trace fines; trace rootlets.			6, 6, 6, 6, 7	
				1			D to M	D to VD		1.05m: DCP conducted within base of test pit
									5, 8, 9, 9, 8, 8	
			35.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.



TEST PIT LOG - TP41

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391656m N.6448386m
Elevation: 40 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
	0.0 - 0.1	D	39.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on a mound
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow with black; trace fines; trace rootlets.	D to M	D	5, 6, 6, 6, 7, 7	
				1						1.05m: DCP conducted within base of test pit
			38.6			SP: SAND: fine to medium grained, subangular to subrounded; orange with black; trace fines; trace rootlets.		L	2, 3	
								D to VD	6, 9, 15	
			38.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP42

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391769m N.6448368m
Elevation: 36 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			35.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation and branches.				
			35.7			FILL: SAND: fine to medium grained, subangular to subrounded; orange brown; trace fines; trace rootlets.	D to M	D to VD	5, 7, 14	
				1		SP: SAND: fine to medium grained, subangular to subrounded; orange; trace fines; trace root and rootlets.			5, 6, 6, 6, 5, 6	1.05m: DCP conducted within base of test pit
			34.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP43

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391858m N.6448357m
Elevation: 35 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			34.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.		MD	4	
						FILL: SAND: fine to medium grained, subangular to subrounded; grey orange; trace fines; trace rootlets.			4	
			34.4						7	
						SP: SAND: fine to medium grained, subangular to subrounded; orange with black white; trace fines; trace rootlets.			7	
									8	
				1			D to M	D to VD	12	1.05m: DCP conducted within base of test pit
									7	
									15	
			33.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP44

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391800m N.6448352m
Elevation: 35 m

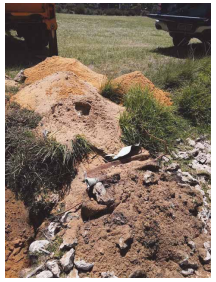
Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			34.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; with gravel, coarse grained, subangular to subrounded; with cobbles and boulders, subangular to subrounded (surface); dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation and branches.		MD	3	0.00m: test pit located next to lake
			34.8			FILL: SAND: fine to medium grained, subangular to subrounded; brown orange; trace fines; trace root and rootlets.			5	0.20m: plastic liner
						SP: SAND: fine to medium grained, subangular to subrounded; orange; trace fines; trace rootlets.			6	
								D to VD	9	
				1			D to M		9	
									9	
			33.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.



TEST PIT LOG - TP45

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391830m N.6448277m
Elevation: 37 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			36.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on a tee box
						FILL: SAND: fine to medium grained, subangular to subrounded; grey with black; trace fines; trace rootlets.		D	5, 6, 6	
			36.4			SP: SAND: fine to medium grained, subangular to subrounded; orange with black white; trace fines; trace rootlets.			7, 11, 17	
				1			D to M	D to VD		1.05m: DCP conducted within base of test pit
			35.0	2		Test pit terminated at 2.00 m			7, 13	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP46

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391760m N.6448174m
Elevation: 42 m

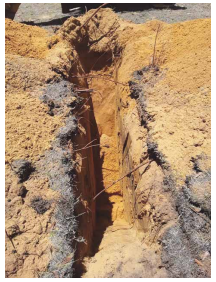
Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
	0.0 - 0.1	D	41.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation and branches.				0.00m: test pit located on a mound
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow; trace fines; trace root and rootlets; trace branches.		MD to D	8, 5, 4	
			41.4			SP: SAND: fine to medium grained, subangular to subrounded; orange; trace fines; trace rootlets.			8, 10, 9	
				1			D to M	D to VD		1.05m: PSP conducted within base of test pit
			40.0	2		Test pit terminated at 2.00 m			7, 13	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.



TEST PIT LOG - TP47

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392020m N.6447932m
Elevation: 27 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			26.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation and branches.				
			26.7			FILL: SAND: fine to medium grained, subangular to subrounded; brown orange; trace fines; trace root and rootlets.				
						SP: SAND: fine to medium grained, subangular to subrounded; white; trace fines; trace root and rootlets.		D to VD	7, 8, 9, 11	
				1		... at 0.90m, becoming orange	D to M			1.05m: DCP conducted within base of test pit
								MD to D	3, 4, 5, 6, 6	
			25.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP48

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392002m N.6447829m
Elevation: 26 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
	0.0 - 0.1	D	25.9			TOPSOIL: CLAYEY SAND: fine to medium grained, subangular to subrounded; clay, low plasticity; dark grey brown; with organics; trace roots and rootlets; very light, crusted material found at base of lake.	M			0.00m: test pit located on a previous lake
						FILL: SAND: fine to medium grained, subangular to subrounded; orange brown; trace fines.	W	VL to L	2, 3	
			25.5			SP: SAND: fine to medium grained, subangular to subrounded; white; trace fines.			6, 6, 7	0.50m: plastic liner
				1			M			1.05m: DCP conducted within base of test pit
								MD to D	3, 5, 6, 7, 7	
				2		Test pit terminated at 2.00 m			7	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP49

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392001m N.6447777m
Elevation: 28 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			27.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on a mound
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow; trace fines; trace rootlets.		VD	8, 8, 8, 9, 10, 9	
						... at 0.70m, becoming pale yellow with black	D to M			
				1						1.05m: DCP conducted within base of test pit
								MD to D	3, 5, 5, 4, 3, 4	
			26.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP50

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392027m N.6447786m
Elevation: 27 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			26.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				
			26.8			FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace root and rootlets.				
						SP: SAND: fine to medium grained, subangular to subrounded; pale grey; trace fines; trace root and rootlets; trace branches.				
						... at 0.70m, becoming orange	D to M			
				1				MD to D	5, 4, 5, 4, 4, 4	1.05m: PSP conducted within base of test pit
									3, 4, 5, 5, 6, 6	
			25.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP51

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 7

Logged by: MO
Checked by:AP

Position: E.392051m N.6447678m
Elevation: 27 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			26.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace root and rootlets.		D	6, 6, 7	
			26.4			SP: SAND: fine to medium grained, subangular to subrounded; pale grey; trace fines; trace rootlets.			7, 7, 7	
				1			D to M			1.05m: PSP conducted within base of test pit
								L	2, 3	
								MD	4, 4	
									11, 11	
			25.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP52

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392157m N.6447272m
Elevation: 26 m

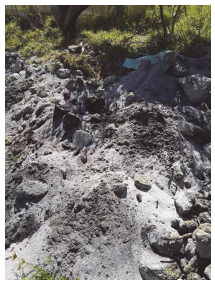
Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			25.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; with gravel, coarse grained, subangular to subrounded; with cobbles and boulders, subangular to subrounded (surface); dark grey; trace fines; trace organics; trace roots and rootlets; trace vegetation and branches.		MD	3	0.00m: test pit located on edge of lake 0.10m: plastic liner on lake embankment
			25.7			SAND: FILL: fine to medium grained, subangular to subrounded; brown orange, trace roots and rootlets.			6	
						SP: SAND: fine to medium grained, subangular to subrounded; pale grey; trace fines; trace root and rootlets.			8	
									8	
							D to M	D to VD	9	
						... at 0.90m, becoming orange			8	
			25.0	1		COFFEE ROCK: fine to medium grained, subangular to subrounded; dark brown; weakly cemented; trace fines.				1.05m: DCP conducted within base of test pit
									4	
								VD	20	
			24.3			Test pit terminated at 1.70 m				
				2						
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.



TEST PIT LOG - TP53

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392109m N.6447575m
Elevation: 28 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			27.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on mound
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets.			5	
			27.6			SP: SAND: fine to medium grained, subangular to subrounded; pale grey; trace fines; trace root and rootlets.		D to VD	7	
									7	
									6	
				1			D to M		7	
									9	1.05m: PSP conducted within base of test pit
									4	
								MD to D	5	
									6	
									6	
									6	
			26.0	2		Test pit terminated at 2.00 m			6	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP54

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392112m N.6447508m
Elevation: 30 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			29.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on mound
						FILL: SAND: fine to medium grained; dark grey with black; trace fines; trace rootlets.			2	
									1	
									1	
								L	1	
				1			D to M		1	
									1	1.05m: PSP conducted within base of test pit
									1	
									2	
								MD	4	
									6	
			28.1						8	
			28.0	2		SP: SAND: fine to medium grained, subangular to subrounded; pale grey.		VD	8	
						Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP55

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

CMW Geosciences

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392174m N.6447445m
Elevation: 29 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			28.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow; trace fines; trace rootlets.	D to M	D	6, 7, 7, 7, 7, 6	
			27.8	1		SP: SAND: fine to medium grained, subangular to subrounded; orange; trace fines.		MD to D	3, 3, 4, 5, 6	1.05m: PSP conducted within base of test pit
			27.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

Appendix B

Permeability Test Results

CMW Geosciences	CLIENT: JDSi Consulting Engineers	DESIGNER:	MO
	PROJECT: Glen Iris Estate Jandakot, WA	CHECKED:	AP
		REVISION:	1
	TITLE: Falling Head Permeability Test 1	DATE:	3/12/2020
		PROJECT:	PER2020-0452

Specifications - Open-Ended Tube

Length L_1:	1.41	m
Diameter:	80	mm
Non-Perm L_2:		m
Above Gnd L_3:	0.05	m

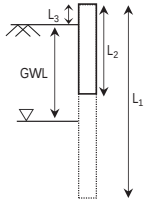
Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m: 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.36 m BGL



Hydraulic Conductivity (k)

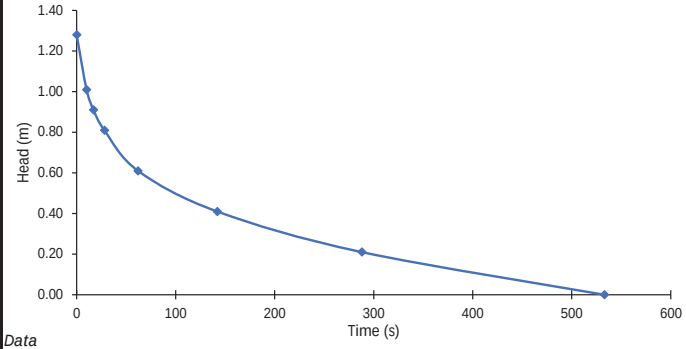
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 3.15E-04 ms^{-1} : 27.22 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2 \ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 6.50E-05 ms^{-1} : 5.61 m/day



STRATIGRAPHIC LOG

Sand

EOH @ 1.36m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})
0	0.130	1.280				
10	0.400	1.010	1.145		5.55E-05	4.01E-04
17	0.500	0.910	0.960		3.95E-05	2.49E-04
28	0.600	0.810	0.860		3.02E-05	1.76E-04
62	0.800	0.610	0.710		2.71E-05	1.39E-04
142	1.000	0.410	0.510		1.99E-05	8.19E-05
288	1.200	0.210	0.310		2.44E-05	7.49E-05
533	1.410	0.000	0.105		2.58E-04	1.08E-03

12.00

CMW Geosciences	CLIENT: JDSi Consulting Engineers	DESIGNER:	MO
	PROJECT: Glen Iris Estate Jandakot, WA	CHECKED:	AP
		REVISION:	1
	TITLE: Falling Head Permeability Test 2	DATE:	3/12/2020
		PROJECT:	PER2020-0452

Specifications - Open-Ended Tube

Length L_1:	1.43	m
Diameter:	80	mm
Non-Perm L_2:		m
Above Gnd L_3:	0.01	m

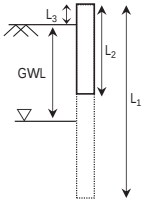
Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m: 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.42 m BGL



Hydraulic Conductivity (k)

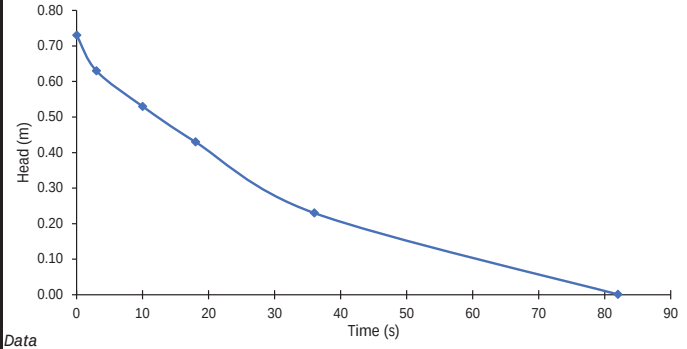
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 1.22E-03 ms^{-1} : 105.00 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2 \ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 2.99E-04 ms^{-1} : 25.84 m/day



STRATIGRAPHIC LOG

Sand

EOH @ 1.42m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})
0	0.700	0.730				
3	0.800	0.630	0.680		1.64E-04	8.08E-04
10	0.900	0.530	0.580		9.12E-05	4.03E-04
18	1.000	0.430	0.480		1.09E-04	4.22E-04
36	1.200	0.230	0.330		1.79E-04	5.68E-04
82	1.429	0.001	0.116		9.52E-04	3.87E-03

49.11

CMW Geosciences	CLIENT: JDSi Consulting Engineers	DESIGNER:	MO
	PROJECT: Glen Iris Estate, Jandakot, WA	CHECKED:	AP
		REVISION:	1
	TITLE: Falling Head Permeability Test 3	DATE:	3/12/2020
		PROJECT:	PER2020-0452

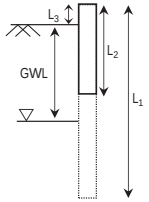
Specifications - Open-Ended Tube

Length L_1: 1.39 m
Diameter: 80 mm
Non-Perm L_2: m
Above Gnd L_3: 0.04 m

Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)
Permeability Anisotropy
m: 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.35 m BGL



Hydraulic Conductivity (k)

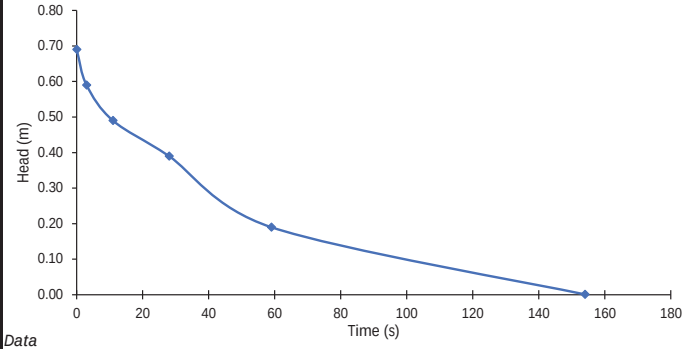
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 6.73E-04 ms^{-1} : 58.18 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2 ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 1.85E-04 ms^{-1} : 16.00 m/day



STRATIGRAPHIC LOG

Sand

EOH @ 1.35m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})	
0	0.700	0.690					
3	0.800	0.590	0.640		1.81E-04	8.56E-04	
11	0.900	0.490	0.540		8.97E-05	3.77E-04	
28	1.000	0.390	0.440		5.87E-05	2.15E-04	
59	1.200	0.190	0.290		1.28E-04	3.80E-04	32.79
154	1.389	0.001	0.095		4.68E-04	1.54E-03	

CMW Geosciences	CLIENT: JDSi Consulting Engineers	DESIGNER:	MO
	PROJECT: Glen Iris Estate, Jandakot, WA	CHECKED:	AP
		REVISION:	1
	TITLE: Falling Head Permeability Test 4	DATE:	3/12/2020
		PROJECT:	PER2020-0452

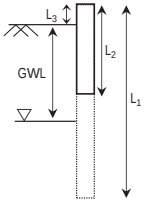
Specifications - Open-Ended Tube

Length L_1: 1.42 m
Diameter: 80 mm
Non-Perm L_2: m
Above Gnd L_3: 0.04 m

Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)
Permeability Anisotropy
m: 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.38 m BGL



Hydraulic Conductivity (k)

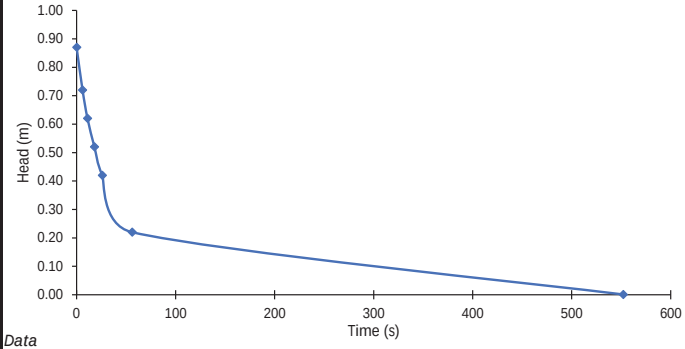
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 4.25E-04 ms^{-1} : 36.75 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2 ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 1.01E-04 ms^{-1} : 8.69 m/day



STRATIGRAPHIC LOG

Fill

EOH @ 1.38m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})	
0	0.550	0.870					
6	0.700	0.720	0.795		9.50E-05	5.25E-04	
11	0.800	0.620	0.670		1.01E-04	4.92E-04	
18	0.900	0.520	0.570		9.39E-05	4.10E-04	
26	1.000	0.420	0.470		1.12E-04	4.30E-04	37.18
56	1.200	0.220	0.320		1.13E-04	3.52E-04	
552	1.419	0.001	0.111		8.87E-05	3.43E-04	

CMW Geosciences	CLIENT: JDSi Consulting Engineers	DESIGNER:	MO
	PROJECT: Glen Iris Estate Jandakot, WA	CHECKED:	AP
		REVISION:	1
	TITLE: Falling Head Permeability Test 5	DATE:	3/12/2020
		PROJECT:	PER2020-0452

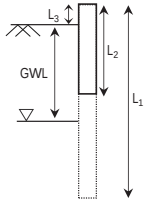
Specifications - Open-Ended Tube

Length L_1: 1.42 m
Diameter: 80 mm
Non-Perm L_2: m
Above Gnd L_3: 0.02 m

Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)
Permeability Anisotropy
m: 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.40 m BGL



Hydraulic Conductivity (k)

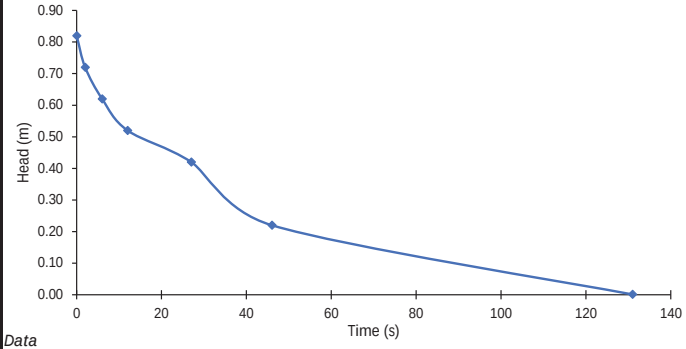
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 8.26E-04 ms^{-1} : 71.39 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2 \ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 1.99E-04 ms^{-1} : 17.16 m/day



STRATIGRAPHIC LOG

Sand

EOH @ 1.4m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})	
0	0.600	0.820					
2	0.700	0.720	0.770		2.00E-04	1.08E-03	
6	0.800	0.620	0.670		1.26E-04	6.15E-04	
12	0.900	0.520	0.570		1.10E-04	4.78E-04	
27	1.000	0.420	0.470		5.99E-05	2.29E-04	19.83
46	1.200	0.220	0.320		1.78E-04	5.56E-04	
131	1.419	0.001	0.111		5.18E-04	2.00E-03	

CMW Geosciences	CLIENT: JDSi Consulting Engineers	DESIGNER:	MO
	PROJECT: Glen Iris Estate Jandakot, WA	CHECKED:	AP
		REVISION:	1
	TITLE: Falling Head Permeability Test 6	DATE:	3/12/2020
		PROJECT:	PER2020-0452

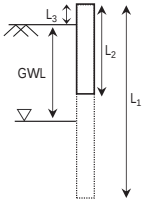
Specifications - Open-Ended Tube

Length L_1: 1.44 m
Diameter: 80 mm
Non-Perm L_2: m
Above Gnd L_3: 0.04 m

Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)
Permeability Anisotropy
m: 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.40 m BGL



Hydraulic Conductivity (k)

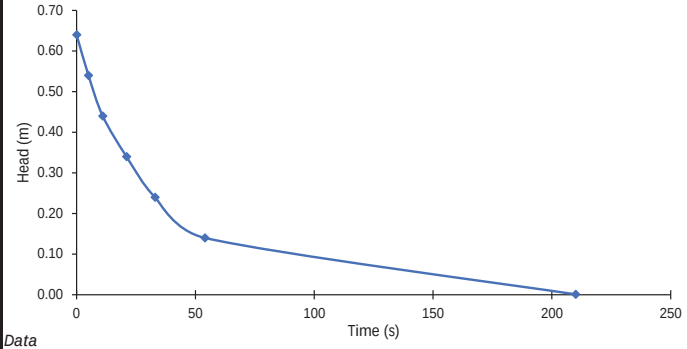
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 5.05E-04 ms^{-1} : 43.61 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2 \ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 1.67E-04 ms^{-1} : 14.46 m/day



STRATIGRAPHIC LOG

Sand

EOH @ 1.4m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})	
0	0.800	0.640					
5	0.900	0.540	0.590		1.24E-04	5.55E-04	
11	1.000	0.440	0.490		1.40E-04	5.52E-04	
21	1.100	0.340	0.390		1.21E-04	4.10E-04	
33	1.200	0.240	0.290		1.60E-04	4.51E-04	38.92
54	1.300	0.140	0.190		1.73E-04	3.82E-04	
210	1.439	0.001	0.070		2.86E-04	6.80E-04	

CMW Geosciences	CLIENT: JDSi Consulting Engineers	DESIGNER:	MO
	PROJECT: Glen Iris Estate Jandakot, WA	CHECKED:	AP
		REVISION:	1
	TITLE: Falling Head Permeability Test 7	DATE:	3/12/2020
		PROJECT:	PER2020-0452

Specifications - Open-Ended Tube

Length L_1:	1.44	m
Diameter:	80	mm
Non-Perm L_2:		m
Above Gnd L_3:	0.03	m

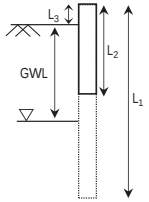
Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m: 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.41 m BGL



Hydraulic Conductivity (k)

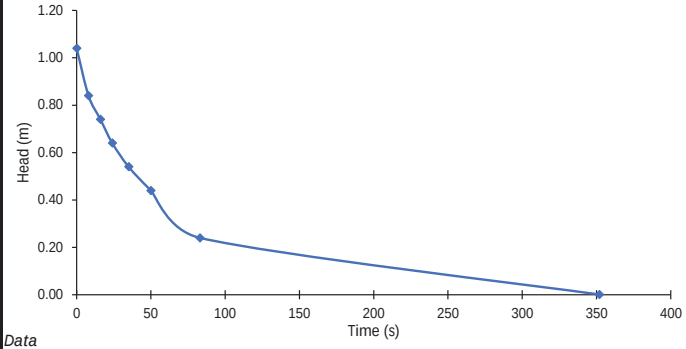
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 3.54E-04 ms^{-1} : 30.55 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2 \ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 7.82E-05 ms^{-1} : 6.75 m/day



STRATIGRAPHIC LOG

Sand

EOH @ 1.41m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})	
0	0.400	1.040					
8	0.600	0.840	0.940		7.18E-05	4.48E-04	
16	0.700	0.740	0.790		4.79E-05	2.63E-04	
24	0.800	0.640	0.690		6.00E-05	2.99E-04	
35	0.900	0.540	0.590		5.65E-05	2.52E-04	21.81
50	1.000	0.440	0.490		5.60E-05	2.21E-04	
83	1.200	0.240	0.340		9.31E-05	3.00E-04	
352	1.439	0.001	0.121		1.62E-04	6.92E-04	

CMW Geosciences	CLIENT: JDSi Consulting Engineers	DESIGNER:	MO
	PROJECT: Glen Iris Estate Jandakot, WA	CHECKED:	AP
		REVISION:	1
	TITLE: Falling Head Permeability Test 8	DATE:	3/12/2020
		PROJECT:	PER2020-0452

Specifications - Open-Ended Tube

Length L_1:	1.44	m
Diameter:	80	mm
Non-Perm L_2:		m
Above Gnd L_3:	0.03	m

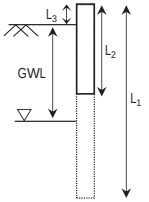
Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m: 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.41 m BGL



Hydraulic Conductivity (k)

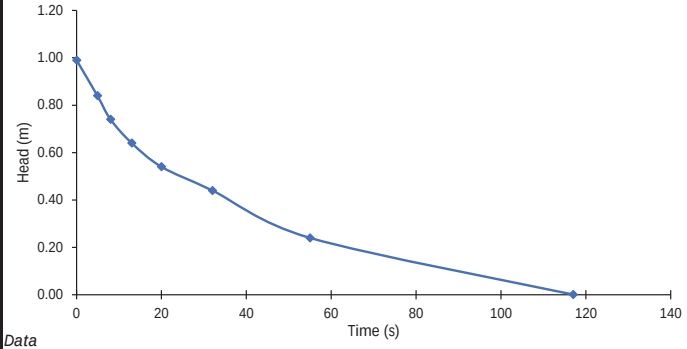
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 8.32E-04 ms^{-1} : 71.89 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2 \ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 1.87E-04 ms^{-1} : 16.13 m/day



STRATIGRAPHIC LOG

Sand

EOH @ 1.41m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})	
0	0.450	0.990					
4.9	0.600	0.840	0.915		9.18E-05	5.60E-04	
8	0.700	0.740	0.790		1.24E-04	6.78E-04	
13	0.800	0.640	0.690		9.60E-05	4.78E-04	
20	0.900	0.540	0.590		8.87E-05	3.97E-04	34.27
32	1.000	0.440	0.490		7.00E-05	2.76E-04	
55	1.200	0.240	0.340		1.34E-04	4.31E-04	
117	1.439	0.001	0.121		7.03E-04	3.00E-03	

Appendix C

Laboratory Test Results

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - ASTM D2974-14 (Test Method C)

Client:	CMW Geosciences	*Ticket No.*	S2166
Client Address:	Suite 1, Level 3/29 Flynn Street, Wembley WA	*Report No.*	WG20/11347-11354_1_OF
Project:	Geotechnical Investigation	*Sample No.*	WG20/11347-11354
Location:	Glen Iris Golf Course	*Date Sampled:*	Not Specified
Sample Identification:	Various - See Below	*Date Tested:*	4-12-2020

TEST RESULTS - Organic Content

Sampling Method:	Sampled by Client, Tested as Received
Testing Completed By:	WGLS - KT
Furnace Temperature (°C):	440

Sample Number	Sample Identification	Ash Content (%)	Organic Content (%)
WG20/11347	TP04 0.01m	95.8	4.2
WG20/11348	TP14 0.01m	94.7	5.3
WG20/11349	TP29 0.01m	96.0	4.0
WG20/11350	TP41 0.01m	91.4	8.6
WG20/11351	TP46 0.01m	95.6	4.4
WG20/11352	TP48 0.01m	74.5	25.5
WG20/11353	TP23 0.01m	94.6	5.4
WG20/11354	TP15 0.01m	96.7	3.3

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 05-December-2020

NATA **Accreditation No. 20599**
Accredited for compliance with ISO/IEC 17025 - Testing

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APPENDIX C
Hyd2o Permeability Testing

Borehole Permeameter : Field Result Analysis

Project/Site	Glen Iris Test Site 1
Soil Descrip	Yellow grey fine to medium sand
Location	392063 mE
	6447929 mN

TEST 1

r	6.0	cm
H	10.0	cm
time step	5	secs
H/r	1.67	
C	0.75	

Time (sec)	Level (cm)	Diff (cm)
0	4.5	
5	25.0	20.5
10	37.5	12.5
15	51.0	13.5
20	73.0	22.0
		17.1
q (cm^3/s)		30.1

TEST 2

r	6.0	cm
H	10.0	cm
time step	5	secs
H/r	1.67	
C	0.75	

Time (sec)	Level (cm)	Diff (cm)
0	8.5	
5	33.0	24.5
10	44.0	11.0
15	64.0	20.0
Avg Diff (cm)		18.5
q (cm^3/s)		32.6

TEST 3

r		cm
H		cm
time step		secs
H/r		
C		

Time (sec)	Level (cm)	Diff (cm)
Avg Diff (cm)		
q (cm^3/s)		

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0316	Ks (cm/s)	0.0341	Ks (cm/s)	
Ks (m/day)	27.26	Ks (m/day)	29.45	Ks (m/day)	
Average (m/day)	28.4				

METHOD 2 : Talsma and Hallam Method (for low Ks only <2.9)

q (cm3/min)	1808.4		1953.6 cm3/min		cm3/min
r (cm)	6		6.0 cm		cm
H (cm)	10.0		10.0 cm		cm
0.5sinh^{-1}(H/2r)	0.38		0.38		
-sqrt((r/H)^2+0.25)	-0.78		-0.78		
r/H	0.60		0.60		
Sum	0.20		0.20		
Sum*4.4*q	1577.21		1703.85		
2*pi*H^2	628.32		628.32		
Ksat (cm/min)	2.5		2.7		
Ksat (m/day)	36.15		39.05		
Average (m/day)	37.6				

Borehole Permeameter : Field Result Analysis

Project/Site	Glen Iris Test Site 2
Soil Descrip	Dark grey fine to medium sand
Location	391613 mE
	6448399 mN

TEST 1

r	6.0	cm
H	10.0	cm
time step	5	secs
H/r	1.67	
C	0.75	

Time (sec)	Level (cm)	Diff (cm)
0	3.0	
5	7.5	4.5
10	12.0	4.5
15	16.0	4.0
20	19.5	3.5
25	23.2	3.7
30	23.2	0.0
35	26.5	3.3
40	26.5	0.0
45	29.5	3.0
50	32.0	2.5
55	36.3	4.3
60	36.3	0.0
65	39.5	3.2
70	40.0	0.5
75	40.0	0.0
80	40.0	0.0
85	40.0	0.0
90	45.0	5.0
95	45.0	0.0
100	49.0	4.0
105	56.5	7.5
110	56.5	0.0
115	60.5	4.0
120	64.0	3.5
125	64.0	0.0
130	67.0	3.0
135	67.0	0.0
140	71.0	4.0
145	74.0	3.0
150	74.0	0.0
		2.4
q (cm^3/s)		4.2

TEST 2

r	6.0	cm
H	10.0	cm
time step	10	secs
H/r	1.67	
C	0.75	

Time (sec)	Level (cm)	Diff (cm)
0	6.3	
10	16.8	10.5
20	21.2	4.4
30	26.0	4.8
40	31.0	5.0
50	35.0	4.0
60	39.7	4.7
70	39.7	0.0
80	44.2	4.5
90	48.6	4.4
100	48.6	0.0
110	57.0	8.4
120	61.0	4.0
130	65.1	4.1
140	69.3	4.2
150	73.5	4.2
Avg Diff (cm)		4.5
q (cm^3/s)		3.9

TEST 3

r		cm
H		cm
time step		secs
H/r		
C		

Time (sec)	Level (cm)	Diff (cm)
Avg Diff (cm)		
q (cm^3/s)		

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0044	Ks (cm/s)	0.0041	Ks (cm/s)	
Ks (m/day)	3.77	Ks (m/day)	3.57	Ks (m/day)	
Average (m/day)	3.7				

METHOD 2 : Talsma and Hallam Method (for low Ks only <2.9)

q (cm3/min)	249.9		236.5 cm3/min		cm3/min
r (cm)	6		6.0 cm		cm
H (cm)	10.0		10.0 cm		cm
0.5sinh^{-1}(H/2r)	0.38		0.38		
-sqrt((r/H)^2+0.25)	-0.78		-0.78		
r/H	0.60		0.60		
Sum	0.20		0.20		
Sum*4.4*q	217.97		206.30		
2*pi*H^2	628.32		628.32		
Ksat (cm/min)	0.3		0.3		
Ksat (m/day)	5.00		4.73		
Average (m/day)	4.9				

Borehole Permeameter : Field Result Analysis

Project/Site	Glen Iris Test Site 3
Soil Descrip	Grey to dark grey fine to medium sand
Location	391674 mE
	6447970 mN

TEST 1

r	5.0	cm
H	10.0	cm
time step	10	secs
H/r	2.00	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	4.5	
10	28.0	23.5
20	50.2	22.2
30	71.5	21.3
		22.3
q (cm³/s)		19.7

TEST 2

r	5.0	cm
H	8.0	cm
time step	5	secs
H/r	1.60	
C	0.75	

Time (sec)	Level (cm)	Diff (cm)
0	5.5	
5	24.0	18.5
10	34.0	10.0
15	41.0	7.0
20	51.2	10.2
25	58.5	7.3
30	66.0	7.5
Avg Diff (cm)		10.1
q (cm³/s)		17.7

TEST 3

r		cm
H		cm
time step		secs
H/r		
C		

Time (sec)	Level (cm)	Diff (cm)
Avg Diff (cm)		
q (cm³/s)		

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0256	Ks (cm/s)	0.0287	Ks (cm/s)	
Ks (m/day)	22.14	Ks (m/day)	24.83	Ks (m/day)	
Average (m/day)	23.5				

METHOD 2 : Talsma and Hallam Method (for low Ks only <2.9)

q (cm3/min)	1179.2		1064.8 cm3/min		cm3/min
r (cm)	5		5.0 cm		cm
H (cm)	10.0		8.0 cm		cm
0.5sinh^{-1}(H/2r)	0.44		0.37		
-sqrt((r/H)^2+0.25)	-0.71		-0.80		
r/H	0.50		0.63		
Sum	0.23		0.19		
Sum*4.4*q	1211.93		894.59		
2*pi*H^2	628.32		402.12		
Ksat (cm/min)	1.9		2.2		
Ksat (m/day)	27.78		32.04		
Average (m/day)	29.9				

Borehole Permeameter : Field Result Analysis

Project/Site	Glen Iris Test Site 4
Soil Descrip	Grey to dark grey fine to medium sand
Location	391658 mE
	6447775 mN

TEST 1

r	5.0	cm
H	10.0	cm
time step	5	secs
H/r	2.00	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	2.5	
5	44.0	41.5
10	61.0	17.0
		29.3
q (cm³/s)		51.5

TEST 2

r	5.0	cm
H	9.0	cm
time step	5	secs
H/r	1.80	
C	0.83	

Time (sec)	Level (cm)	Diff (cm)
0	5.0	
5	43.0	38.0
10	61.0	18.0
15	73.0	12.0
Avg Diff (cm)		22.7
q (cm³/s)		39.9

TEST 3

r		cm
H		cm
time step		secs
H/r		
C		

Time (sec)		Diff (cm)
Avg Diff (cm)		
q (cm³/s)		

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0671	Ks (cm/s)	0.0578	Ks (cm/s)	
Ks (m/day)	57.98	Ks (m/day)	49.91	Ks (m/day)	
Average (m/day)	53.9				

METHOD 2 : Talsma and Hallam Method (for low Ks only <2.9)

q (cm3/min)	3088.8		2393.6 cm3/min		cm3/min
r (cm)	5		5.0 cm		cm
H (cm)	10.0		9.0 cm		cm
0.5sinh^{-1}(H/2r)	0.44		0.40		
-sqrt((r/H)^2+0.25)	-0.71		-0.75		
r/H	0.50		0.56		
Sum	0.23		0.21		
Sum*4.4*q	3174.52		2238.71		
2*pi*H^2	628.32		508.94		
Ksat (cm/min)	5.1		4.4		
Ksat (m/day)	72.75		63.34		
Average (m/day)	68.0				

Borehole Permeameter : Field Result Analysis

Project/Site	Glen Iris Test Site 5
Soil Descrip	Grey fine to medium sand
Location	391757 mE
	6447775 mN

TEST 1

r	6.0	cm
H	10.0	cm
time step	5	secs
H/r	1.67	
C	0.75	

Time (sec)	Level (cm)	Diff (cm)
0	4.0	
5	8.1	4.1
10	12.1	4.0
15	16.0	3.9
20	20.2	4.2
25	23.5	3.3
30	27.0	3.5
35	31.1	4.1
40	34.8	3.7
45	39.0	4.2
50	43.0	4.0
55	43.0	0.0
60	46.9	3.9
65	52.2	5.3
70	52.2	0.0
75	56.2	4.0
80	60.2	4.0
85	65.0	4.8
90	69.0	4.0
95	69.0	0.0
100	73.5	4.5
		3.5
	q (cm^3/s)	6.1

TEST 2

r	6.0	cm
H	8.0	cm
time step	5	secs
H/r	1.33	
C	0.66	

Time (sec)	Level (cm)	Diff (cm)
0	4.7	
5	9.5	4.8
10	13.7	4.2
15	17.6	3.9
20	21.5	3.9
25	25.0	3.5
30	29.2	4.2
35	29.2	0.0
40	33.5	4.3
45	37.4	3.9
50	43.1	5.7
55	43.1	0.0
60	47.0	3.9
65	52.3	5.3
70	52.3	0.0
75	56.4	4.1
80	62.0	5.6
85	62.0	0.0
90	65.9	3.9
95	71.0	5.1
	Avg Diff (cm)	3.5
	q (cm^3/s)	6.1

TEST 3

r	6.0	cm
H	10.0	cm
time step	5	secs
H/r	1.67	
C	0.75	

Time (sec)	Level (cm)	Diff (cm)
0	4.5	
5	9.1	4.6
10	13.0	3.9
15	13.0	0.0
20	17.1	4.1
25	21.2	4.1
30	25.2	4.0
35	29.6	4.4
40	29.6	0.0
45	33.5	3.9
50	38.2	4.7
55	42.7	4.5
60	42.7	0.0
65	47.1	4.4
70	51.6	4.5
75	51.6	0.0
80	54.6	3.0
85	60.0	5.4
90	60.0	0.0
95	65.0	5.0
100	69.2	4.2
105	73.4	4.2
110	73.4	0.0
	Avg Diff (cm)	3.1
	q (cm^3/s)	5.5

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0064	Ks (cm/s)	0.0085	Ks (cm/s)	0.0058
Ks (m/day)	5.53	Ks (m/day)	7.30	Ks (m/day)	4.99
Average (m/day)	5.9				

METHOD 2 : Talsma and Hallam Method (for low Ks only <2.9)

q (cm3/min)	367.0		368.5 cm3/min		330.7 cm3/min
r (cm)	6		6.0 cm		6.0 cm
H (cm)	10.0		8.0 cm		10.0 cm
0.5sinh^{-1}(H/2r)	0.38		0.31		0.38
-sqrt((r/H)^2+0.25)	-0.78		-0.90		-0.78
r/H	0.60		0.75		0.60
Sum	0.20		0.16		0.20
Sum*4.4*q	320.05		261.34		288.44
2*pi*H^2	628.32		402.12		628.32
Ksat (cm/min)	0.5		0.6		0.5
Ksat (m/day)	7.33		9.36		6.61
Average (m/day)	8.3				

Borehole Permeameter : Field Result Analysis

Project/Site	Glen Iris Test Site 6
Soil Descrip	Grey to dark grey fine to medium sand
Location	391723 mE
	6447547 mN

TEST 1

r	5.0	cm
H	10.0	cm
time step	5	secs
H/r	2.00	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	5.0	
5	28.0	23.0
10	60.0	32.0
		27.5
	q (cm^3/s)	48.4

TEST 2

r	5.0	cm
H	10.0	cm
time step	5	secs
H/r	2.00	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	5.8	
5	46.0	40.2
10	54.0	8.0
	Avg Diff (cm)	24.1
	q (cm^3/s)	42.4

TEST 3

r		cm
H		cm
time step		secs
H/r		
C		

Time (sec)	Level (cm)	Diff (cm)
	Avg Diff (cm)	
	q (cm^3/s)	

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0631	Ks (cm/s)	0.0553	Ks (cm/s)	
Ks (m/day)	54.51	Ks (m/day)	47.77	Ks (m/day)	
Average (m/day)	51.1				

METHOD 2 : Talsma and Hallam Method (for low Ks only <2.9)

q (cm3/min)	2904.0		2545.0 cm3/min		cm3/min
r (cm)	5		5.0 cm		cm
H (cm)	10.0		10.0 cm		cm
0.5sinh^{-1}(H/2r)	0.44		0.44		
-sqrt((r/H)^2+0.25)	-0.71		-0.71		
r/H	0.50		0.50		
Sum	0.23		0.23		
Sum*4.4*q	2984.59		2615.59		
2*pi*H^2	628.32		628.32		
Ksat (cm/min)	4.8		4.2		
Ksat (m/day)	68.40		59.94		
Average (m/day)	64.2				

Borehole Permeameter : Field Result Analysis

Project/Site	Glen Iris Test Site 7
Soil Descrip	Grey to dark grey fine to medium sand
Location	391790 mE
	6447430 mN

TEST 1

r	5.0	cm
H	10.0	cm
time step	5	secs
H/r	2.00	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	8.2	
5	15.6	7.4
10	21.0	5.4
15	29.4	8.4
20	29.4	0.0
25	36.1	6.7
30	39.4	3.3
35	46.0	6.6
40	50.0	4.0
45	53.5	3.5
50	60.5	7.0
55	67.0	6.5
60	71.0	4.0
65	75.0	4.0
		5.1
	q (cm^3/s)	9.0

TEST 2

r	5.0	cm
H	10.0	cm
time step	5	secs
H/r	2.00	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	5.0	
5	13.2	8.2
10	18.0	4.8
15	28.5	10.5
20	34.5	6.0
25	36.4	1.9
30	36.4	0.0
35	40.4	4.0
40	49.0	8.6
45	52.0	3.0
50	57.0	5.0
55	65.0	8.0
60	72.1	7.1
	Avg Diff (cm)	5.6
	q (cm^3/s)	9.8

TEST 3

r		cm
H		cm
time step		secs
H/r		
C		

Time (sec)	Level (cm)	Diff (cm)
	Avg Diff (cm)	
	q (cm^3/s)	

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0118	Ks (cm/s)	0.0128	Ks (cm/s)	
Ks (m/day)	10.19	Ks (m/day)	11.08	Ks (m/day)	
Average (m/day)	10.6				

METHOD 2 : Talsma and Hallam Method (for low Ks only <2.9)

q (cm3/min)	542.6		590.5 cm3/min		cm3/min
r (cm)	5		5.0 cm		cm
H (cm)	10.0		10.0 cm		cm
0.5sinh^{-1}(H/2r)	0.44		0.44		
-sqrt((r/H)^2+0.25)	-0.71		-0.71		
r/H	0.50		0.50		
Sum	0.23		0.23		
Sum*4.4*q	557.68		606.87		
2*pi*H^2	628.32		628.32		
Ksat (cm/min)	0.9		1.0		
Ksat (m/day)	12.78		13.91		
Average (m/day)	13.3				

Borehole Permeameter : Field Result Analysis

Project/Site	Glen Iris Test Site 8
Soil Descrip	Grey to dark grey fine to medium sand
Location	392037 mE
	6447313 mN

TEST 1

r	5.5	cm
H	10.0	cm
time step	5	secs
H/r	1.82	
C	0.83	

Time (sec)	Level (cm)	Diff (cm)
0	7.5	
5	76.0	68.5
		68.5
	q (cm^3/s)	120.6

TEST 2

r	5.5	cm
H	10.0	cm
time step	5	secs
H/r	1.82	
C	0.83	

Time (sec)	Level (cm)	Diff (cm)
0	9.0	
5	76.0	67.0
	Avg Diff (cm)	67.0
	q (cm^3/s)	117.9

TEST 3

r		cm
H		cm
time step		secs
H/r		
C		

Time (sec)	Level (cm)	Diff (cm)
	Avg Diff (cm)	
	q (cm^3/s)	

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.1417	Ks (cm/s)	0.1386	Ks (cm/s)	
Ks (m/day)	122.45	Ks (m/day)	119.77	Ks (m/day)	
Average (m/day)	121.1				

METHOD 2 : Talsma and Hallam Method (for low Ks only <2.9)

q (cm3/min)	7233.6		7075.2 cm3/min		cm3/min
r (cm)	5.5		5.5 cm		cm
H (cm)	10.0		10.0 cm		cm
0.5sinh^{-1}(H/2r)	0.41		0.41		
-sqrt((r/H)^2+0.25)	-0.74		-0.74		
r/H	0.55		0.55		
Sum	0.21		0.21		
Sum*4.4*q	6827.10		6677.61		
2*pi*H^2	628.32		628.32		
Ksat (cm/min)	10.9		10.6		
Ksat (m/day)	156.47		153.04		
Average (m/day)	154.8				

Borehole Permeameter : Field Result Analysis

Project/Site	Glen Iris Test Site 9
Soil Descrip	Grey to dark grey fine to medium sand
Location	392107 mE
	6447280 mN

hyd2o HYDROLOGY

TEST 1

r	6.0	cm
H	10.0	cm
time step	5	secs
H/r	1.67	
C	0.75	

Time (sec)	Level (cm)	Diff (cm)
0	5.5	
5	28.0	5.5
10	49.0	28.0
15	74.0	49.0

27.5

q (cm³/s) 48.4

TEST 2

r	6.0	cm
H	10.0	cm
time step	5	secs
H/r	1.67	
C	0.75	

Time (sec)	Level (cm)	Diff (cm)
0	9.0	
5	29.5	20.5
10	41.5	12.0
15	57.0	15.5
20	71.0	14.0

Avg Diff (cm) 15.5

q (cm³/s) 27.3

TEST 3

r		cm
H		cm
time step		secs
H/r		
C		

Time (sec)	Level (cm)	Diff (cm)

Avg Diff (cm)

q (cm³/s)

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0507	Ks (cm/s)	0.0286	Ks (cm/s)	
Ks (m/day)	43.78	Ks (m/day)	24.68	Ks (m/day)	

Average (m/day) 34.2

METHOD 2 : Talsma and Hallam Method (for low Ks only <2.9)

q (cm3/min)	2904.0		1636.8 cm3/min		cm3/min
r (cm)	6		6.0 cm		cm
H (cm)	10.0		10.0 cm		cm
0.5sinh^{-1}(H/2r)	0.38		0.38		
-sqrt((r/H)^2+0.25)	-0.78		-0.78		
r/H	0.60		0.60		
Sum	0.20		0.20		
Sum*4.4*q	2532.75		1427.55		
2*pi*H^2	628.32		628.32		
Ksat (cm/min)	4.0		2.3		
Ksat (m/day)	58.05		32.72		

Average (m/day) 45.4

Borehole Permeameter : Field Result Analysis

Project/Site	Glen Iris Test Site 10
Soil Descrip	Grey to dark grey fine to medium sand
Location	392118 mE
	6447046 mN

hyd2o HYDROLOGY

TEST 1

r	6.0	cm
H	10.0	cm
time step	5	secs
H/r	1.67	
C	0.75	

Time (sec)	Level (cm)	Diff (cm)
0	6.3	
5	15.2	8.9
10	20.2	5.0
15	20.2	0.0
20	24.4	4.2
25	31.0	6.6
30	43.0	12.0
35	37.6	-5.4
40	40.9	3.3
45	45.2	4.3
50	49.5	4.3
55	54.1	4.6
60	60.0	5.9
65	65.6	5.6
70	71.0	5.4
75	71.0	0.0
80	76.0	5.0

4.4

q (cm³/s) 7.7

TEST 2

r	6.0	cm
H	10.0	cm
time step	5	secs
H/r	1.67	
C	0.75	

Time (sec)	Level (cm)	Diff (cm)
0	4.7	
5	12.0	7.3
10	18.0	6.0
15	26.0	8.0
20	31.2	5.2
25	39.5	8.3
30	42.9	3.4
35	51.1	8.2
40	55.0	3.9
45	59.1	4.1
50	68.0	8.9
55	75.0	7.0

Avg Diff (cm) 6.4

q (cm³/s) 11.2

TEST 3

r	6.0	cm
H	10.0	cm
time step	5	secs
H/r	1.67	
C	0.75	

Time (sec)	Level (cm)	Diff (cm)
0	4.8	
5	15.2	10.4
10	19.8	4.6
15	29.5	9.7
20	32.6	3.1
25	41.2	8.6
30	50.0	8.8
35	57.0	7.0
40	66.0	9.0
45	72.5	6.5

Avg Diff (cm) 7.5

q (cm³/s) 13.2

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0080	Ks (cm/s)	0.0118	Ks (cm/s)	0.0139
Ks (m/day)	6.94	Ks (m/day)	10.17	Ks (m/day)	11.98

Average (m/day) 9.7

METHOD 2 : Talsma and Hallam Method (for low Ks only <2.9)

q (cm3/min)	460.0		674.9 cm3/min		794.3 cm3/min
r (cm)	6		6.0 cm		6.0 cm
H (cm)	10.0		10.0 cm		10.0 cm
0.5sinh^{-1}(H/2r)	0.38		0.38		0.38
-sqrt((r/H)^2+0.25)	-0.78		-0.78		-0.78
r/H	0.60		0.60		0.60
Sum	0.20		0.20		0.20
Sum*4.4*q	401.21		588.60		692.80
2*pi*H^2	628.32		628.32		628.32
Ksat (cm/min)	0.6		0.9		1.1
Ksat (m/day)	9.20		13.49		15.88

Average (m/day) 11.3

Borehole Permeameter : Field Result Analysis

Project/Site	Glen Iris Test Site 11
Soil Descrip	Fine to medium grey sand
Location	391956 mE
	6446486 mN

TEST 1

r	4.5	cm
H	10.0	cm
time step	5	secs
H/r	2.22	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	4.5	
5	26.0	21.5
10	50.4	24.4
15	64.0	13.6
		19.8
	q (cm^3/s)	34.9

TEST 2

r	4.5	cm
H	10.0	cm
time step	5	secs
H/r	2.22	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	13.0	
5	41.1	28.1
10	52.3	11.2
	Avg Diff (cm)	19.7
	q (cm^3/s)	34.6

TEST 3

r	4.5	cm
H	10.0	cm
time step	5	secs
H/r	2.22	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	5.5	
5	28.0	22.5
10	52.2	24.2
15	74.8	22.6
	Avg Diff (cm)	23.1
	q (cm^3/s)	40.7

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0464	Ks (cm/s)	0.0460	Ks (cm/s)	0.0540
Ks (m/day)	40.09	Ks (m/day)	39.72	Ks (m/day)	46.70

Average (m/day) 42.2

METHOD 2 : Talsma and Hallam Method (for low Ks only <2.9)

q (cm3/min)	2094.4		2075.0	cm3/min	2439.4	cm3/min
r (cm)	4.5		4.5	cm	4.5	cm
H (cm)	10.0		10.0	cm	10.0	cm
0.5sinh^{-1}(H/2r)	0.48		0.48		0.48	
-sqrt((r/H)^2+0.25)	-0.67		-0.67		-0.67	
r/H	0.45		0.45		0.45	
Sum	0.26		0.26		0.26	
Sum*4.4*q	2361.15		2339.32		2750.05	
2*pi*H^2	628.32		628.32		628.32	
Ksat (cm/min)	3.8		3.7		4.4	
Ksat (m/day)	54.11		53.61		63.03	

Average (m/day) 53.9

Borehole Permeameter : Field Result Analysis

Project/Site	Glen Iris Test Site 12
Soil Descrip	Fine to medium brown grey sand
Location	391933 mE
	6446563 mN

TEST 1

r	5.5	cm
H	10.0	cm
time step	5	secs
H/r	1.82	
C	0.83	

Time (sec)	Level (cm)	Diff (cm)
0	4.5	
5	28.5	24.0
10	47.3	18.8
15	68.4	21.1
		21.3
	q (cm^3/s)	37.5

TEST 2

r	5.5	cm
H	10.0	cm
time step	5	secs
H/r	1.82	
C	0.83	

Time (sec)	Level (cm)	Diff (cm)
0	3.6	
5	27.7	24.1
10	46.8	19.1
15	75.0	28.2
	Avg Diff (cm)	23.8
	q (cm^3/s)	41.9

TEST 3

r	5.5	cm
H	10.0	cm
time step	5	secs
H/r	1.82	
C	0.83	

Time (sec)	Level (cm)	Diff (cm)
0	4.2	
5	37.5	33.3
10	52.8	15.3
15	75.0	22.2
	Avg Diff (cm)	23.6
	q (cm^3/s)	41.5

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0441	Ks (cm/s)	0.0492	Ks (cm/s)	0.0488
Ks (m/day)	38.08	Ks (m/day)	42.55	Ks (m/day)	42.19

Average (m/day) 40.9

METHOD 2 : Talsma and Hallam Method (for low Ks only <2.9)

q (cm3/min)	2249.3		2513.3	cm3/min	2492.2	cm3/min
r (cm)	5.5		5.5	cm	5.5	cm
H (cm)	10.0		10.0	cm	10.0	cm
0.5sinh^{-1}(H/2r)	0.41		0.41		0.41	
-sqrt((r/H)^2+0.25)	-0.74		-0.74		-0.74	
r/H	0.55		0.55		0.55	
Sum	0.21		0.21		0.21	
Sum*4.4*q	2122.88		2372.04		2352.11	
2*pi*H^2	628.32		628.32		628.32	
Ksat (cm/min)	3.4		3.8		3.7	
Ksat (m/day)	48.65		54.36		53.91	

Average (m/day) 51.5

Borehole Permeameter : Field Result Analysis

Project/Site	Glen Iris Test Site 13
Soil Descrip	Fine to medium sand. Grey to white.
Location	391992 mE
	6446852 mN

TEST 1

r	5.0	cm
H	10.0	cm
time step	5	secs
H/r	2.00	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	9.0	
5	76.0	67.0
		67.0
	q (cm³/s)	117.9

TEST 2

r	5.0	cm
H	10.0	cm
time step	5	secs
H/r	2.00	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	3.2	
5	76.0	72.8
	Avg Diff (cm)	72.8
	q (cm³/s)	128.1

TEST 3

r		cm
H		cm
time step		secs
H/r		
C		

Time (sec)	Level (cm)	Diff (cm)
	Avg Diff (cm)	
	q (cm³/s)	

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.1537	Ks (cm/s)	0.1670	Ks (cm/s)	
Ks (m/day)	132.81	Ks (m/day)	144.31	Ks (m/day)	
Average (m/day)	138.6				

METHOD 2 : Talsma and Hallam Method (for low Ks only <2.9)

q (cm3/min)	7075.2		7687.7 cm3/min		cm3/min
r (cm)	5		5.0 cm		cm
H (cm)	10.0		10.0 cm		cm
0.5sinh^{-1}(H/2r)	0.44		0.44		
-sqrt((r/H)^2+0.25)	-0.71		-0.71		
r/H	0.50		0.50		
Sum	0.23		0.23		
Sum*4.4*q	7271.55		7901.03		
2*pi*H^2	628.32		628.32		
Ksat (cm/min)	11.6		12.6		
Ksat (m/day)	166.65		181.08		
Average (m/day)	173.9				

Borehole Permeameter : Field Result Analysis

Project/Site	Glen Iris Test Site 14
Soil Descrip	Grey to yellow, fine to medium grain sand
Location	391620 mE
	6448394 mN

TEST 1

r	4.0	cm
H	10.0	cm
time step	5	secs
H/r	2.50	
C	1.06	

Time (sec)	Level (cm)	Diff (cm)
0	4.5	
5	17.0	12.5
10	25.8	8.8
15	37.0	11.2
20	50.5	13.5
25	57.0	6.5
30	73.4	16.4
35	76.0	2.6
		10.2
	q (cm³/s)	18.0

TEST 2

r	5.0	cm
H	10.0	cm
time step	5	secs
H/r	2.00	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	4.1	
5	18.6	14.5
10	31.3	12.7
15	41.5	10.2
20	54.0	12.5
25	72.5	18.5
30	76.0	3.5
	Avg Diff (cm)	12.0
	q (cm³/s)	21.1

TEST 3

r		cm
H		cm
time step		secs
H/r		
C		

Time (sec)	Level (cm)	Diff (cm)
	Avg Diff (cm)	
	q (cm³/s)	

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0280	Ks (cm/s)	0.0275	Ks (cm/s)	
Ks (m/day)	24.22	Ks (m/day)	23.75	Ks (m/day)	
Average (m/day)	24.0				

METHOD 2 : Talsma and Hallam Method (for low Ks only <2.9)

q (cm3/min)	1078.6		1265.4 cm3/min		cm3/min
r (cm)	4		5.0 cm		cm
H (cm)	10.0		10.0 cm		cm
0.5sinh^{-1}(H/2r)	0.52		0.44		
-sqrt((r/H)^2+0.25)	-0.64		-0.71		
r/H	0.40		0.50		
Sum	0.28		0.23		
Sum*4.4*q	1345.41		1300.56		
2*pi*H^2	628.32		628.32		
Ksat (cm/min)	2.1		2.1		
Ksat (m/day)	30.83		29.81		
Average (m/day)	30.3				

Borehole Permeameter : Field Result Analysis

Project/Site	Glen Iris Test Site 15
Soil Descrip	Fine to medium sand. Grey to dark grey.
Location	391795 mE
	6447827 mN

TEST 1

r	5.0	cm
H	10.0	cm
time step	5	secs
H/r	2.00	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	3.0	
5	41.0	38.0
10	47.0	6.0
15	65.0	18.0
20	76.0	11.0
		18.3
	q (cm^3/s)	32.1

TEST 2

r	5.0	cm
H	10.0	cm
time step	5	secs
H/r	2.00	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	3.2	
5	34.0	30.8
10	53.0	19.0
15	70.0	17.0
20	76.0	6.0
	Avg Diff (cm)	18.2
	q (cm^3/s)	32.0

TEST 3

r		cm
H		cm
time step		secs
H/r		
C		

Time (sec)	Level (cm)	Diff (cm)
	Avg Diff (cm)	
	q (cm^3/s)	

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0419	Ks (cm/s)	0.0418	Ks (cm/s)	
Ks (m/day)	36.18	Ks (m/day)	36.08	Ks (m/day)	
Average (m/day)	36.1				

METHOD 2 : Talsma and Hallam Method (for low Ks only <2.9)

q (cm3/min)	1927.2		1921.9 cm3/min		cm3/min
r (cm)	5		5.0 cm		cm
H (cm)	10.0		10.0 cm		cm
0.5sinh^{-1}(H/2r)	0.44		0.44		
-sqrt((r/H)^2+0.25)	-0.71		-0.71		
r/H	0.50		0.50		
Sum	0.23		0.23		
Sum*4.4*q	1980.68		1975.26		
2*pi*H^2	628.32		628.32		
Ksat (cm/min)	3.2		3.1		
Ksat (m/day)	45.39		45.27		
Average (m/day)	45.3				

Borehole Permeameter : Field Result Analysis

Project/Site	Glen Iris Test Site 16
Soil Descrip	Fine to medium sand. Grey to dark grey.
Location	392078 mE
	6446319 mN

TEST 1

r	4.0	cm
H	10.0	cm
time step	5	secs
H/r	2.50	
C	1.06	

Time (sec)	Level (cm)	Diff (cm)
0	9.2	
5	20.1	10.9
10	28.4	8.3
15	36.5	8.1
20	45.4	8.9
25	45.4	0.0
30	53.0	7.6
35	60.0	7.0
40	64.0	4.0
45	67.0	3.0
		6.4
	q (cm^3/s)	11.3

TEST 2

r	5.0	cm
H	10.0	cm
time step	5	secs
H/r	2.00	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	7.0	
5	18.0	11.0
10	27.2	9.2
15	34.4	7.2
20	40.0	5.6
25	48.0	8.0
30	58.4	10.4
35	66.5	8.1
40	75.0	8.5
45	76.0	1.0
	Avg Diff (cm)	7.7
	q (cm^3/s)	13.5

TEST 3

r		cm
H		cm
time step		secs
H/r		
C		

Time (sec)	Level (cm)	Diff (cm)
	Avg Diff (cm)	
	q (cm^3/s)	

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0176	Ks (cm/s)	0.0176	Ks (cm/s)	
Ks (m/day)	15.23	Ks (m/day)	15.20	Ks (m/day)	
Average (m/day)	15.2				

METHOD 2 : Talsma and Hallam Method (for low Ks only <2.9)

q (cm3/min)	678.2		809.6 cm3/min		cm3/min
r (cm)	4		5.0 cm		cm
H (cm)	10.0		10.0 cm		cm
0.5sinh^{-1}(H/2r)	0.52		0.44		
-sqrt((r/H)^2+0.25)	-0.64		-0.71		
r/H	0.40		0.50		
Sum	0.28		0.23		
Sum*4.4*q	845.92		832.07		
2*pi*H^2	628.32		628.32		
Ksat (cm/min)	1.3		1.3		
Ksat (m/day)	19.39		19.07		
Average (m/day)	19.2				

APPENDIX D
Existing Stormwater System Plates

PLATES

PLATE 1:

PLATE 2:

PLATE 3:

PLATE 4:

PLATE 5:

PLATE 6:

SW1

SW2

SW3

SW8

PLATE 7-10: Various Existing Stormwater Outlets

SW10

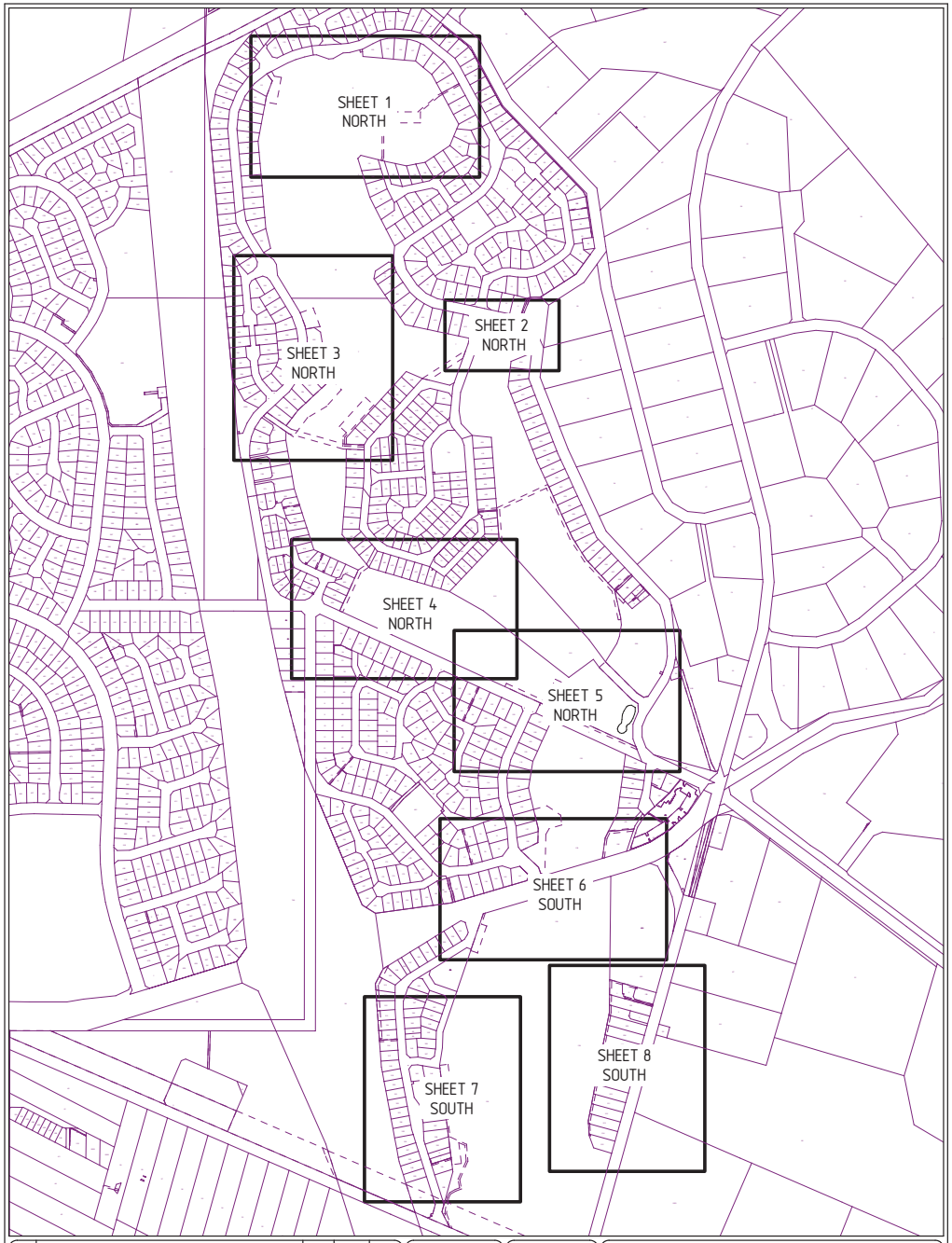
SW11

SW13

SW15

PLATE 11-14: Various Existing Stormwater Outlets

APPENDIX E
Survey of Existing Stormwater Storages & Outlets



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DRAINAGE INVESTIGATION
GLEN IRIS GOLF COURSE
INDEX SHEET

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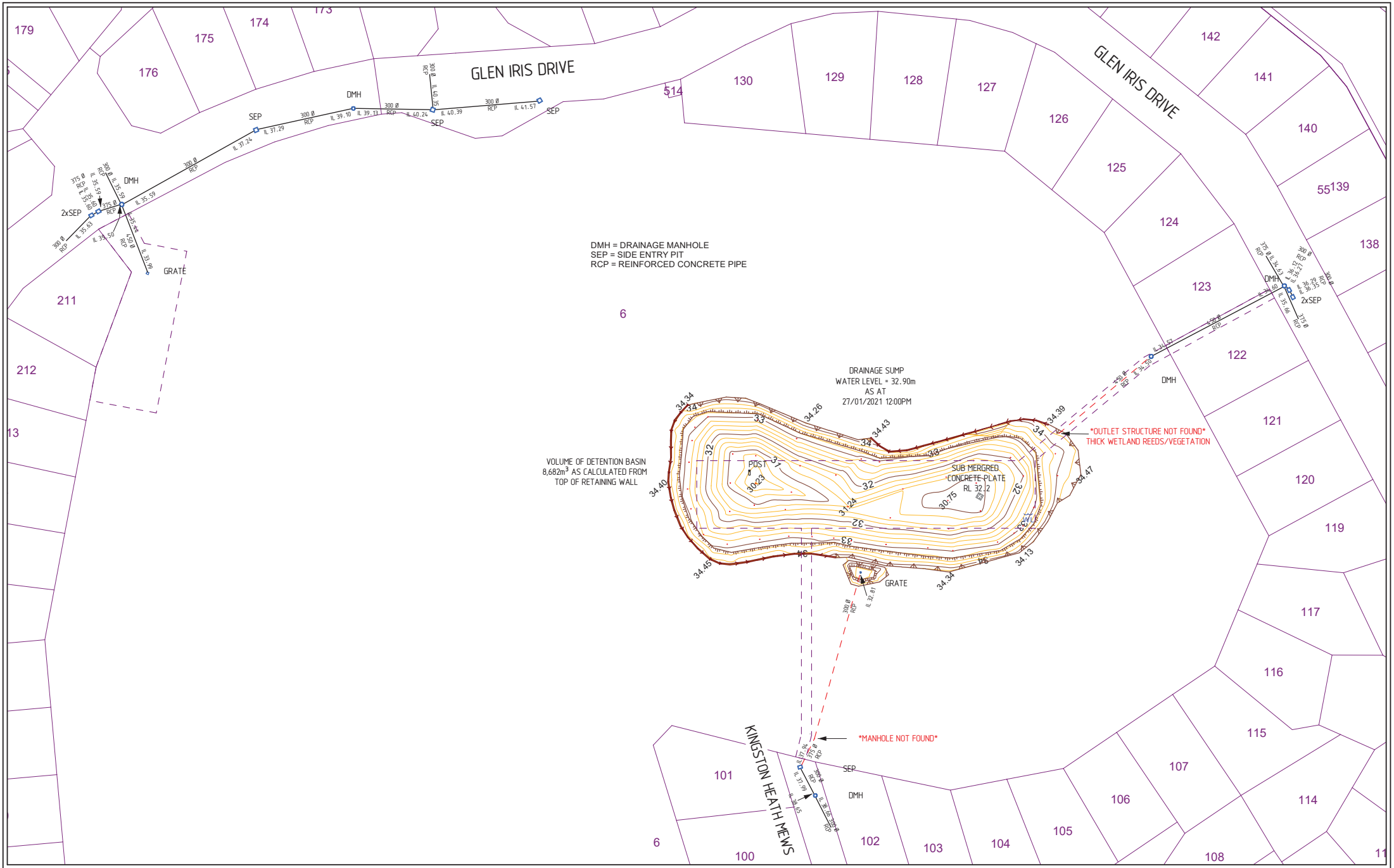

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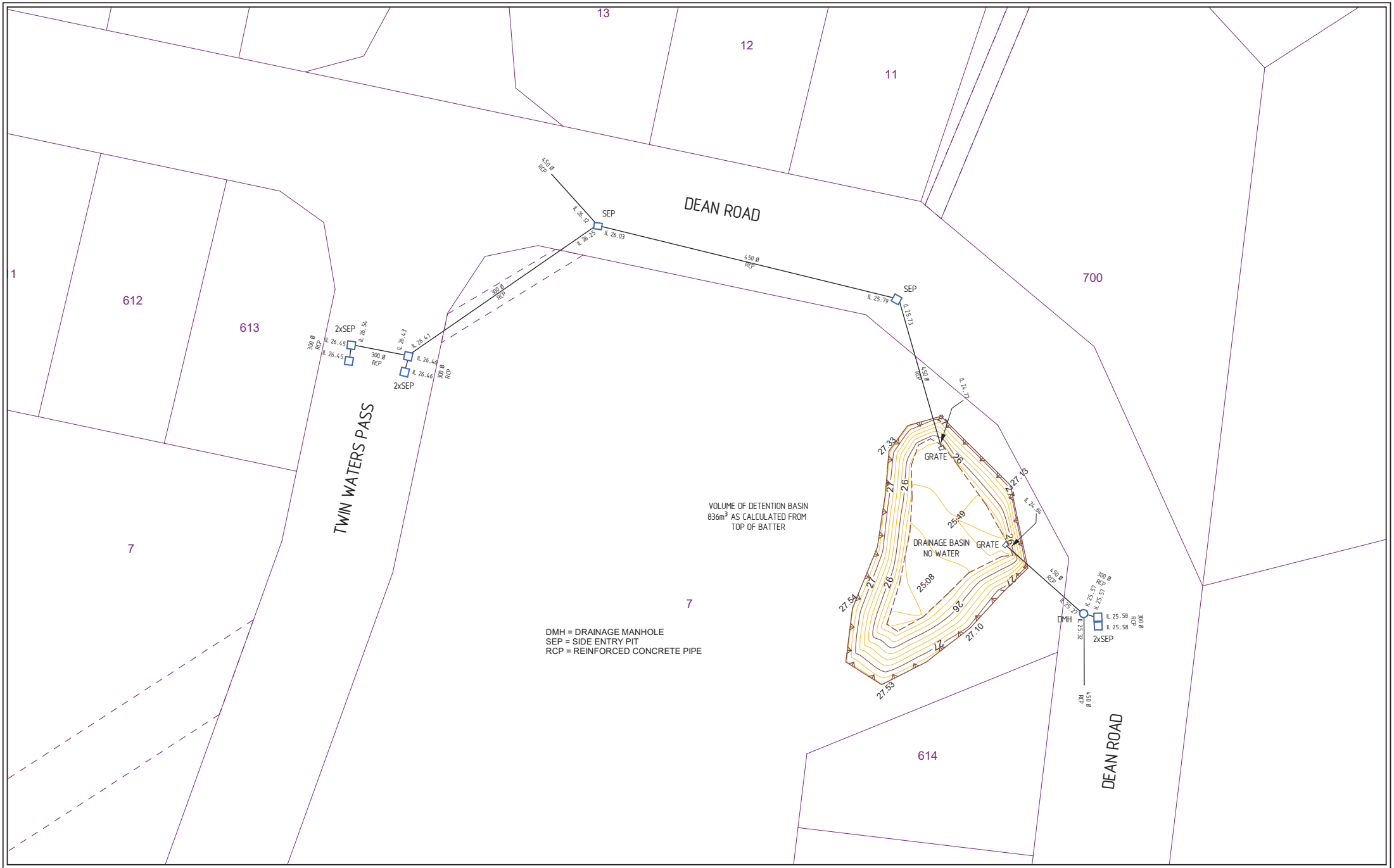

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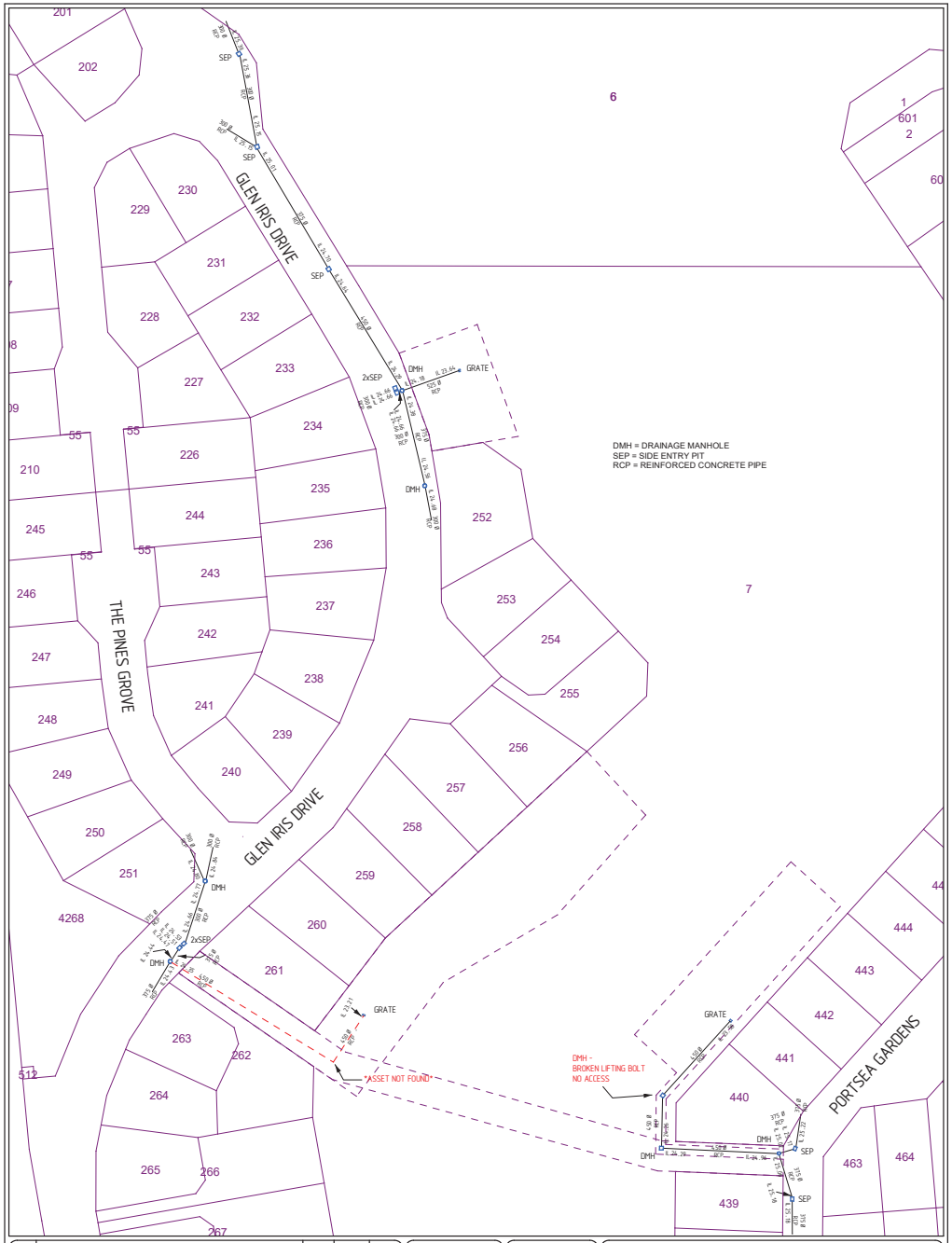

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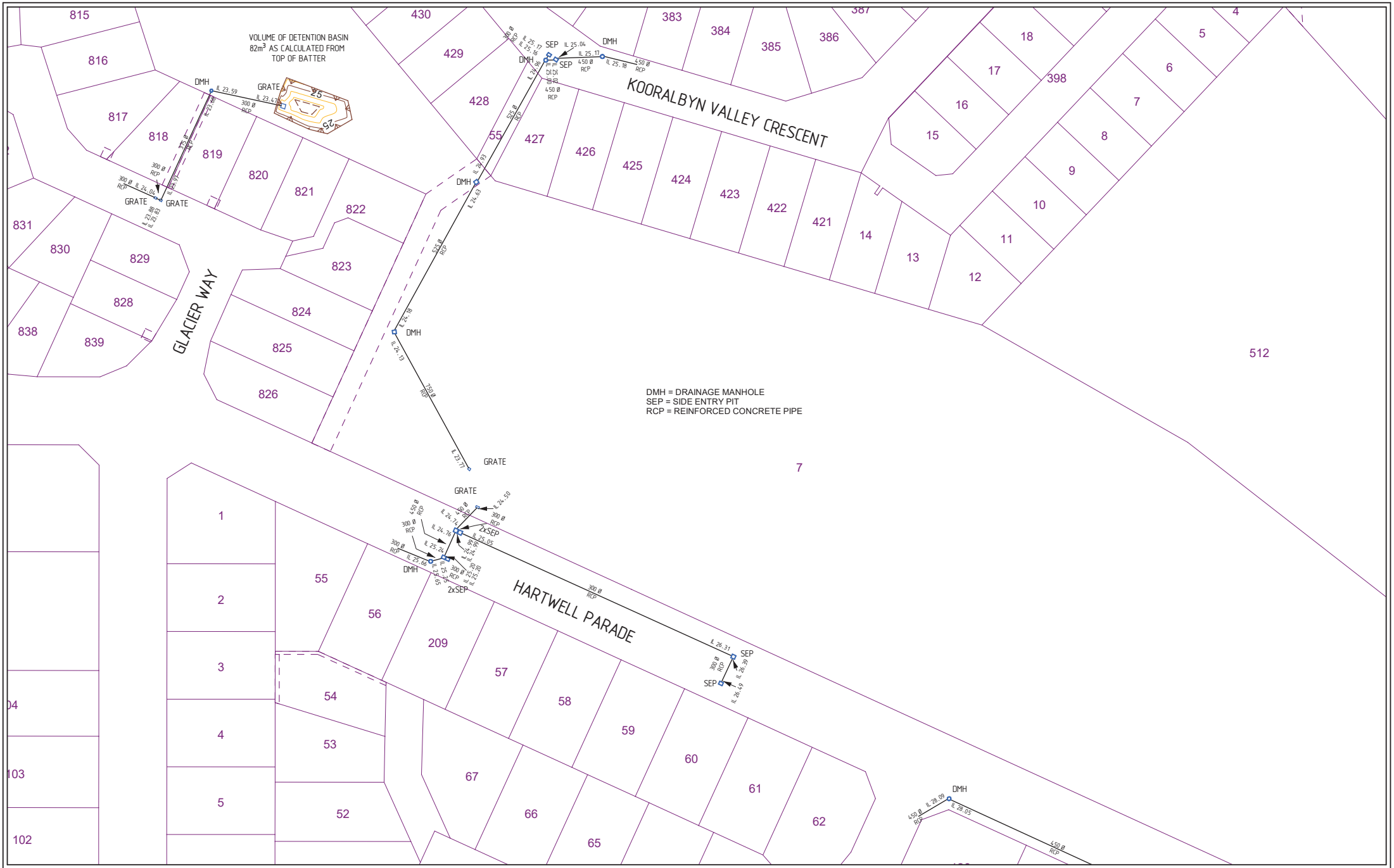

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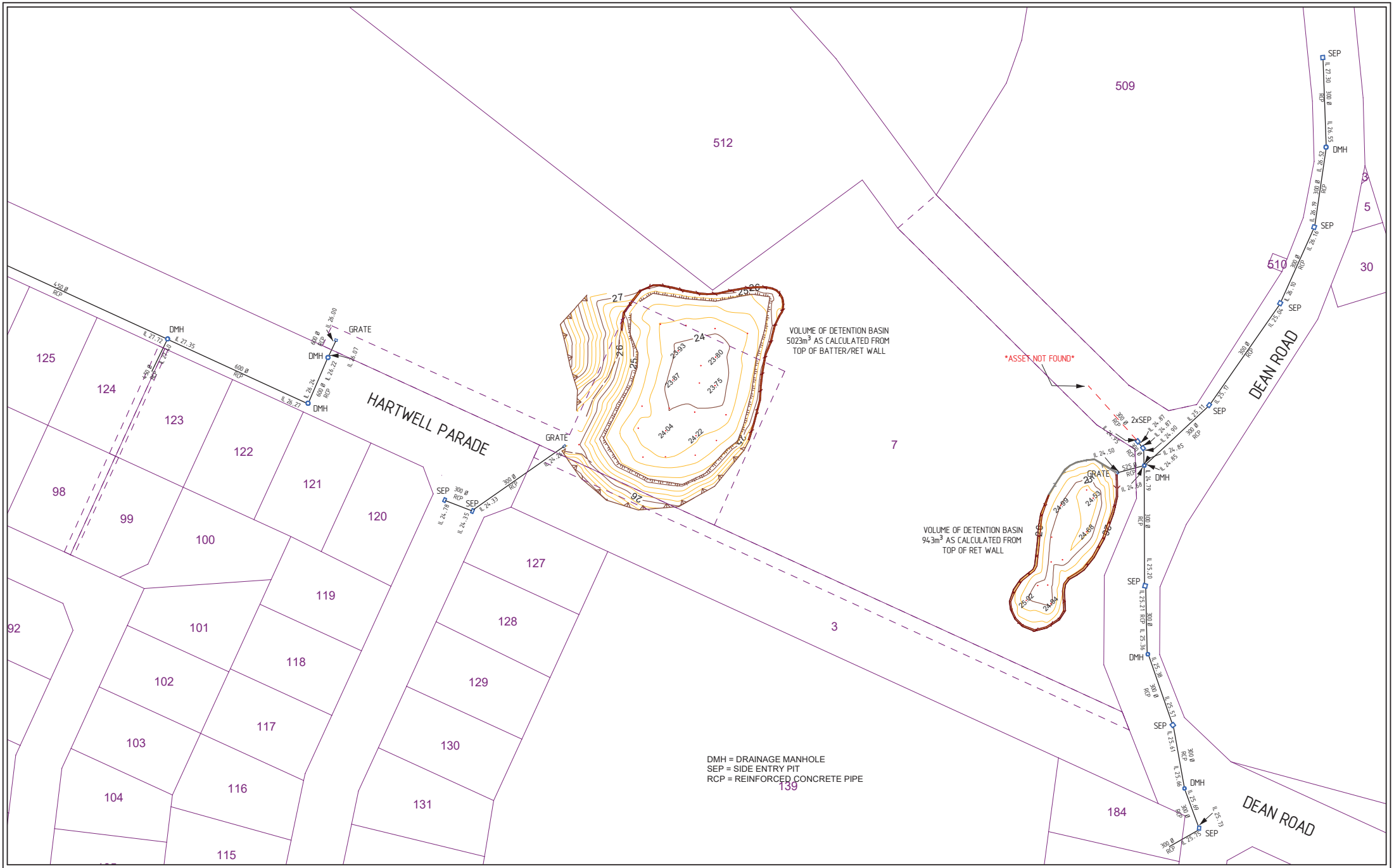

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Project Mngr	KEN SELLERS	Datum	PCG94 / AHD

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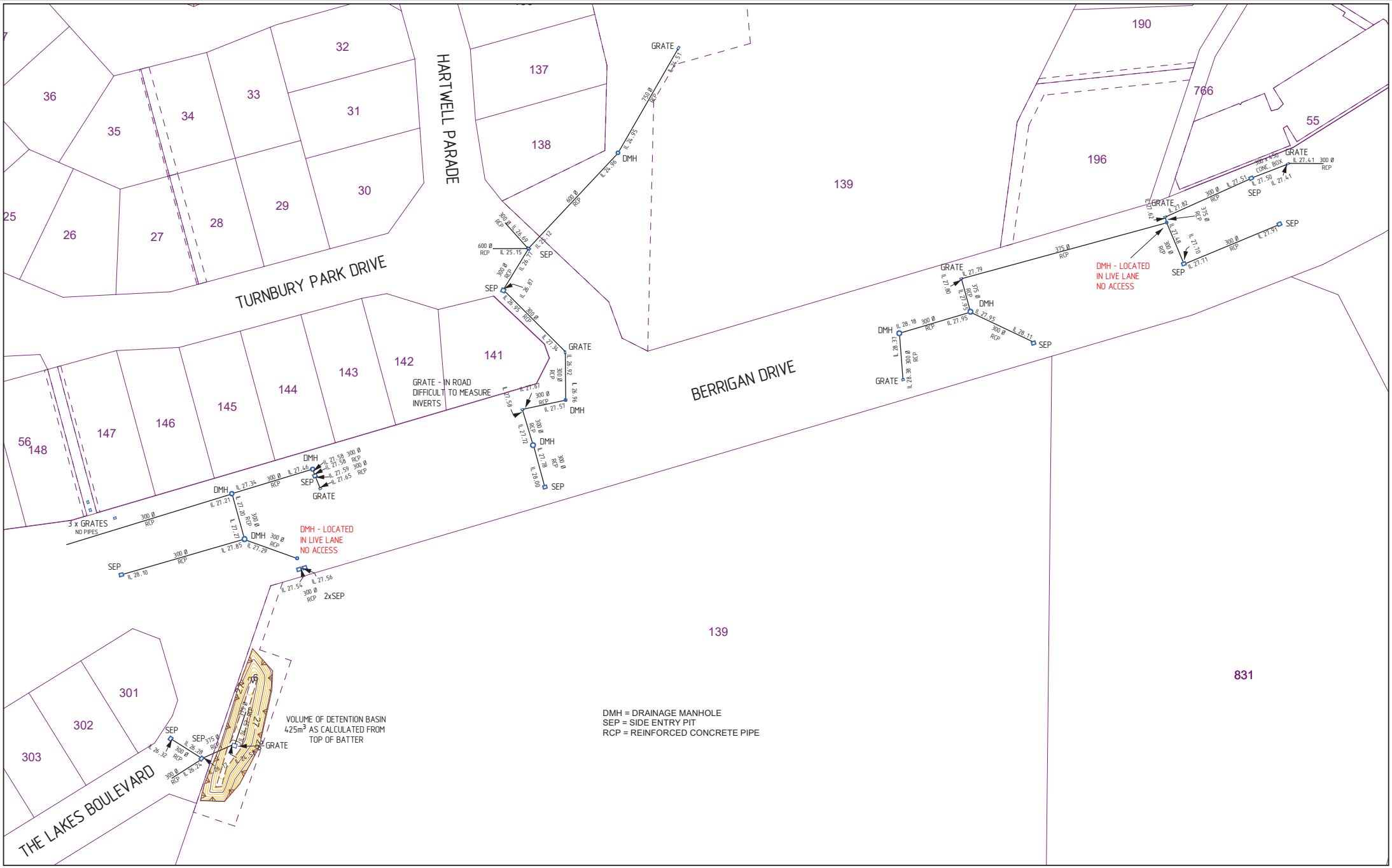

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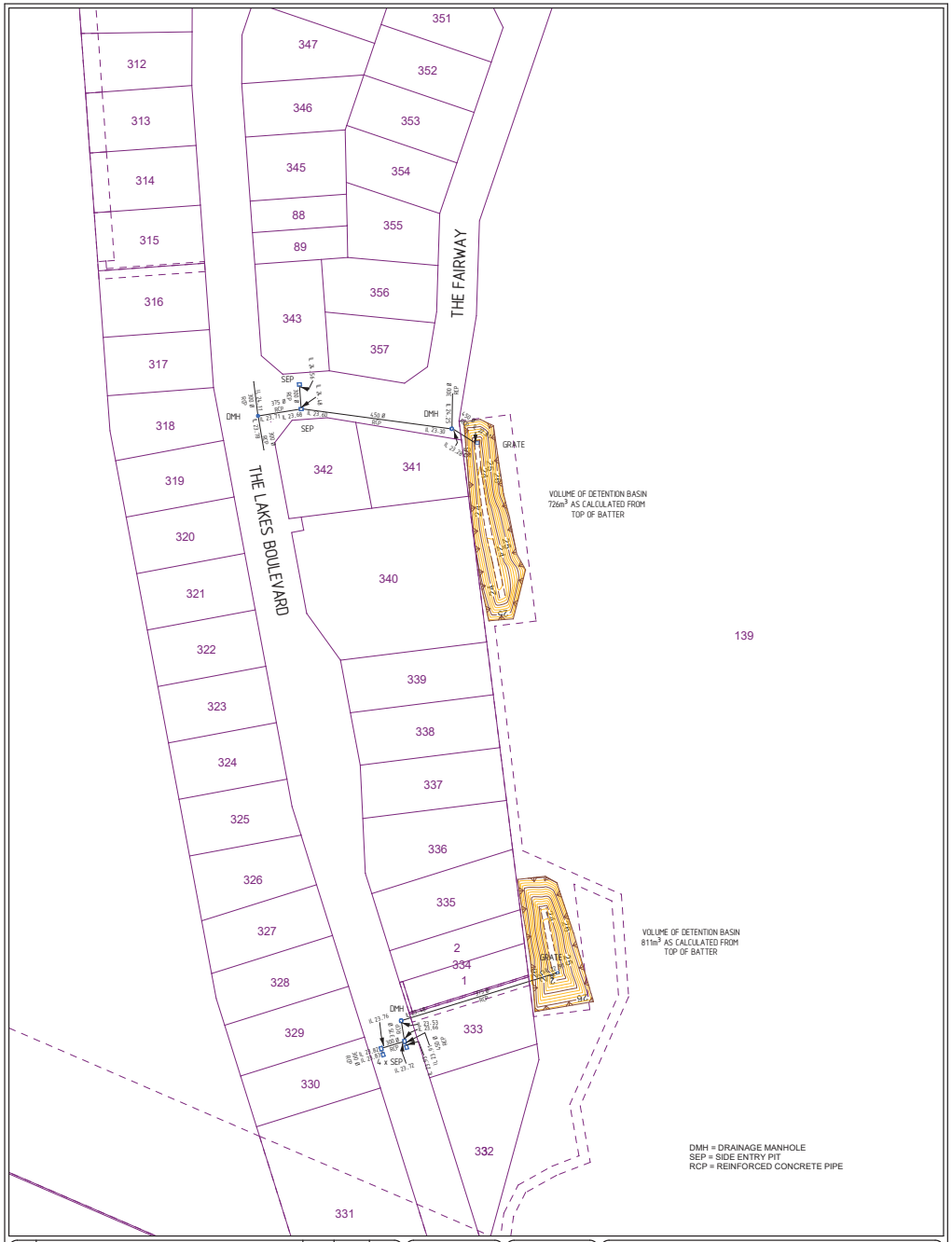

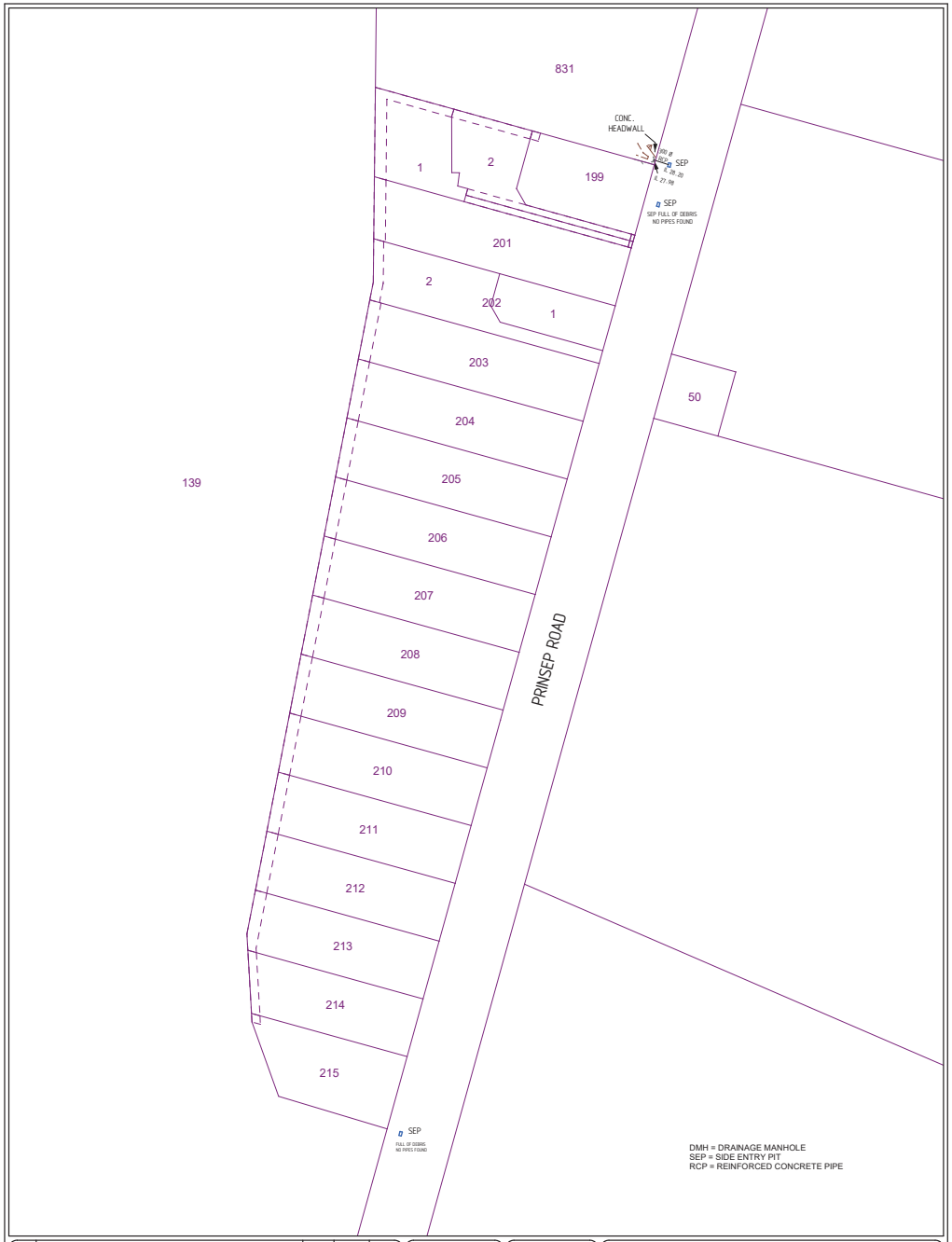

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APPENDIX F
Predevelopment Site Monitoring Data

Date: 16/09/2021 Job No. H20002

A Stormwater Monitoring Sites
A Site Groundwater Bores
Site Boundary

0 100 200 300 400 Meters

hyd2o
Glen Iris Jandakot Local Water Management Strategy
Site Monitoring Locations
Appendix F1

Date: 16/09/2021 Job No. H20002

Site Boundary
A Stormwater Monitoring Sites
A Site Groundwater Bores
A DWER Groundwater Bores

0 150 300 450 600 Meters

hyd2o
Glen Iris Jandakot Local Water Management Strategy
DWER Groundwater Monitoring Bore Locations
Appendix F2

H20002 Glen Iris GC

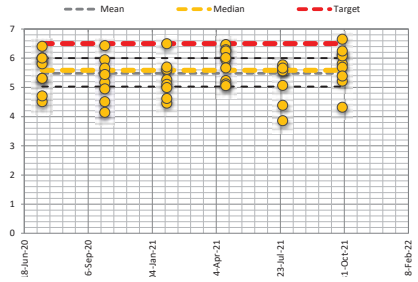
Aggregated Data for All Sites
Groundwater

Data Analysis Period Start Date: 1/06/2020
Data Analysis Period End Date: 31/12/2021

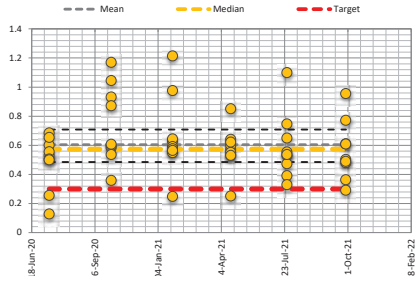
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	227	2.44	3.74	5.89	**5.36**	8.16	13.39		0
GWL mAHD	Groundwater Level mAHD	mAHD	227	21.29	22.26	22.90	**22.82**	23.64	24.93		0
T	Temperature	°C	54	17.00	18.90	20.63	**20.45**	22.40	26.00		0
EC	Electrical Conductivity	mS/cm	54	0.13	0.48	0.603	**0.57**	0.71	1.21	0.30	49
pH	pH	pH	54	3.85	5.03	5.48	**5.58**	6.00	6.64	6.50	1
DO%	Dissolved Oxygen	%	53	10.50	22.93	31.56	**31.00**	35.78	72.80		0
TN	Total Nitrogen	mg/L	54	0.30	0.80	1.83	**1.35**	2.20	13.00	1.20	32
TKN	Total Kej Nitrogen	mg/L	54	0.10	0.40	0.84	**0.80**	1.30	1.70		0
NH3-N	Ammonia as N	mg/L	54	0.01	0.01	0.19	**0.12**	0.33	0.69	1.90	0
NO_3-N	Nitrate as N	mg/L	54	0.01	0.01	0.97	**0.13**	1.84	11.00	0.70	19
NO2-N	Nitrite as N	mg/L	54	0.01	0.01	0.02	**0.01**	0.01	0.43		0
TP	Total Phosphorous	mg/L	54	0.05	0.05	0.05	**0.05**	0.05	0.15	0.07	1
PO4-	Phosphate as P	mg/L	54	0.01	0.01	0.01	**0.01**	0.01	0.01	0.04	0
As	Arsenic	mg/L	54	0.00100	0.00100	0.00180	**0.00100**	0.00100	0.01000	0.02400	0
Cd	Cadmium	mg/L	54	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	54	0.00100	0.00100	0.00109	**0.00100**	0.00100	0.00200	0.00100	5
Cu	Copper	mg/L	54	0.00100	0.00100	0.00613	**0.00100**	0.00100	0.10000	0.00140	9
Pb	Lead	mg/L	54	0.00100	0.00100	0.00124	**0.00100**	0.00100	0.00400	0.00340	1
Hg	Mercury	mg/L	54	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	54	0.00100	0.00100	0.00170	**0.00100**	0.00100	0.01100	0.01100	0
Zn	Zinc	mg/L	54	0.00100	0.00100	0.00983	**0.00150**	0.00880	0.08900	0.00800	11
Nox	Nox	mg/L	54	0.01	0.01	0.98	**0.13**	1.84	11.00	0.15000	27

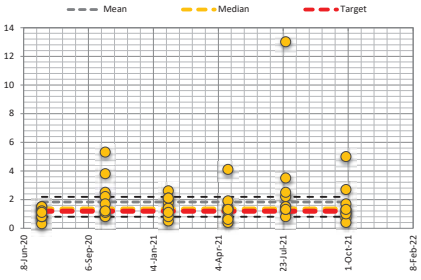
pH



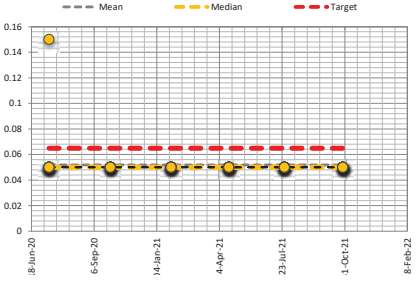
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

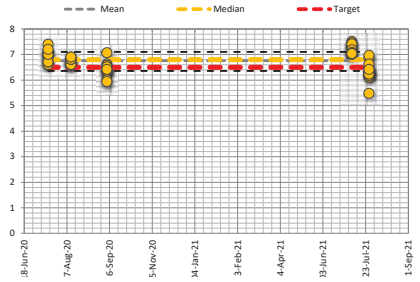
Aggregated Data for All Sites
Surface Water

Data Analysis Period Start Date: 1/06/2020
Data Analysis Period End Date: 31/12/2021

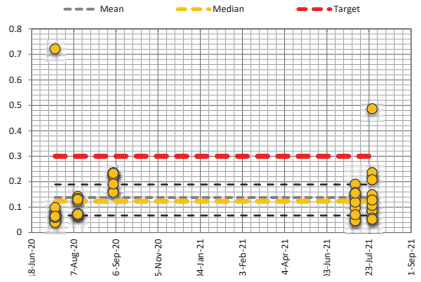
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
GWL mAHD	Groundwater Level mAHD	mAHD	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
T	Temperature	°C	60	11.40	14.48	15.66	**15.40**	16.82	23.50		0
EC	Electrical Conductivity	mS/cm	60	0.04	0.07	0.138	**0.12**	0.19	0.72	0.30	2
pH	pH	pH	60	5.47	6.36	6.76	**6.80**	7.10	7.51	6.50	43
DO%	Dissolved Oxygen	%	60	6.20	35.54	55.91	**64.55**	72.44	82.60		0
TN	Total Nitrogen	mg/L	60	0.10	0.20	0.37	**0.30**	0.50	1.90	1.20	3
TKN	Total Kej Nitrogen	mg/L	60	0.01	0.20	0.35	**0.20**	0.40	1.90		0
NH3-N	Ammonia as N	mg/L	60	0.01	0.01	0.03	**0.01**	0.03	0.26	1.90	0
NO_3-N	Nitrate as N	mg/L	60	0.01	0.01	0.03	**0.02**	0.05	0.12	0.70	0
NO2-N	Nitrite as N	mg/L	60	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	60	0.05	0.05	0.09	**0.05**	0.09	0.50	0.07	15
PO4-	Phosphate as P	mg/L	60	0.00	0.01	0.02	**0.01**	0.02	0.19	0.04	6
As	Arsenic	mg/L	60	0.00100	0.00100	0.00102	**0.00100**	0.00100	0.00200	0.02400	0
Cd	Cadmium	mg/L	60	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	60	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	60	0.00100	0.00100	0.00307	**0.00100**	0.00200	0.10000	0.00140	17
Pb	Lead	mg/L	60	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	60	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	60	0.00100	0.00100	0.00108	**0.00100**	0.00100	0.00600	0.01100	0
Zn	Zinc	mg/L	60	0.00200	0.00700	0.03260	**0.01300**	0.04440	0.30000	0.00800	41
Nox	Nox	mg/L	60	0.01	0.01	0.03	**0.02**	0.05	0.12	0.15000	0

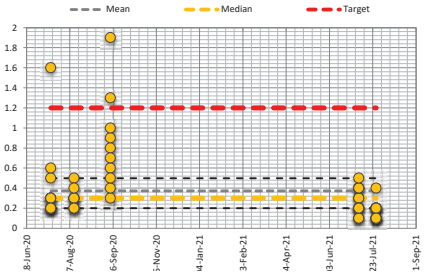
pH



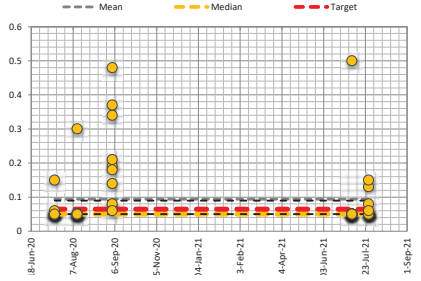
Electrical Conductivity



Total Nitrogen



Total Phosphorous



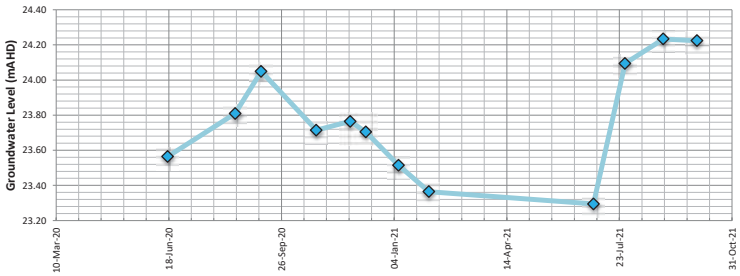
FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

J310 DWER Bore 1

Data Analysis Period Start Date	1/06/2020	Easting	396862	Natural Surface (mAHD)	
Data Analysis Period End Date	31/12/2021	Northing	6442071	Top of Casing (m AHD)	26.69
				End of Hole (mAHD)	

Report Date : 28/08/2023



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
17/06/2020	3.13	23.56	
16/08/2020	2.89	23.81	
8/09/2020	2.65	24.05	
27/10/2020	2.98	23.71	
26/11/2020	2.93	23.76	
10/12/2020	2.99	23.70	
8/01/2021	3.18	23.51	
4/02/2021	3.33	23.36	
30/06/2021	3.40	23.29	
28/07/2021	2.60	24.09	
31/08/2021	2.46	24.23	
30/09/2021	2.47	24.22	

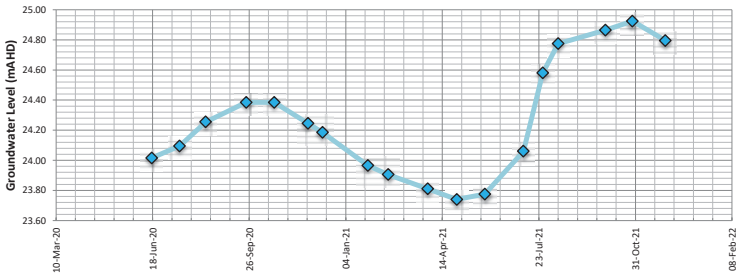
Minimum Recorded Level (mAHD)	23.29
Maximum Recorded Level (mAHD)	24.23

H20002 Glen Iris GC

JM45A DWER Bore 2

Data Analysis Period Start Date	1/06/2020	Easting	393033	Natural Surface (mAHD)	27.50
Data Analysis Period End Date	31/12/2021	Northing	6447505	Top of Casing (m AHD)	27.93
				End of Hole (mAHD)	

Report Date : 28/08/2023



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
17/06/2020	3.91	24.02	3.48
16/07/2020	3.83	24.10	3.40
12/08/2020	3.67	24.26	3.24
23/09/2020	3.54	24.39	3.11
22/10/2020	3.54	24.39	3.11
26/11/2020	3.68	24.25	3.25
11/12/2020	3.74	24.19	3.31
27/01/2021	3.96	23.97	3.53
17/02/2021	4.02	23.91	3.59
30/03/2021	4.12	23.81	3.69
29/04/2021	4.19	23.74	3.76
28/05/2021	4.15	23.78	3.72
7/07/2021	3.87	24.06	3.44
27/07/2021	3.35	24.58	2.92
12/08/2021	3.15	24.78	2.72
30/09/2021	3.06	24.87	2.63
28/10/2021	3.00	24.93	2.57
1/12/2021	3.13	24.80	2.70

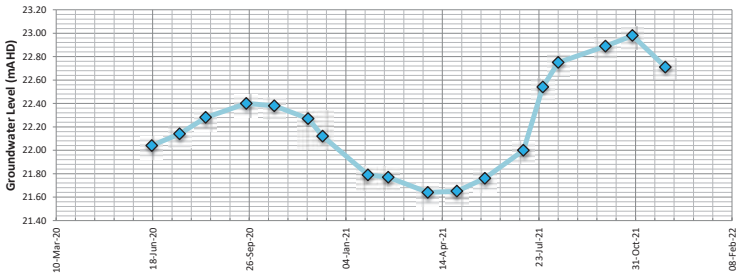
Minimum Recorded Level (mAHD)	23.74
Maximum Recorded Level (mAHD)	24.93

H20002 Glen Iris GC

JM2 DWER Bore 3

Data Analysis Period Start Date	1/06/2020	Easting	393255	Natural Surface (mAHD)	27.79
Data Analysis Period End Date	31/12/2021	Northing	6449864	Top of Casing (m AHD)	28.23
				End of Hole (mAHD)	

Report Date : 28/08/2023



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
17/06/2020	6.19	22.04	5.75
16/07/2020	6.09	22.14	5.65
12/08/2020	5.95	22.28	5.51
23/09/2020	5.83	22.40	5.39
22/10/2020	5.85	22.38	5.41
26/11/2020	5.96	22.27	5.52
11/12/2020	6.11	22.12	5.67
27/01/2021	6.44	21.79	6.00
17/02/2021	6.46	21.77	6.02
30/03/2021	6.59	21.64	6.15
29/04/2021	6.58	21.65	6.14
28/05/2021	6.47	21.76	6.03
7/07/2021	6.23	22.00	5.79
27/07/2021	5.69	22.54	5.25
12/08/2021	5.48	22.75	5.04
30/09/2021	5.34	22.89	4.90
28/10/2021	5.25	22.98	4.81
1/12/2021	5.52	22.71	5.08

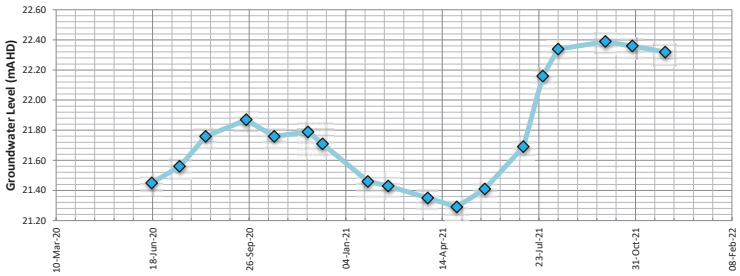
Minimum Recorded Level (mAHD)	21.64
Maximum Recorded Level (mAHD)	22.98

H20002 Glen Iris GC

JM12 DWER Bore 4

Data Analysis Period Start Date	1/06/2020	Easting	391437	Natural Surface (mAHD)	34.51
Data Analysis Period End Date	31/12/2021	Northing	6447453	Top of Casing (m AHD)	34.68
				End of Hole (mAHD)	

Report Date : 28/08/2023



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
17/06/2020	13.23	21.45	13.06
16/07/2020	13.12	21.56	12.95
12/08/2020	12.92	21.76	12.75
23/09/2020	12.81	21.87	12.64
22/10/2020	12.92	21.76	12.75
26/11/2020	12.89	21.79	12.72
11/12/2020	12.97	21.71	12.80
27/01/2021	13.22	21.46	13.05
17/02/2021	13.25	21.43	13.08
30/03/2021	13.33	21.35	13.16
29/04/2021	13.39	21.29	13.22
28/05/2021	13.27	21.41	13.10
7/07/2021	12.99	21.69	12.82
27/07/2021	12.52	22.16	12.35
12/08/2021	12.34	22.34	12.17
30/09/2021	12.29	22.39	12.12
28/10/2021	12.32	22.36	12.15
1/12/2021	12.36	22.32	12.19

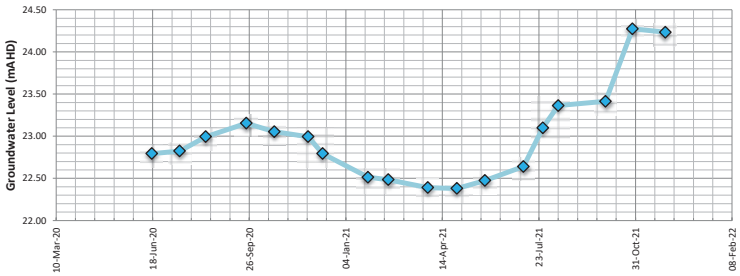
Minimum Recorded Level (mAHD)	21.29
Maximum Recorded Level (mAHD)	22.39

H20002 Glen Iris GC

MW1 Site Monitoring Bore 1

Data Analysis Period Start Date	1/06/2020	Easting	392219	Natural Surface (mAHD)	30.93
Data Analysis Period End Date	31/12/2021	Northing	6447400	Top of Casing (m AHD)	31.53
				End of Hole (mAHD)	

Report Date : 28/08/2023



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
17/06/2020	8.74	22.79	8.14
16/07/2020	8.71	22.82	8.11
12/08/2020	8.54	22.99	7.94
23/09/2020	8.38	23.15	7.78
22/10/2020	8.48	23.05	7.88
26/11/2020	8.54	22.99	7.94
11/12/2020	8.74	22.79	8.14
27/01/2021	9.02	22.51	8.42
17/02/2021	9.05	22.48	8.45
30/03/2021	9.14	22.39	8.54
29/04/2021	9.15	22.38	8.55
28/05/2021	9.06	22.47	8.46
7/07/2021	8.89	22.64	8.29
27/07/2021	8.43	23.10	7.83
12/08/2021	8.17	23.36	7.57
30/09/2021	8.12	23.41	7.52
28/10/2021	7.26	24.27	6.66
1/12/2021	7.30	24.23	6.70

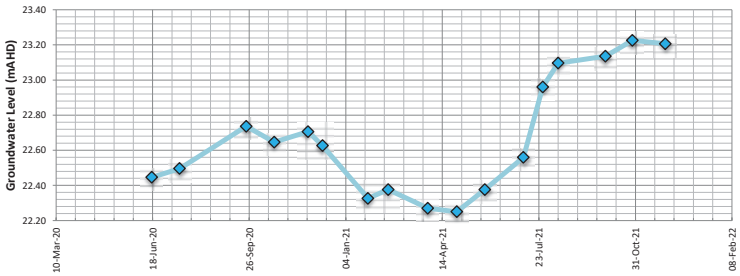
Minimum Recorded Level (mAHD)	22.38
Maximum Recorded Level (mAHD)	24.27

H20002 Glen Iris GC

MW2 Site Monitoring Bore 2

Data Analysis Period Start Date	1/06/2020	Easting	392008	Natural Surface (mAHD)	27.22
Data Analysis Period End Date	31/12/2021	Northing	6447916	Top of Casing (m AHD)	27.82
				End of Hole (mAHD)	

Report Date : 28/08/2023



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
17/06/2020	5.37	22.45	4.77
16/07/2020	5.32	22.50	4.72
23/09/2020	5.08	22.74	4.48
22/10/2020	5.17	22.65	4.57
26/11/2020	5.11	22.71	4.51
11/12/2020	5.19	22.63	4.59
27/01/2021	5.49	22.33	4.89
17/02/2021	5.44	22.38	4.84
30/03/2021	5.55	22.27	4.95
29/04/2021	5.57	22.25	4.97
28/05/2021	5.44	22.38	4.84
7/07/2021	5.26	22.56	4.66
27/07/2021	4.86	22.96	4.26
12/08/2021	4.72	23.10	4.12
30/09/2021	4.68	23.14	4.08
28/10/2021	4.59	23.23	3.99
1/12/2021	4.61	23.21	4.01

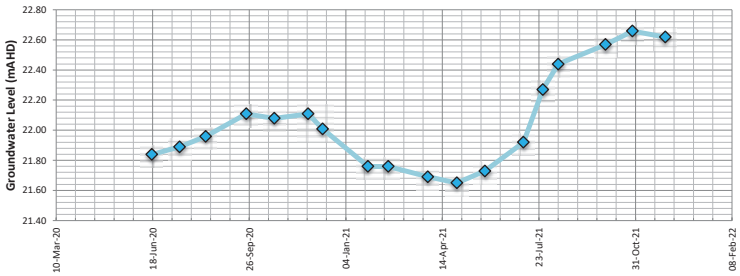
Minimum Recorded Level (mAHD)	22.25
Maximum Recorded Level (mAHD)	23.23

H20002 Glen Iris GC

MW3 Site Monitoring Bore 3

Data Analysis Period Start Date	1/06/2020	Easting	391661	Natural Surface (mAHD)	29.73
Data Analysis Period End Date	31/12/2021	Northing	6448084	Top of Casing (m AHD)	30.33
				End of Hole (mAHD)	

Report Date : 28/08/2023



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
17/06/2020	8.49	21.84	7.89
16/07/2020	8.44	21.89	7.84
12/08/2020	8.37	21.96	7.77
23/09/2020	8.22	22.11	7.62
22/10/2020	8.25	22.08	7.65
26/11/2020	8.22	22.11	7.62
11/12/2020	8.32	22.01	7.72
27/01/2021	8.57	21.76	7.97
17/02/2021	8.57	21.76	7.97
30/03/2021	8.64	21.69	8.04
29/04/2021	8.68	21.65	8.08
28/05/2021	8.60	21.73	8.00
7/07/2021	8.41	21.92	7.81
27/07/2021	8.06	22.27	7.46
12/08/2021	7.89	22.44	7.29
30/09/2021	7.76	22.57	7.16
28/10/2021	7.67	22.66	7.07
1/12/2021	7.71	22.62	7.11

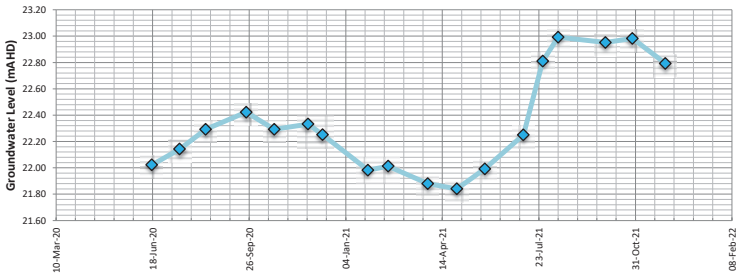
Minimum Recorded Level (mAHD)	21.65
Maximum Recorded Level (mAHD)	22.66

H20002 Glen Iris GC

MW4 Site Monitoring Bore 4

Data Analysis Period Start Date	1/06/2020	Easting	391708	Natural Surface (mAHD)	25.67
Data Analysis Period End Date	31/12/2021	Northing	6447579	Top of Casing (m AHD)	26.27
				End of Hole (mAHD)	

Report Date : 28/08/2023



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
17/06/2020	4.25	22.02	3.65
16/07/2020	4.13	22.14	3.53
12/08/2020	3.98	22.29	3.38
23/09/2020	3.85	22.42	3.25
22/10/2020	3.98	22.29	3.38
26/11/2020	3.94	22.33	3.34
11/12/2020	4.02	22.25	3.42
27/01/2021	4.29	21.98	3.69
17/02/2021	4.26	22.01	3.66
30/03/2021	4.39	21.88	3.79
29/04/2021	4.43	21.84	3.83
28/05/2021	4.28	21.99	3.68
7/07/2021	4.02	22.25	3.42
27/07/2021	3.46	22.81	2.86
12/08/2021	3.28	22.99	2.68
30/09/2021	3.32	22.95	2.72
28/10/2021	3.29	22.98	2.69
1/12/2021	3.48	22.79	2.88

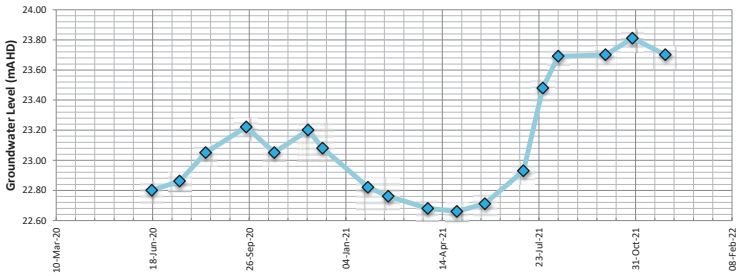
Minimum Recorded Level (mAHD)	21.84
Maximum Recorded Level (mAHD)	22.99

H20002 Glen Iris GC

MW5 Site Monitoring Bore 5

Data Analysis Period Start Date	1/06/2020	Easting	392170	Natural Surface (mAHD)	26.84
Data Analysis Period End Date	31/12/2021	Northing	6447202	Top of Casing (m AHD)	27.44
				End of Hole (mAHD)	

Report Date : 28/08/2023



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
17/06/2020	4.64	22.80	4.04
16/07/2020	4.58	22.86	3.98
12/08/2020	4.39	23.05	3.79
23/09/2020	4.22	23.22	3.62
22/10/2020	4.39	23.05	3.79
26/11/2020	4.24	23.20	3.64
11/12/2020	4.36	23.08	3.76
27/01/2021	4.62	22.82	4.02
17/02/2021	4.68	22.76	4.08
30/03/2021	4.76	22.68	4.16
29/04/2021	4.78	22.66	4.18
28/05/2021	4.73	22.71	4.13
7/07/2021	4.51	22.93	3.91
27/07/2021	3.96	23.48	3.36
12/08/2021	3.75	23.69	3.15
30/09/2021	3.74	23.70	3.14
28/10/2021	3.63	23.81	3.03
1/12/2021	3.74	23.70	3.14

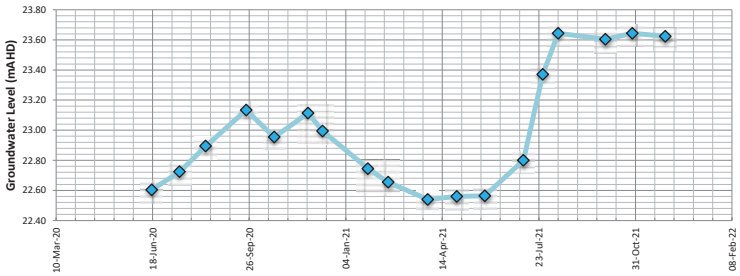
Minimum Recorded Level (mAHD)	22.66
Maximum Recorded Level (mAHD)	23.81

H20002 Glen Iris GC

MW6 Site Monitoring Bore 6

Data Analysis Period Start Date	1/06/2020	Easting	392027	Natural Surface (mAHD)	28.56
Data Analysis Period End Date	31/12/2021	Northing	6446878	Top of Casing (m AHD)	29.16
				End of Hole (mAHD)	

Report Date : 28/08/2023



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
17/06/2020	6.56	22.60	5.96
16/07/2020	6.44	22.72	5.84
12/08/2020	6.27	22.89	5.67
23/09/2020	6.03	23.13	5.43
22/10/2020	6.21	22.95	5.61
26/11/2020	6.05	23.11	5.45
11/12/2020	6.17	22.99	5.57
27/01/2021	6.42	22.74	5.82
17/02/2021	6.51	22.65	5.91
30/03/2021	6.62	22.54	6.02
29/04/2021	6.60	22.56	6.00
28/05/2021	6.60	22.56	6.00
7/07/2021	6.36	22.80	5.76
27/07/2021	5.79	23.37	5.19
12/08/2021	5.52	23.64	4.92
30/09/2021	5.56	23.60	4.96
28/10/2021	5.52	23.64	4.92
1/12/2021	5.54	23.62	4.94

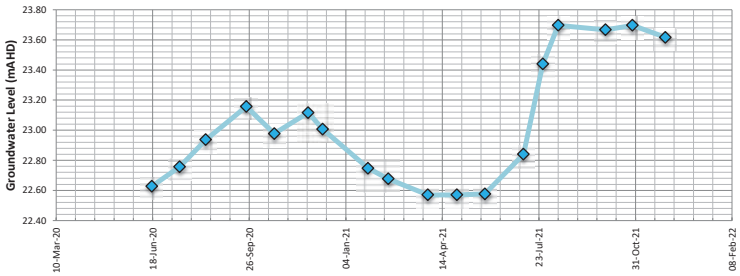
Minimum Recorded Level (mAHD)	22.54
Maximum Recorded Level (mAHD)	23.64

H20002 Glen Iris GC

MW7 Site Monitoring Bore 7

Data Analysis Period Start Date	1/06/2020	Easting	391965	Natural Surface (mAHD)	27.70
Data Analysis Period End Date	31/12/2021	Northing	6446606	Top of Casing (m AHD)	28.30
				End of Hole (mAHD)	

Report Date : 28/08/2023



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
17/06/2020	5.67	22.63	5.07
16/07/2020	5.54	22.76	4.94
12/08/2020	5.36	22.94	4.76
23/09/2020	5.14	23.16	4.54
22/10/2020	5.32	22.98	4.72
26/11/2020	5.18	23.12	4.58
11/12/2020	5.29	23.01	4.69
27/01/2021	5.55	22.75	4.95
17/02/2021	5.62	22.68	5.02
30/03/2021	5.73	22.57	5.13
29/04/2021	5.73	22.57	5.13
28/05/2021	5.72	22.58	5.12
7/07/2021	5.46	22.84	4.86
27/07/2021	4.86	23.44	4.26
12/08/2021	4.60	23.70	4.00
30/09/2021	4.63	23.67	4.03
28/10/2021	4.60	23.70	4.00
1/12/2021	4.68	23.62	4.08

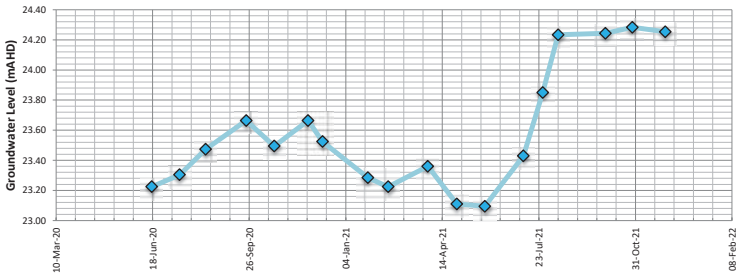
Minimum Recorded Level (mAHD)	22.57
Maximum Recorded Level (mAHD)	23.70

H20002 Glen Iris GC

MW8 Site Monitoring Bore 8

Data Analysis Period Start Date	1/06/2020	Easting	392151	Natural Surface (mAHD)	26.12
Data Analysis Period End Date	31/12/2021	Northing	6446249	Top of Casing (m AHD)	26.72
				End of Hole (mAHD)	

Report Date : 28/08/2023



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
17/06/2020	3.50	23.22	2.90
16/07/2020	3.42	23.30	2.82
12/08/2020	3.25	23.47	2.65
23/09/2020	3.06	23.66	2.46
22/10/2020	3.23	23.49	2.63
26/11/2020	3.06	23.66	2.46
11/12/2020	3.20	23.52	2.60
27/01/2021	3.44	23.28	2.84
17/02/2021	3.50	23.22	2.90
30/03/2021	3.36	23.36	2.76
29/04/2021	3.61	23.11	3.01
28/05/2021	3.63	23.09	3.03
7/07/2021	3.29	23.43	2.69
27/07/2021	2.87	23.85	2.27
12/08/2021	2.49	24.23	1.89
30/09/2021	2.48	24.24	1.88
28/10/2021	2.44	24.28	1.84
1/12/2021	2.47	24.25	1.87

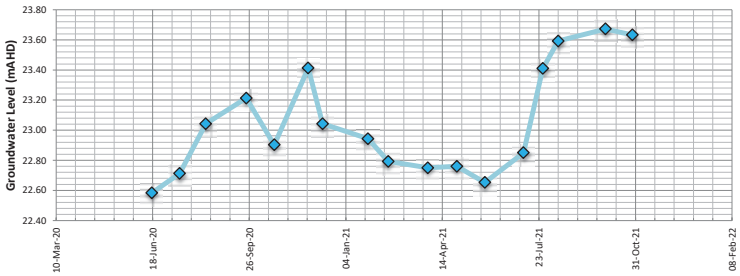
Minimum Recorded Level (mAHD)	23.09
Maximum Recorded Level (mAHD)	24.28

H20002 Glen Iris GC

MW9 Site Monitoring Bore 9

Data Analysis Period Start Date	1/06/2020	Easting	392221	Natural Surface (mAHD)	27.83
Data Analysis Period End Date	31/12/2021	Northing	6446790	Top of Casing (m AHD)	28.43
				End of Hole (mAHD)	

Report Date : 28/08/2023



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
17/06/2020	5.85	22.58	5.25
16/07/2020	5.72	22.71	5.12
12/08/2020	5.39	23.04	4.79
23/09/2020	5.22	23.21	4.62
22/10/2020	5.53	22.90	4.93
26/11/2020	5.02	23.41	4.42
11/12/2020	5.39	23.04	4.79
27/01/2021	5.49	22.94	4.89
17/02/2021	5.64	22.79	5.04
30/03/2021	5.68	22.75	5.08
29/04/2021	5.67	22.76	5.07
28/05/2021	5.78	22.65	5.18
7/07/2021	5.58	22.85	4.98
27/07/2021	5.02	23.41	4.42
12/08/2021	4.84	23.59	4.24
30/09/2021	4.76	23.67	4.16
28/10/2021	4.80	23.63	4.20

Minimum Recorded Level (mAHD)	22.58
Maximum Recorded Level (mAHD)	23.67

H20002 Glen Iris GC

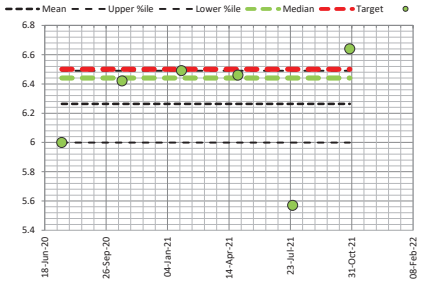
MW1 Site Monitoring Bore 1

Easting	392219	Data Analysis Period Start Date	1/06/2020
Northing	6447400	Data Analysis Period End Date	31/12/2021

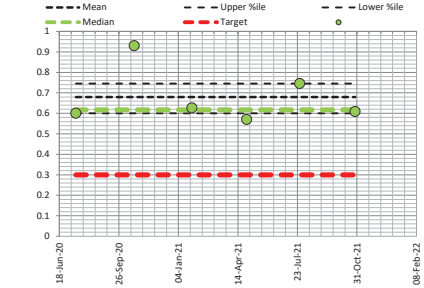
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	18	7.26	8.25	8.54	**8.63**	9.04	9.15		0
GWL mAHD	Groundwater Level mAHD	mAHD	18	22.38	22.50	22.99	**22.91**	23.28	24.27		0
T	Temperature	°C	6	19.10	19.40	21.05	**20.75**	21.40	24.90		0
EC	Electrical Conductivity	mS/cm	6	0.57	0.60	0.680	**0.62**	0.75	0.93	0.30	6
pH	pH	pH	6	5.57	6.00	6.26	**6.44**	6.49	6.64	6.50	1
DO%	Dissolved Oxygen	%	6	18.20	29.40	31.00	**32.95**	35.00	37.50		0
TN	Total Nitrogen	mg/L	6	0.40	0.70	1.55	**1.10**	2.20	3.80	1.20	3
TKN	Total Kej Nitrogen	mg/L	6	0.40	0.40	0.47	**0.40**	0.50	0.70		0
NH3-N	Ammonia as N	mg/L	6	0.01	0.01	0.04	**0.02**	0.05	0.11	1.90	0
NO_3-N	Nitrate as N	mg/L	6	0.01	0.25	1.10	**0.71**	1.80	3.10	0.70	3
NO2-N	Nitrite as N	mg/L	6	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	6	0.05	0.05	0.05	**0.05**	0.05	0.05	0.07	0
PO4-	Phosphate as P	mg/L	6	0.01	0.01	0.01	**0.01**	0.01	0.01	0.04	0
As	Arsenic	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	6	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	6	0.00100	0.00100	0.04350	**0.04150**	0.07600	0.10000	0.00140	4
Pb	Lead	mg/L	6	0.00100	0.00100	0.00217	**0.00200**	0.00300	0.00400	0.00340	1
Hg	Mercury	mg/L	6	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	6	0.00100	0.00100	0.00567	**0.00700**	0.00700	0.01100	0.01100	0
Zn	Zinc	mg/L	6	0.00800	0.02700	0.05650	**0.06400**	0.08700	0.08900	0.00800	5
Nox	Nox	mg/L	6	0.01	0.25	1.10	**0.71**	1.80	3.10	0.15	5

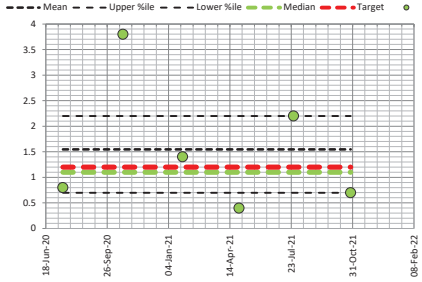
pH



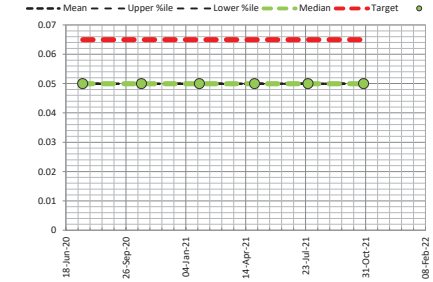
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

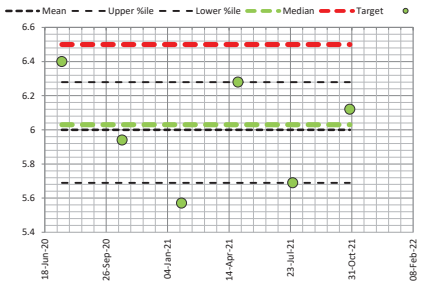
MW2 Site Monitoring Bore 2

Easting 392008 | Northing 6447916 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

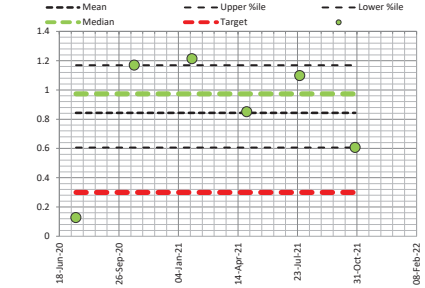
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	17	4.59	4.75	5.14	**5.19**	5.44	5.57		0
GWL mAHD	Groundwater Level mAHD	mAHD	17	22.25	22.38	22.67	**22.63**	23.07	23.23		0
T	Temperature	°C	6	18.00	18.90	19.88	**19.80**	21.00	21.80		0
EC	Electrical Conductivity	mS/cm	6	0.13	0.61	0.844	**0.97**	1.17	1.21	0.30	5
pH	pH	pH	6	5.57	5.69	6.00	**6.03**	6.28	6.40	6.50	0
DO%	Dissolved Oxygen	%	6	13.10	18.20	25.29	**26.67**	32.40	34.70		0
TN	Total Nitrogen	mg/L	6	0.30	0.40	2.10	**2.15**	3.50	4.10	1.20	4
TKN	Total Kej Nitrogen	mg/L	6	0.10	0.20	0.28	**0.30**	0.40	0.40		0
NH3-N	Ammonia as N	mg/L	6	0.01	0.01	0.02	**0.01**	0.03	0.05	1.90	0
NO_3-N	Nitrate as N	mg/L	6	0.03	0.19	1.80	**1.75**	3.10	4.00	0.70	4
NO2-N	Nitrite as N	mg/L	6	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	6	0.05	0.05	0.05	**0.05**	0.05	0.05	0.07	0
PO4-	Phosphate as P	mg/L	6	0.01	0.01	0.01	**0.01**	0.01	0.01	0.04	0
As	Arsenic	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	6	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00140	0
Pb	Lead	mg/L	6	0.00100	0.00100	0.00133	**0.00100**	0.00200	0.00200	0.00340	0
Hg	Mercury	mg/L	6	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	6	0.00100	0.00100	0.00117	**0.00100**	0.00100	0.00200	0.00800	0
Nox	Nox	mg/L	6	0.04	0.19	1.80	**1.75**	3.10	4.00	0.15	5

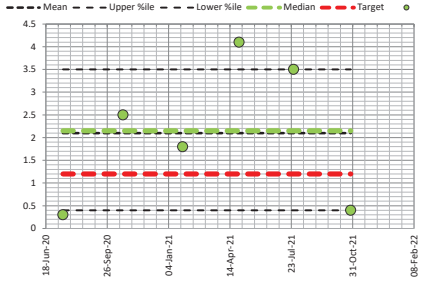
pH



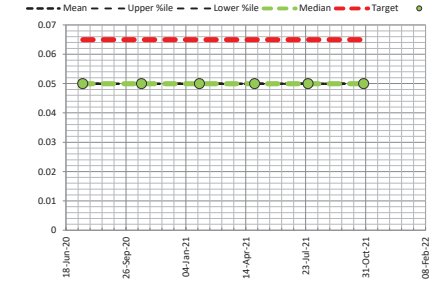
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

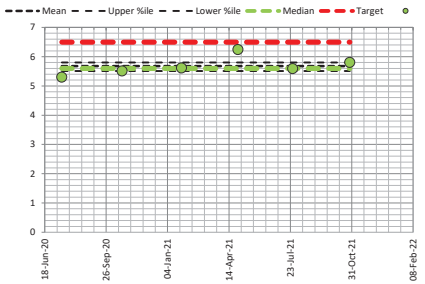
MW3 Site Monitoring Bore 3

Easting 391661 | Northing 6448084 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

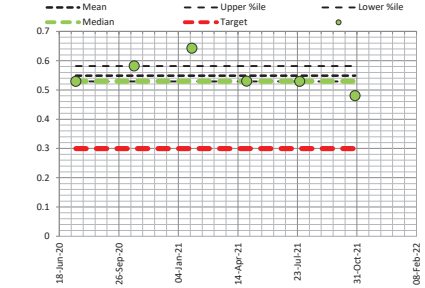
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	18	7.67	7.96	8.27	**8.35**	8.57	8.68		0
GWL mAHD	Groundwater Level mAHD	mAHD	18	21.65	21.76	22.06	**21.98**	22.37	22.66		0
T	Temperature	°C	6	19.10	19.10	20.58	**20.15**	22.40	22.60		0
EC	Electrical Conductivity	mS/cm	6	0.48	0.53	0.549	**0.53**	0.58	0.64	0.30	6
pH	pH	pH	6	5.30	5.51	5.68	**5.60**	5.80	6.24	6.50	0
DO%	Dissolved Oxygen	%	6	41.60	53.80	59.69	**62.22**	65.50	72.80		0
TN	Total Nitrogen	mg/L	6	1.40	1.50	2.15	**2.35**	2.60	2.70	1.20	6
TKN	Total Kej Nitrogen	mg/L	6	0.20	0.20	0.25	**0.20**	0.30	0.40		0
NH3-N	Ammonia as N	mg/L	6	0.01	0.01	0.01	**0.01**	0.01	0.01	1.90	0
NO_3-N	Nitrate as N	mg/L	6	1.20	1.30	1.88	**2.05**	2.30	2.40	0.70	6
NO2-N	Nitrite as N	mg/L	6	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	6	0.05	0.05	0.05	**0.05**	0.05	0.05	0.07	0
PO4-	Phosphate as P	mg/L	6	0.01	0.01	0.01	**0.01**	0.01	0.01	0.04	0
As	Arsenic	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	6	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00140	0
Pb	Lead	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	6	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	6	0.00100	0.00100	0.00267	**0.00150**	0.00300	0.00800	0.00800	0
Nox	Nox	mg/L	6	1.20	1.31	1.88	**2.05**	2.30	2.40	0.15	6

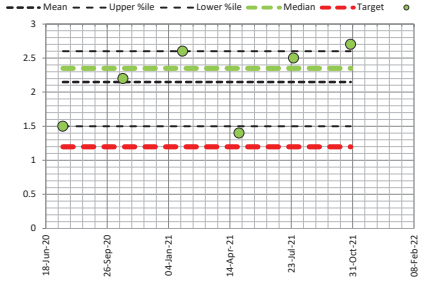
pH



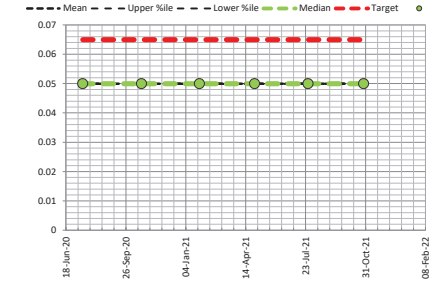
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

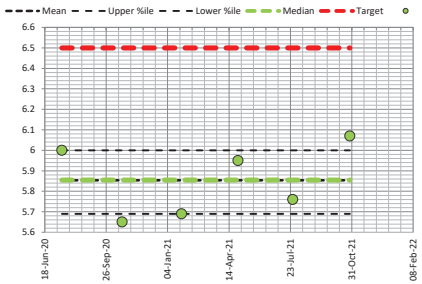
MW4 Site Monitoring Bore 4

Easting 391708 | Northing 6447579 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

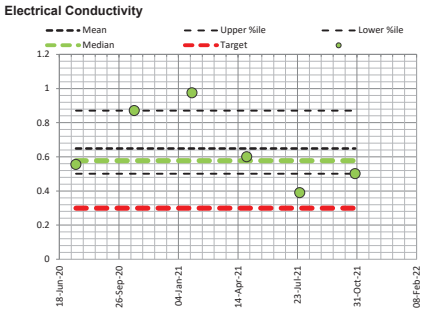
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	18	3.28	3.47	3.93	**4.00**	4.27	4.43		0
GWL mAHD	Groundwater Level mAHD	mAHD	18	21.84	22.00	22.35	**22.27**	22.80	22.99		0
T	Temperature	°C	6	19.10	19.30	21.15	**21.10**	23.10	23.20		0
EC	Electrical Conductivity	mS/cm	6	0.39	0.50	0.649	**0.58**	0.87	0.98	0.30	6
pH	pH	pH	6	5.65	5.69	5.85	**5.86**	6.00	6.07	6.50	0
DO%	Dissolved Oxygen	%	6	14.20	24.30	26.68	**29.35**	31.40	31.50		0
TN	Total Nitrogen	mg/L	6	0.50	0.70	0.78	**0.80**	0.80	1.10	1.20	0
TKN	Total Kej Nitrogen	mg/L	6	0.70	0.80	0.90	**0.80**	1.10	1.20		0
NH3-N	Ammonia as N	mg/L	6	0.10	0.14	0.20	**0.21**	0.26	0.28	1.90	0
NO_3-N	Nitrate as N	mg/L	6	0.01	0.01	0.02	**0.01**	0.05	0.05	0.70	0
NO2-N	Nitrite as N	mg/L	5	#REF!	0.00	0.00	**0.00**	0.00	#REF!		0
TP	Total Phosphorous	mg/L	6	0.05	0.05	0.05	**0.05**	0.05	0.05	0.07	0
PO4-	Phosphate as P	mg/L	6	0.01	0.01	0.01	**0.01**	0.01	0.01	0.04	0
As	Arsenic	mg/L	6	0.00300	0.00400	0.00650	**0.00650**	0.00900	0.01000	0.02400	0
Cd	Cadmium	mg/L	6	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00140	0
Pb	Lead	mg/L	6	0.00100	0.00100	0.00167	**0.00150**	0.00200	0.00300	0.00340	0
Hg	Mercury	mg/L	6	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	6	0.00100	0.00100	0.00117	**0.00100**	0.00100	0.00200	0.01100	0
Zn	Zinc	mg/L	6	0.00100	0.00100	0.00200	**0.00150**	0.00200	0.00500	0.00800	0
Nox	Nox	mg/L	6	0.01	0.01	0.02	**0.01**	0.05	0.05	0.15	0

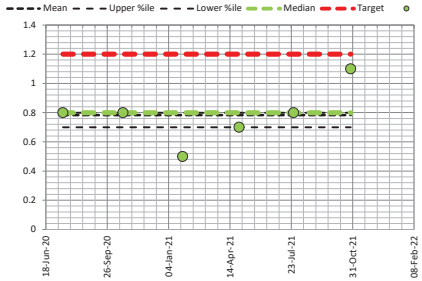
pH



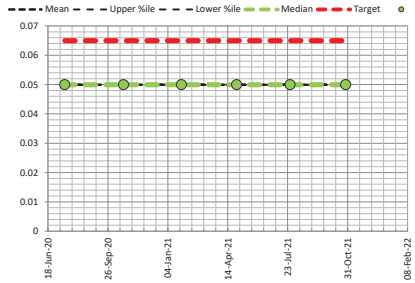
Electrical Conductivity



Total Nitrogen



Total Phosphorous



H20002 Glen Iris GC

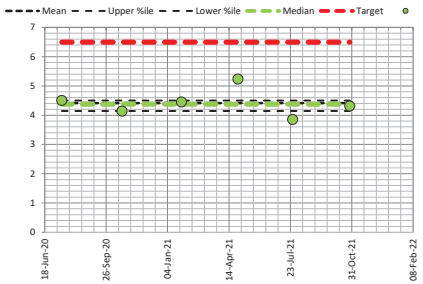
MW5 Site Monitoring Bore 5

Easting 392170 | Northing 6447202 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

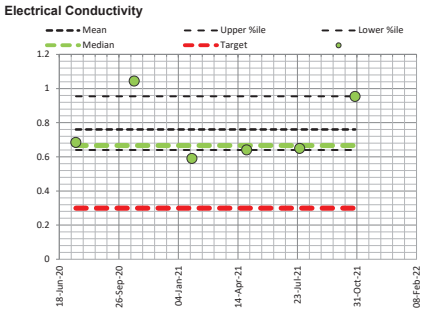
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	18	3.63	3.83	4.32	**4.39**	4.66	4.78		0
GWL mAHD	Groundwater Level mAHD	mAHD	18	22.66	22.78	23.12	**23.05**	23.61	23.81		0
T	Temperature	°C	6	17.90	18.90	20.25	**20.25**	21.80	22.40		0
EC	Electrical Conductivity	mS/cm	6	0.59	0.64	0.760	**0.67**	0.95	1.04	0.30	6
pH	pH	pH	6	3.85	4.14	4.41	**4.38**	4.50	5.23	6.50	0
DO%	Dissolved Oxygen	%	6	13.30	21.20	27.82	**32.07**	33.60	34.70		0
TN	Total Nitrogen	mg/L	6	1.20	1.20	1.33	**1.35**	1.40	1.50	1.20	4
TKN	Total Kej Nitrogen	mg/L	6	0.90	1.00	1.20	**1.25**	1.40	1.40		0
NH3-N	Ammonia as N	mg/L	6	0.27	0.35	0.40	**0.42**	0.45	0.49	1.90	0
NO_3-N	Nitrate as N	mg/L	6	0.01	0.01	0.13	**0.01**	0.19	0.59	0.70	0
NO2-N	Nitrite as N	mg/L	6	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	6	0.05	0.05	0.05	**0.05**	0.05	0.05	0.07	0
PO4-	Phosphate as P	mg/L	6	0.01	0.01	0.01	**0.01**	0.01	0.01	0.04	0
As	Arsenic	mg/L	6	0.00100	0.00100	0.00117	**0.00100**	0.00100	0.00200	0.02400	0
Cd	Cadmium	mg/L	6	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00140	0
Pb	Lead	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	6	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	6	0.00100	0.00100	0.00217	**0.00150**	0.00400	0.00400	0.01100	0
Zn	Zinc	mg/L	6	0.00100	0.00100	0.00767	**0.00100**	0.00600	0.03600	0.00800	1
Nox	Nox	mg/L	6	0.01	0.01	0.14	**0.01**	0.20	0.60	0.15	2

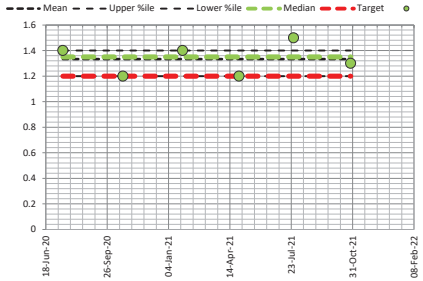
pH



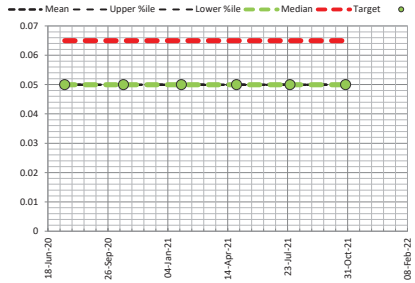
Electrical Conductivity



Total Nitrogen



Total Phosphorous



H20002 Glen Iris GC

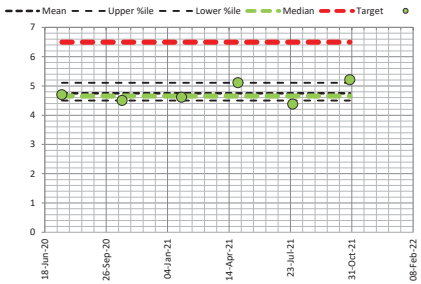
MW6 Site Monitoring Bore 6

Easting 392027 | Northing 6446878 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

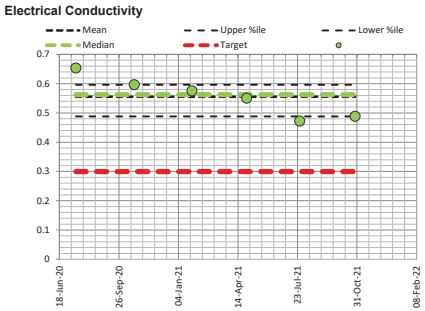
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	18	5.52	5.65	6.15	**6.24**	6.54	6.62		0
GWL mAHD	Groundwater Level mAHD	mAHD	18	22.54	22.62	23.01	**22.92**	23.51	23.64		0
T	Temperature	°C	6	18.20	18.90	20.28	**20.05**	21.50	23.00		0
EC	Electrical Conductivity	mS/cm	6	0.47	0.49	0.556	**0.56**	0.60	0.65	0.30	6
pH	pH	pH	6	4.38	4.50	4.75	**4.66**	5.11	5.21	6.50	0
DO%	Dissolved Oxygen	%	6	13.10	26.20	29.22	**29.36**	31.40	45.90		0
TN	Total Nitrogen	mg/L	6	1.40	1.50	4.72	**3.55**	5.30	13.00	1.20	6
TKN	Total Kej Nitrogen	mg/L	6	0.90	1.20	1.27	**1.30**	1.40	1.50		0
NH3-N	Ammonia as N	mg/L	6	0.01	0.16	0.21	**0.25**	0.30	0.31	1.90	0
NO_3-N	Nitrate as N	mg/L	6	0.01	0.27	3.26	**2.26**	3.80	11.00	0.70	4
NO2-N	Nitrite as N	mg/L	6	0.01	0.01	0.08	**0.01**	0.01	0.43		0
TP	Total Phosphorous	mg/L	6	0.05	0.05	0.07	**0.05**	0.05	0.15	0.07	1
PO4-	Phosphate as P	mg/L	6	0.01	0.01	0.01	**0.01**	0.01	0.01	0.04	0
As	Arsenic	mg/L	6	0.00100	0.00100	0.00250	**0.00200**	0.00400	0.00500	0.02400	0
Cd	Cadmium	mg/L	6	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	6	0.00100	0.00100	0.00150	**0.00150**	0.00200	0.00200	0.00100	3
Cu	Copper	mg/L	6	0.00100	0.00100	0.00133	**0.00100**	0.00200	0.00200	0.00140	2
Pb	Lead	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	6	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	6	0.00100	0.00100	0.00133	**0.00100**	0.00200	0.00200	0.01100	0
Zn	Zinc	mg/L	6	0.00100	0.00100	0.00500	**0.00150**	0.00500	0.02000	0.00800	1
Nox	Nox	mg/L	6	0.01	0.28	3.33	**2.31**	4.10	11.00	0.15	5

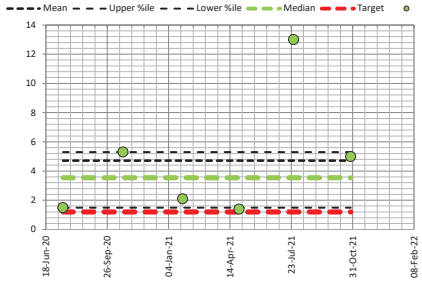
pH



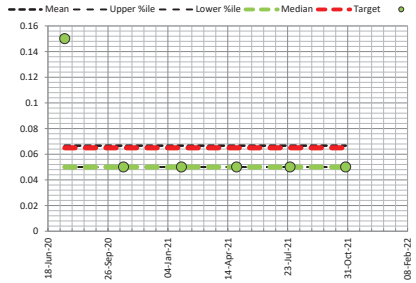
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

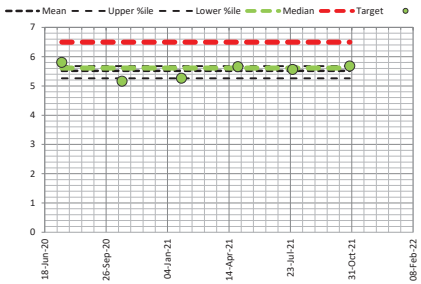
MW7 Site Monitoring Bore 7

Easting 391965 | Northing 6446606 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

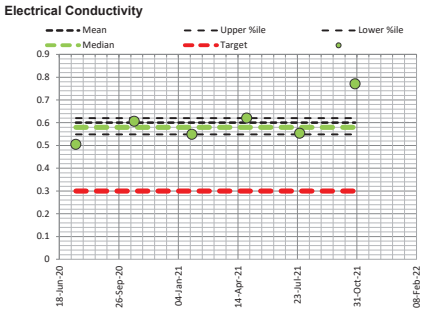
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	18	4.60	4.75	5.26	**5.34**	5.65	5.73		0
GWL mAHD	Groundwater Level mAHD	mAHD	18	22.57	22.65	23.04	**22.96**	23.55	23.70		0
T	Temperature	°C	6	17.00	18.60	20.08	**20.15**	22.10	22.50		0
EC	Electrical Conductivity	mS/cm	6	0.51	0.55	0.601	**0.58**	0.62	0.77	0.30	6
pH	pH	pH	6	5.16	5.26	5.52	**5.61**	5.68	5.80	6.50	0
DO%	Dissolved Oxygen	%	6	10.50	22.98	28.43	**30.00**	34.70	42.40		0
TN	Total Nitrogen	mg/L	6	1.20	1.30	1.65	**1.70**	1.90	2.10	1.20	5
TKN	Total Kej Nitrogen	mg/L	6	0.70	0.70	1.20	**1.30**	1.50	1.70		0
NH3-N	Ammonia as N	mg/L	6	0.01	0.04	0.07	**0.06**	0.11	0.15	1.90	0
NO_3-N	Nitrate as N	mg/L	6	0.01	0.02	0.48	**0.50**	0.91	0.93	0.70	2
NO2-N	Nitrite as N	mg/L	6	0.01	0.01	0.01	**0.01**	0.02	0.02		0
TP	Total Phosphorous	mg/L	6	0.05	0.05	0.05	**0.05**	0.05	0.05	0.07	0
PO4-	Phosphate as P	mg/L	6	0.01	0.01	0.01	**0.01**	0.01	0.01	0.04	0
As	Arsenic	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	6	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	6	0.00100	0.00100	0.00133	**0.00100**	0.00200	0.00200	0.00100	2
Cu	Copper	mg/L	6	0.00100	0.00100	0.00167	**0.00100**	0.00200	0.00400	0.00140	2
Pb	Lead	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	6	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	6	0.00100	0.00100	0.00517	**0.00200**	0.01000	0.01500	0.00800	2
Nox	Nox	mg/L	6	0.01	0.01	0.40	**0.27**	0.93	0.94	0.15	3

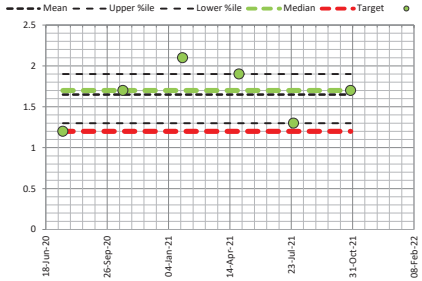
pH



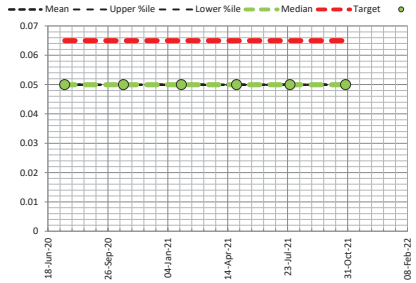
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

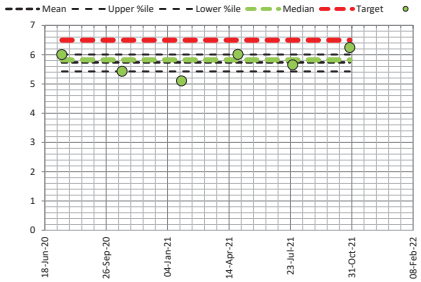
MW8 Site Monitoring Bore 8

Easting 392151 | Northing 6446249 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

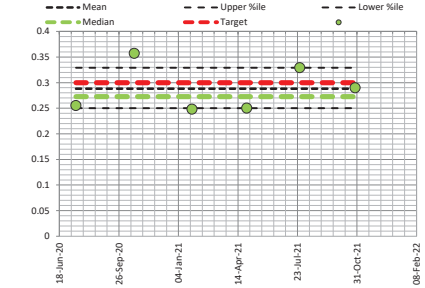
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	18	2.44	2.64	3.13	**3.24**	3.48	3.63		0
GWL mAHD	Groundwater Level mAHD	mAHD	18	23.09	23.25	23.60	**23.48**	24.08	24.28		0
T	Temperature	°C	6	17.70	19.70	21.25	**20.70**	22.70	26.00		0
EC	Electrical Conductivity	mS/cm	6	0.25	0.25	0.288	**0.27**	0.33	0.36	0.30	2
pH	pH	pH	6	5.10	5.43	5.74	**5.83**	6.01	6.24	6.50	0
DO%	Dissolved Oxygen	%	6	12.50	19.34	24.71	**25.65**	28.80	36.30		0
TN	Total Nitrogen	mg/L	6	0.60	0.80	0.97	**0.90**	1.10	1.50	1.20	1
TKN	Total Kej Nitrogen	mg/L	6	0.60	0.80	0.93	**0.90**	1.10	1.30		0
NH3-N	Ammonia as N	mg/L	6	0.06	0.07	0.14	**0.14**	0.22	0.25	1.90	0
NO_3-N	Nitrate as N	mg/L	6	0.01	0.01	0.02	**0.01**	0.01	0.07	0.70	0
NO2-N	Nitrite as N	mg/L	6	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	6	0.05	0.05	0.05	**0.05**	0.05	0.05	0.07	0
PO4-	Phosphate as P	mg/L	6	0.01	0.01	0.01	**0.01**	0.01	0.01	0.04	0
As	Arsenic	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	6	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00140	0
Pb	Lead	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	6	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	6	0.00100	0.00100	0.00450	**0.00300**	0.00600	0.01300	0.00800	1
Nox	Nox	mg/L	6	0.01	0.01	0.10	**0.01**	0.07	0.50	0.15	1

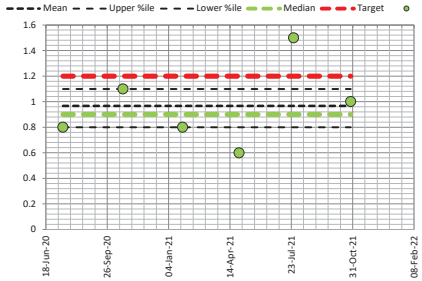
pH



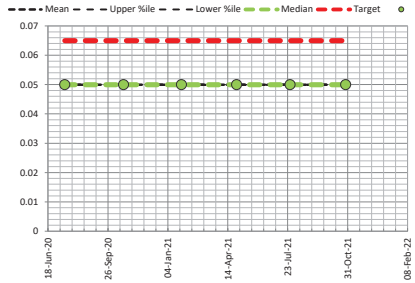
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

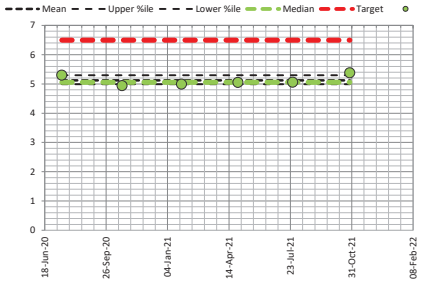
MW9 Site Monitoring Bore 9

Easting 392221 | Northing 6446790 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

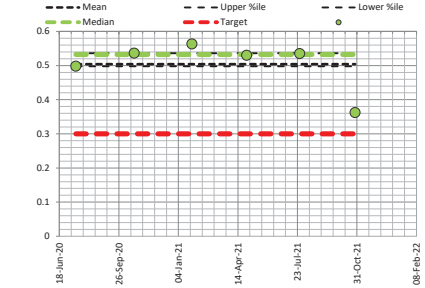
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	17	4.76	5.02	5.38	**5.49**	5.68	5.85		0
GWL mAHD	Groundwater Level mAHD	mAHD	17	22.58	22.75	23.06	**22.94**	23.41	23.67		0
T	Temperature	°C	6	18.70	19.80	21.10	**20.55**	23.10	23.90		0
EC	Electrical Conductivity	mS/cm	6	0.36	0.50	0.504	**0.53**	0.54	0.56	0.30	6
pH	pH	pH	6	4.94	4.99	5.12	**5.06**	5.30	5.38	6.50	0
DO%	Dissolved Oxygen	%	5	22.90	28.34	31.14	**30.88**	34.96	38.00		0
TN	Total Nitrogen	mg/L	6	1.10	1.10	1.22	**1.25**	1.30	1.30	1.20	3
TKN	Total Kej Nitrogen	mg/L	6	0.20	1.10	1.03	**1.15**	1.30	1.30		0
NH3-N	Ammonia as N	mg/L	6	0.54	0.56	0.62	**0.63**	0.67	0.69	1.90	0
NO_3-N	Nitrate as N	mg/L	6	0.01	0.01	0.01	**0.01**	0.01	0.01	0.70	0
NO2-N	Nitrite as N	mg/L	6	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	6	0.05	0.05	0.05	**0.05**	0.05	0.05	0.07	0
PO4-	Phosphate as P	mg/L	6	0.01	0.01	0.01	**0.01**	0.01	0.01	0.04	0
As	Arsenic	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	6	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	6	0.00100	0.00100	0.00367	**0.00100**	0.00100	0.01700	0.00140	1
Pb	Lead	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	6	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	6	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	6	0.00100	0.00100	0.00383	**0.00250**	0.00600	0.01000	0.00800	1
Nox	Nox	mg/L	6	0.01	0.01	0.01	**0.01**	0.01	0.01	0.15	0

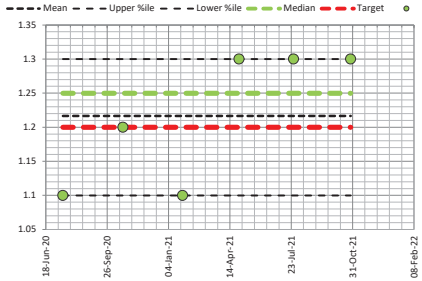
pH



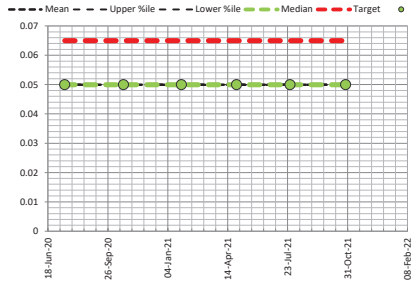
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

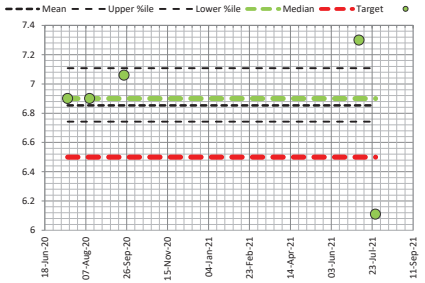
SW1 Surface Water Monitoring Site 1

Easting 392068 | Northing 6447918 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

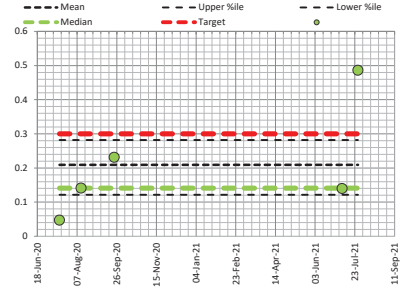
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
GWL mAHD	Groundwater Level mAHD	mAHD	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
T	Temperature	°C	5	11.40	13.88	15.16	**15.80**	16.60	17.80		0
EC	Electrical Conductivity	mS/cm	5	0.05	0.12	0.209	**0.14**	0.28	0.49	0.30	1
pH	pH	pH	5	6.11	6.74	6.85	**6.90**	7.11	7.30	6.50	4
DO%	Dissolved Oxygen	%	5	52.50	56.90	65.62	**67.10**	71.08	82.20		0
TN	Total Nitrogen	mg/L	5	0.20	0.20	0.26	**0.30**	0.30	0.30	1.20	0
TKN	Total Kej Nitrogen	mg/L	5	0.20	0.20	0.22	**0.20**	0.22	0.30		0
NH3-N	Ammonia as N	mg/L	5	0.01	0.01	0.01	**0.01**	0.01	0.01	1.90	0
NO_3-N	Nitrate as N	mg/L	5	0.01	0.01	0.04	**0.03**	0.06	0.10	0.70	0
NO2-N	Nitrite as N	mg/L	5	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	5	0.05	0.05	0.05	**0.05**	0.05	0.07	0.07	1
PO4-	Phosphate as P	mg/L	5	0.01	0.01	0.02	**0.01**	0.02	0.04	0.04	1
As	Arsenic	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	5	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	5	0.00100	0.00100	0.02180	**0.00300**	0.02320	0.10000	0.00140	3
Pb	Lead	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	5	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	5	0.00100	0.00100	0.00200	**0.00100**	0.00200	0.00600	0.01100	0
Zn	Zinc	mg/L	5	0.00200	0.01000	0.02160	**0.01600**	0.02700	0.05900	0.00800	4
Nox	Nox	mg/L	5	0.01	0.01	0.05	**0.04**	0.07	0.11	0.15	0

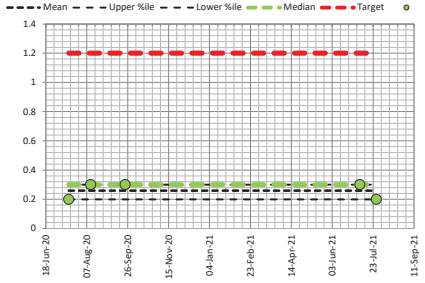
pH



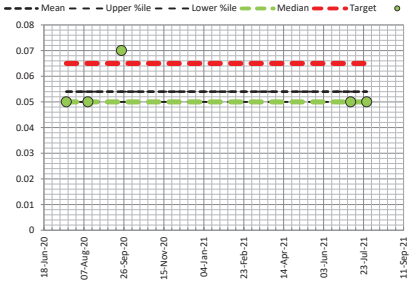
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

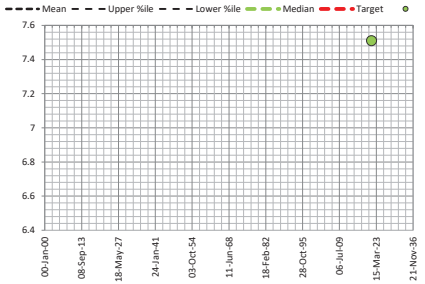
SW2 Surface Water Monitoring Site 2

Easting 392058 | Northing 6447935 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

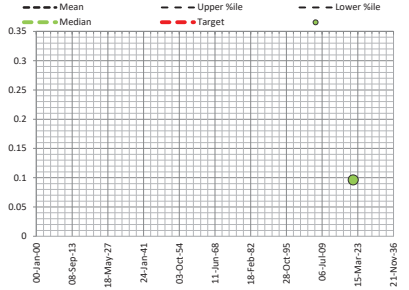
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
GWL mAHD	Groundwater Level mAHD	mAHD	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
T	Temperature	°C	1	15.10	15.10	15.10	**15.10**	15.10	15.10		0
EC	Electrical Conductivity	mS/cm	1	0.10	0.10	0.096	**0.10**	0.10	0.10	0.30	0
pH	pH	pH	1	7.51	7.51	7.51	**7.51**	7.51	7.51	6.50	1
DO%	Dissolved Oxygen	%	1	80.50	80.50	80.50	**80.50**	80.50	80.50		0
TN	Total Nitrogen	mg/L	1	0.20	0.20	0.20	**0.20**	0.20	0.20	1.20	0
TKN	Total Kej Nitrogen	mg/L	1	0.20	0.20	0.20	**0.20**	0.20	0.20		0
NH3-N	Ammonia as N	mg/L	1	0.01	0.01	0.01	**0.01**	0.01	0.01	1.90	0
NO_3-N	Nitrate as N	mg/L	1	0.01	0.01	0.01	**0.01**	0.01	0.01	0.70	0
NO2-N	Nitrite as N	mg/L	1	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	1	0.05	0.05	0.05	**0.05**	0.05	0.05	0.07	0
PO4-	Phosphate as P	mg/L	1	0.01	0.01	0.01	**0.01**	0.01	0.01	0.04	0
As	Arsenic	mg/L	1	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	1	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	1	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	1	0.00200	0.00200	0.00200	**0.00200**	0.00200	0.00200	0.00140	1
Pb	Lead	mg/L	1	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	1	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	1	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	1	0.01200	0.01200	0.01200	**0.01200**	0.01200	0.01200	0.00800	1
Nox	Nox	mg/L	1	0.01	0.01	0.01	**0.01**	0.01	0.01	0.15	0

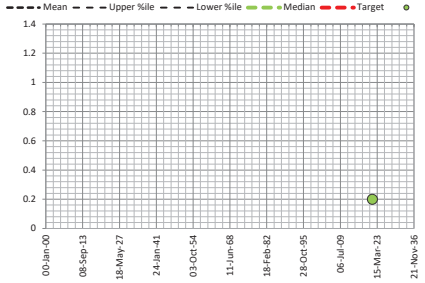
pH



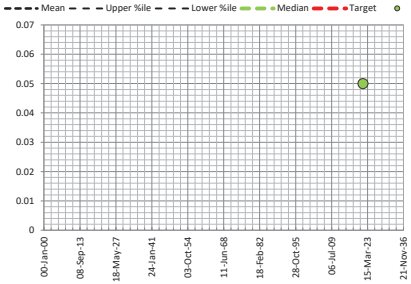
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

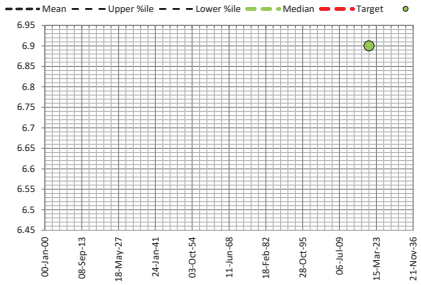
SW3 Surface Water Monitoring Site 3

Easting 391607 | Northing 6448389 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

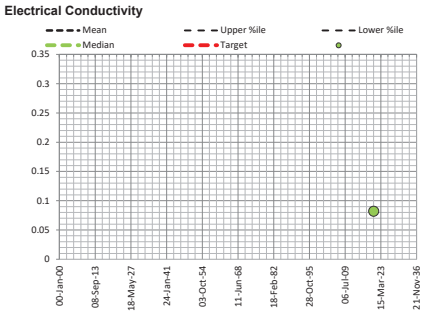
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
GWL mAHD	Groundwater Level mAHD	mAHD	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
T	Temperature	°C	1	17.00	17.00	17.00	**17.00**	17.00	17.00		0
EC	Electrical Conductivity	mS/cm	1	0.08	0.08	0.082	**0.08**	0.08	0.08	0.30	0
pH	pH	pH	1	6.90	6.90	6.90	**6.90**	6.90	6.90	6.50	1
DO%	Dissolved Oxygen	%	1	74.00	74.00	74.00	**74.00**	74.00	74.00		0
TN	Total Nitrogen	mg/L	1	0.30	0.30	0.30	**0.30**	0.30	0.30	1.20	0
TKN	Total Kej Nitrogen	mg/L	1	0.30	0.30	0.30	**0.30**	0.30	0.30		0
NH3-N	Ammonia as N	mg/L	1	0.02	0.02	0.02	**0.02**	0.02	0.02	1.90	0
NO_3-N	Nitrate as N	mg/L	1	0.02	0.02	0.02	**0.02**	0.02	0.02	0.70	0
NO2-N	Nitrite as N	mg/L	1	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	1	0.05	0.05	0.05	**0.05**	0.05	0.05	0.07	0
PO4-	Phosphate as P	mg/L	1	0.03	0.03	0.03	**0.03**	0.03	0.03	0.04	0
As	Arsenic	mg/L	1	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	1	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	1	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	1	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00140	0
Pb	Lead	mg/L	1	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	1	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	1	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	1	0.00500	0.00500	0.00500	**0.00500**	0.00500	0.00500	0.00800	0
Nox	Nox	mg/L	1	0.03	0.03	0.03	**0.03**	0.03	0.03	0.15	0

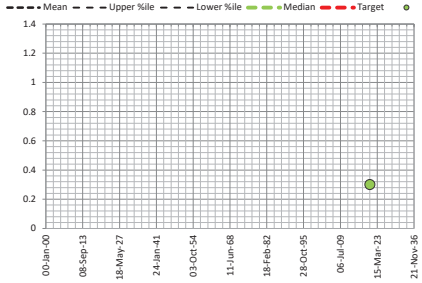
pH



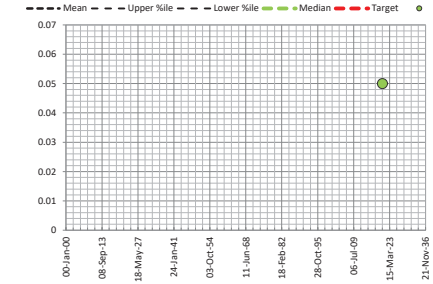
Electrical Conductivity



Total Nitrogen



Total Phosphorous



H20002 Glen Iris GC

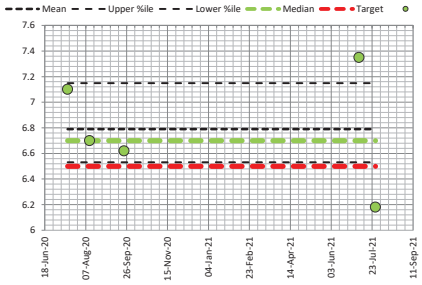
SW4 Surface Water Monitoring Site 4

Easting 391674 | Northing 6447966 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

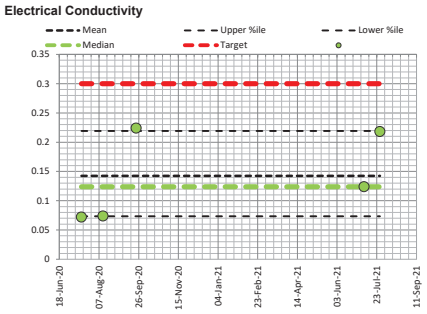
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
GWL mAHD	Groundwater Level mAHD	mAHD	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
T	Temperature	°C	5	14.30	14.62	15.76	**15.50**	16.46	18.30		0
EC	Electrical Conductivity	mS/cm	5	0.07	0.07	0.142	**0.12**	0.22	0.22	0.30	0
pH	pH	pH	5	6.18	6.53	6.79	**6.70**	7.15	7.35	6.50	4
DO%	Dissolved Oxygen	%	5	13.60	22.16	50.18	**68.40**	71.82	73.10		0
TN	Total Nitrogen	mg/L	5	0.20	0.20	0.32	**0.30**	0.36	0.60	1.20	0
TKN	Total Kej Nitrogen	mg/L	5	0.20	0.20	0.32	**0.30**	0.36	0.60		0
NH3-N	Ammonia as N	mg/L	5	0.01	0.01	0.03	**0.01**	0.04	0.11	1.90	0
NO_3-N	Nitrate as N	mg/L	5	0.01	0.01	0.02	**0.02**	0.03	0.04	0.70	0
NO2-N	Nitrite as N	mg/L	5	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	5	0.05	0.05	0.08	**0.05**	0.08	0.19	0.07	1
PO4-	Phosphate as P	mg/L	5	0.01	0.01	0.04	**0.04**	0.06	0.11	0.04	2
As	Arsenic	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	5	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	5	0.00100	0.00100	0.00200	**0.00200**	0.00240	0.00400	0.00140	3
Pb	Lead	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	5	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	5	0.00400	0.00640	0.00980	**0.00900**	0.01360	0.01600	0.00800	3
Nox	Nox	mg/L	5	0.01	0.01	0.02	**0.02**	0.03	0.04	0.15	0

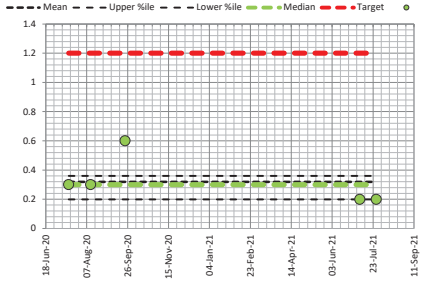
pH



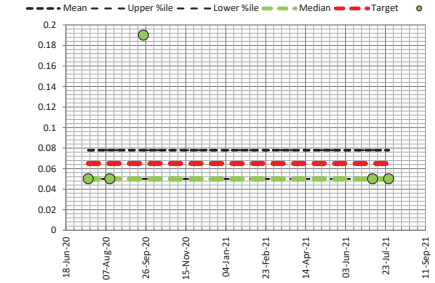
Electrical Conductivity



Total Nitrogen



Total Phosphorous



H20002 Glen Iris GC

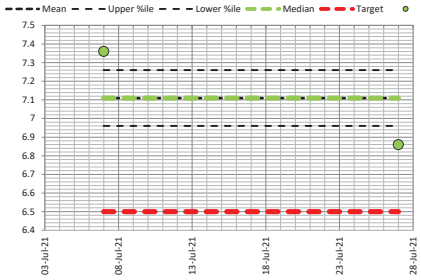
SW5 Surface Water Monitoring Site 5

Easting 391649 | Northing 6447772 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

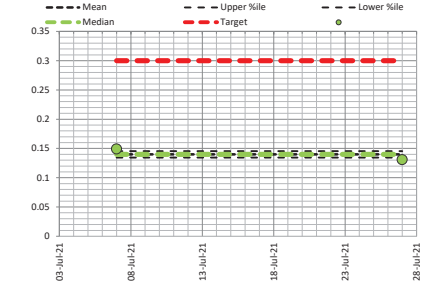
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
GWL mAHD	Groundwater Level mAHD	mAHD	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
T	Temperature	°C	2	15.80	15.84	15.90	**15.90**	15.96	16.00		0
EC	Electrical Conductivity	mS/cm	2	0.13	0.13	0.140	**0.14**	0.15	0.15	0.30	0
pH	pH	pH	2	6.86	6.96	7.11	**7.11**	7.26	7.36	6.50	2
DO%	Dissolved Oxygen	%	2	59.50	60.54	62.10	**62.10**	63.66	64.70		0
TN	Total Nitrogen	mg/L	2	0.20	0.22	0.25	**0.25**	0.28	0.30	1.20	0
TKN	Total Kej Nitrogen	mg/L	2	0.20	0.22	0.25	**0.25**	0.28	0.30		0
NH3-N	Ammonia as N	mg/L	2	0.01	0.01	0.01	**0.01**	0.01	0.01	1.90	0
NO_3-N	Nitrate as N	mg/L	2	0.02	0.02	0.02	**0.02**	0.02	0.03	0.70	0
NO2-N	Nitrite as N	mg/L	2	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	2	0.05	0.07	0.09	**0.09**	0.11	0.13	0.07	1
PO4-	Phosphate as P	mg/L	2	0.01	0.01	0.01	**0.01**	0.01	0.01	0.04	0
As	Arsenic	mg/L	2	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	2	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	2	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	2	0.00100	0.00120	0.00150	**0.00150**	0.00180	0.00200	0.00140	1
Pb	Lead	mg/L	2	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	2	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	2	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	2	0.00600	0.00660	0.00750	**0.00750**	0.00840	0.00900	0.00800	1
Nox	Nox	mg/L	2	0.02	0.02	0.02	**0.02**	0.03	0.03	0.15	0

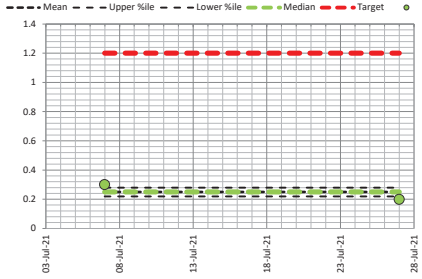
pH



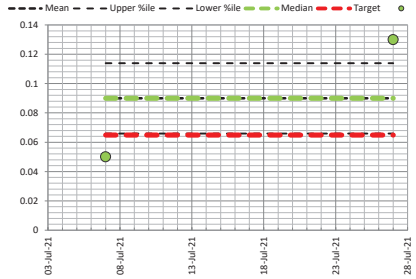
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

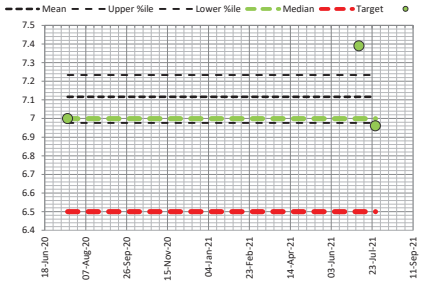
SW6 Surface Water Monitoring Site 6

Easting 391759 | Northing 6447772 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

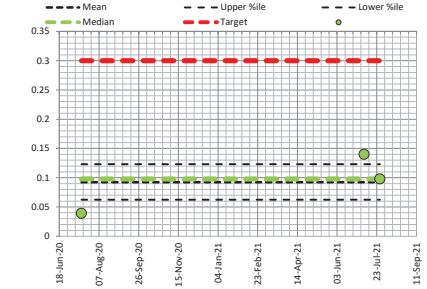
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
GWL mAHD	Groundwater Level mAHD	mAHD	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
T	Temperature	°C	3	11.60	13.00	14.30	**15.10**	15.76	16.20		0
EC	Electrical Conductivity	mS/cm	3	0.04	0.06	0.092	**0.10**	0.12	0.14	0.30	0
pH	pH	pH	3	6.96	6.98	7.12	**7.00**	7.23	7.39	6.50	3
DO%	Dissolved Oxygen	%	3	71.40	71.80	74.70	**72.40**	77.14	80.30		0
TN	Total Nitrogen	mg/L	3	0.10	0.10	0.13	**0.10**	0.16	0.20	1.20	0
TKN	Total Kej Nitrogen	mg/L	3	0.10	0.10	0.10	**0.10**	0.10	0.10		0
NH3-N	Ammonia as N	mg/L	3	0.01	0.01	0.01	**0.01**	0.01	0.02	1.90	0
NO_3-N	Nitrate as N	mg/L	3	0.01	0.01	0.02	**0.01**	0.03	0.04	0.70	0
NO2-N	Nitrite as N	mg/L	3	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	3	0.05	0.05	0.05	**0.05**	0.05	0.05	0.07	0
PO4-	Phosphate as P	mg/L	3	0.01	0.01	0.01	**0.01**	0.01	0.01	0.04	0
As	Arsenic	mg/L	3	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	3	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	3	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	3	0.00100	0.00100	0.00133	**0.00100**	0.00160	0.00200	0.00140	1
Pb	Lead	mg/L	3	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	3	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	3	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	3	0.00300	0.00300	0.00533	**0.00300**	0.00720	0.01000	0.00800	1
Nox	Nox	mg/L	3	0.01	0.01	0.02	**0.01**	0.03	0.05	0.15	0

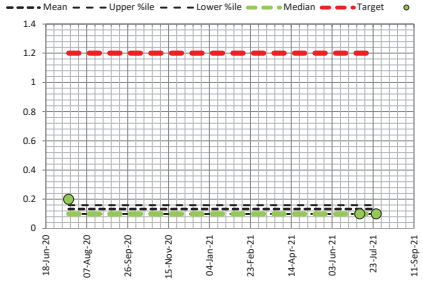
pH



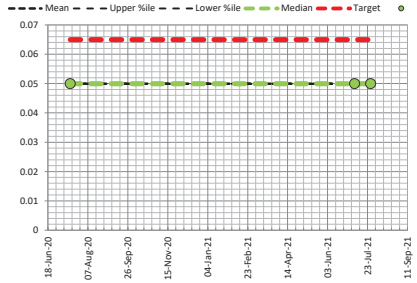
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

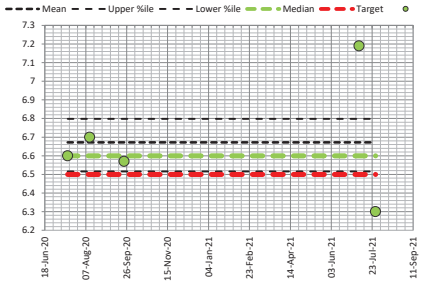
SW7 Surface Water Monitoring Site 7

Easting 391725 | Northing 6447534 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

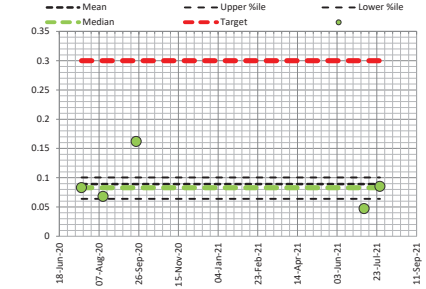
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
GWL mAHD	Groundwater Level mAHD	mAHD	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
T	Temperature	°C	5	14.50	14.90	15.70	**15.40**	16.74	16.90		0
EC	Electrical Conductivity	mS/cm	5	0.05	0.06	0.089	**0.08**	0.10	0.16	0.30	0
pH	pH	pH	5	6.30	6.52	6.67	**6.60**	6.80	7.19	6.50	4
DO%	Dissolved Oxygen	%	5	11.40	30.92	46.70	**41.50**	67.60	80.40		0
TN	Total Nitrogen	mg/L	5	0.10	0.10	0.20	**0.20**	0.24	0.40	1.20	0
TKN	Total Kej Nitrogen	mg/L	5	0.01	0.08	0.18	**0.20**	0.24	0.40		0
NH3-N	Ammonia as N	mg/L	5	0.01	0.01	0.03	**0.01**	0.04	0.10	1.90	0
NO_3-N	Nitrate as N	mg/L	5	0.02	0.03	0.05	**0.05**	0.06	0.07	0.70	0
NO2-N	Nitrite as N	mg/L	5	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	5	0.05	0.05	0.08	**0.05**	0.08	0.18	0.07	1
PO4-	Phosphate as P	mg/L	5	0.01	0.01	0.01	**0.01**	0.02	0.04	0.04	1
As	Arsenic	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	5	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	5	0.00100	0.00100	0.00120	**0.00100**	0.00120	0.00200	0.00140	1
Pb	Lead	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	5	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	5	0.00500	0.00660	0.00940	**0.00700**	0.00980	0.02100	0.00800	1
Nox	Nox	mg/L	5	0.03	0.03	0.05	**0.05**	0.07	0.08	0.15	0

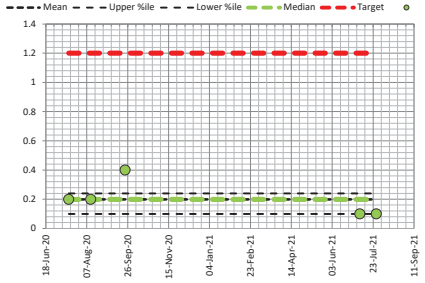
pH



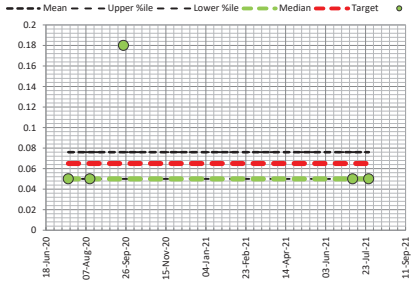
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

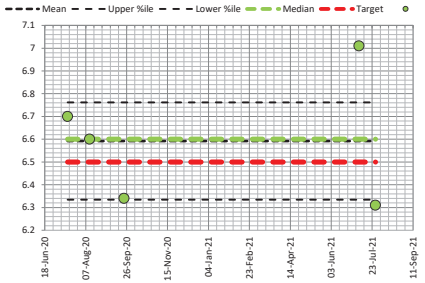
SW8 Surface Water Monitoring Site 8

Easting 391781 | Northing 6447428 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

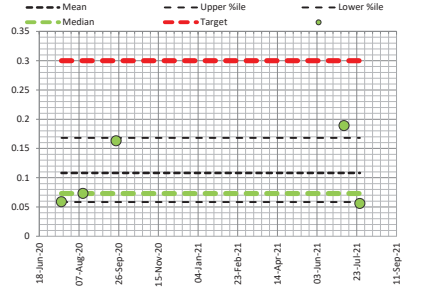
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
GWL mAHD	Groundwater Level mAHD	mAHD	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
T	Temperature	°C	5	13.00	14.92	15.62	**15.50**	16.74	17.70		0
EC	Electrical Conductivity	mS/cm	5	0.06	0.06	0.108	**0.07**	0.17	0.19	0.30	0
pH	pH	pH	5	6.31	6.33	6.59	**6.60**	6.76	7.01	6.50	3
DO%	Dissolved Oxygen	%	5	11.40	28.84	49.54	**59.90**	65.00	82.60		0
TN	Total Nitrogen	mg/L	5	0.10	0.18	0.30	**0.20**	0.50	0.50	1.20	0
TKN	Total Kej Nitrogen	mg/L	5	0.10	0.10	0.28	**0.20**	0.50	0.50		0
NH3-N	Ammonia as N	mg/L	5	0.01	0.01	0.02	**0.01**	0.03	0.09	1.90	0
NO_3-N	Nitrate as N	mg/L	5	0.01	0.01	0.03	**0.04**	0.04	0.04	0.70	0
NO2-N	Nitrite as N	mg/L	5	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	5	0.05	0.05	0.06	**0.05**	0.06	0.08	0.07	1
PO4-	Phosphate as P	mg/L	5	0.01	0.01	0.01	**0.01**	0.01	0.02	0.04	0
As	Arsenic	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	5	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00140	0
Pb	Lead	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	5	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	5	0.00500	0.00580	0.00800	**0.00600**	0.01060	0.01300	0.00800	2
Nox	Nox	mg/L	5	0.01	0.01	0.03	**0.04**	0.04	0.05	0.15	0

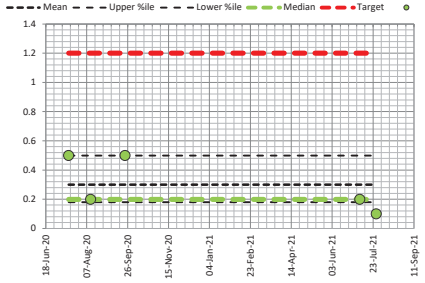
pH



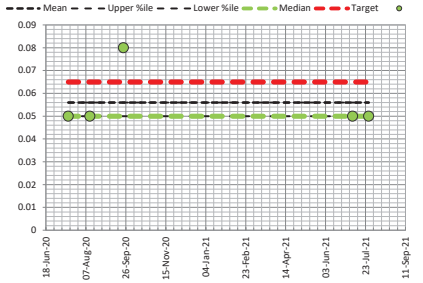
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

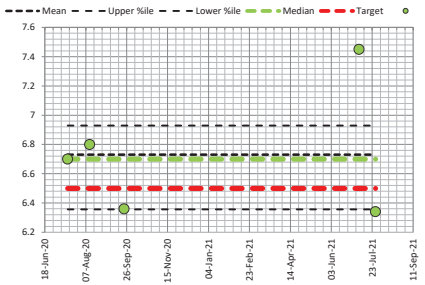
SW9 Surface Water Monitoring Site 9

Easting 391783 | Northing 6447416 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

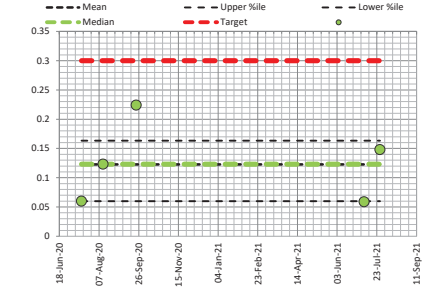
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
GWL mAHD	Groundwater Level mAHD	mAHD	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
T	Temperature	°C	5	14.10	14.18	15.12	**14.80**	15.98	16.70		0
EC	Electrical Conductivity	mS/cm	5	0.06	0.06	0.123	**0.12**	0.16	0.22	0.30	0
pH	pH	pH	5	6.34	6.36	6.73	**6.70**	6.93	7.45	6.50	3
DO%	Dissolved Oxygen	%	5	6.20	16.20	47.86	**64.00**	71.24	81.80		0
TN	Total Nitrogen	mg/L	5	0.10	0.10	0.58	**0.30**	0.96	1.60	1.20	1
TKN	Total Kej Nitrogen	mg/L	5	0.01	0.08	0.56	**0.30**	0.96	1.60		0
NH3-N	Ammonia as N	mg/L	5	0.01	0.01	0.01	**0.01**	0.01	0.01	1.90	0
NO_3-N	Nitrate as N	mg/L	5	0.01	0.01	0.01	**0.01**	0.02	0.03	0.70	0
NO2-N	Nitrite as N	mg/L	5	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	5	0.05	0.05	0.09	**0.05**	0.14	0.15	0.07	2
PO4-	Phosphate as P	mg/L	5	0.01	0.01	0.02	**0.02**	0.03	0.03	0.04	0
As	Arsenic	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	5	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00140	0
Pb	Lead	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	5	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	5	0.00500	0.00660	0.01000	**0.01200**	0.01300	0.01300	0.00800	3
Nox	Nox	mg/L	5	0.01	0.01	0.01	**0.01**	0.02	0.03	0.15	0

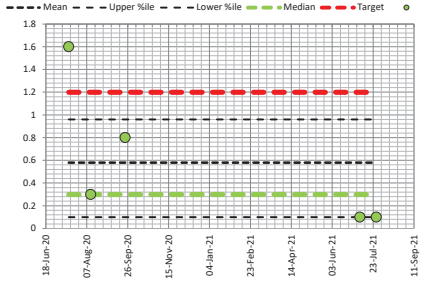
pH



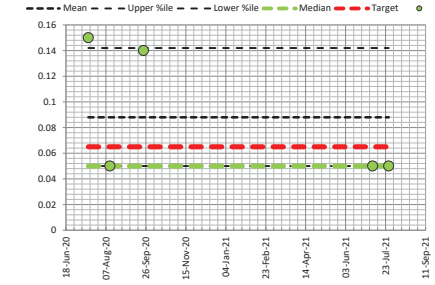
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

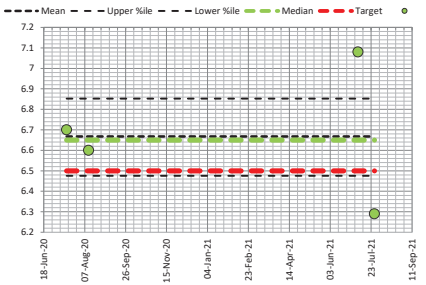
SW10 Surface Water Monitoring Site 10

Easting 392105 | Northing 6447272 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

Report Date : 28/08/2023

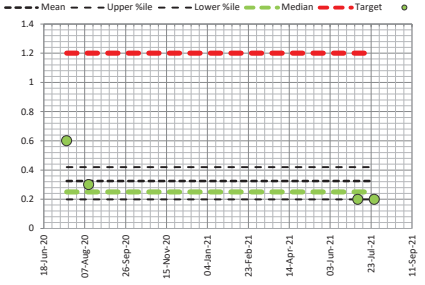
Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
GWL mAHD	Groundwater Level mAHD	mAHD	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
T	Temperature	°C	4	11.40	13.62	14.63	**15.15**	15.84	16.80		0
EC	Electrical Conductivity	mS/cm	4	0.07	0.07	0.133	**0.11**	0.19	0.24	0.30	0
pH	pH	pH	4	6.29	6.48	6.67	**6.65**	6.85	7.08	6.50	3
DO%	Dissolved Oxygen	%	4	36.70	41.44	54.23	**55.15**	67.38	69.90		0
TN	Total Nitrogen	mg/L	4	0.20	0.20	0.33	**0.25**	0.42	0.60	1.20	0
TKN	Total Kej Nitrogen	mg/L	4	0.20	0.20	0.30	**0.20**	0.36	0.60		0
NH3-N	Ammonia as N	mg/L	4	0.01	0.01	0.01	**0.01**	0.01	0.01	1.90	0
NO_3-N	Nitrate as N	mg/L	4	0.01	0.01	0.03	**0.01**	0.04	0.08	0.70	0
NO2-N	Nitrite as N	mg/L	4	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	4	0.05	0.05	0.12	**0.07**	0.17	0.30	0.07	2
PO4-	Phosphate as P	mg/L	4	0.01	0.01	0.01	**0.01**	0.01	0.01	0.04	0
As	Arsenic	mg/L	4	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	4	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	4	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	4	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00140	0
Pb	Lead	mg/L	4	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	4	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	4	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	4	0.00700	0.02860	0.03850	**0.04750**	0.05200	0.05200	0.00800	3
Nox	Nox	mg/L	4	0.01	0.01	0.03	**0.01**	0.04	0.08	0.15	0

pH

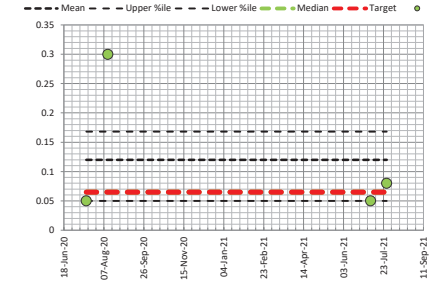


Electrical Conductivity

Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

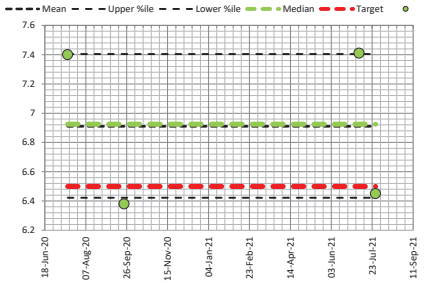
SW11 Surface Water Monitoring Site 11

Easting 392037 | Northing 6447304 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

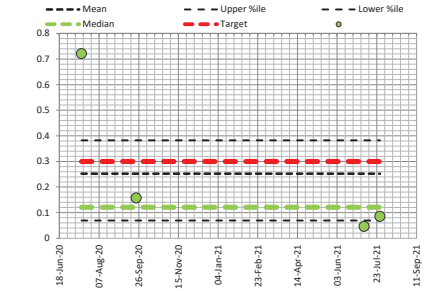
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
GWL mAHD	Groundwater Level mAHD	mAHD	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
T	Temperature	°C	4	14.80	14.98	16.45	**16.30**	17.86	18.40		0
EC	Electrical Conductivity	mS/cm	4	0.05	0.07	0.252	**0.12**	0.38	0.72	0.30	1
pH	pH	pH	4	6.38	6.42	6.91	**6.93**	7.40	7.41	6.50	2
DO%	Dissolved Oxygen	%	4	10.00	43.12	55.23	**68.35**	72.58	74.20		0
TN	Total Nitrogen	mg/L	4	0.20	0.26	0.70	**0.35**	1.00	1.90	1.20	1
TKN	Total Kej Nitrogen	mg/L	4	0.20	0.20	0.65	**0.25**	0.94	1.90		0
NH3-N	Ammonia as N	mg/L	4	0.01	0.01	0.04	**0.01**	0.06	0.13	1.90	0
NO_3-N	Nitrate as N	mg/L	4	0.02	0.02	0.03	**0.03**	0.04	0.06	0.70	0
NO2-N	Nitrite as N	mg/L	4	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	4	0.05	0.11	0.26	**0.25**	0.40	0.50	0.07	3
PO4-	Phosphate as P	mg/L	4	0.01	0.01	0.01	**0.01**	0.01	0.01	0.04	0
As	Arsenic	mg/L	4	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	4	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	4	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	4	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00140	0
Pb	Lead	mg/L	4	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	4	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	4	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	4	0.01200	0.01320	0.02500	**0.01950**	0.03460	0.04900	0.00800	4
Nox	Nox	mg/L	4	0.02	0.02	0.03	**0.03**	0.05	0.06	0.15	0

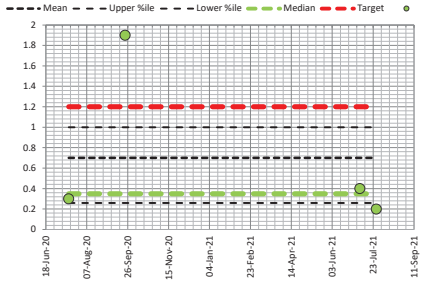
pH



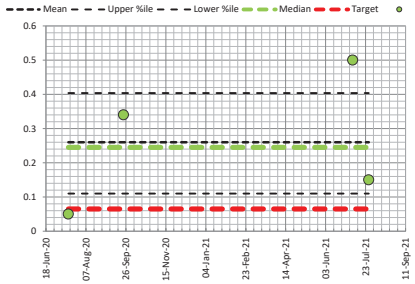
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

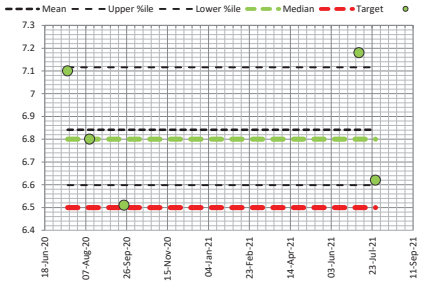
SW12 Surface Water Monitoring Site 12

Easting 392117 | Northing 6447052 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

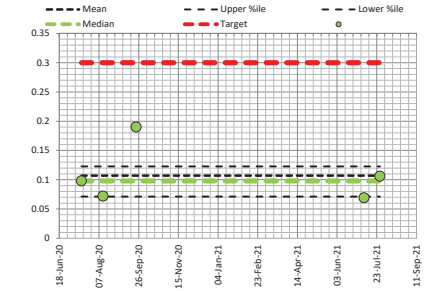
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
GWL mAHD	Groundwater Level mAHD	mAHD	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
T	Temperature	°C	5	14.60	14.92	17.04	**15.50**	17.98	23.50		0
EC	Electrical Conductivity	mS/cm	5	0.07	0.07	0.107	**0.10**	0.12	0.19	0.30	0
pH	pH	pH	5	6.51	6.60	6.84	**6.80**	7.12	7.18	6.50	5
DO%	Dissolved Oxygen	%	5	34.50	44.90	59.22	**70.10**	71.64	72.60		0
TN	Total Nitrogen	mg/L	5	0.10	0.18	0.34	**0.30**	0.46	0.70	1.20	0
TKN	Total Kej Nitrogen	mg/L	5	0.10	0.18	0.26	**0.20**	0.34	0.50		0
NH3-N	Ammonia as N	mg/L	5	0.01	0.01	0.02	**0.02**	0.03	0.06	1.90	0
NO_3-N	Nitrate as N	mg/L	5	0.03	0.04	0.06	**0.05**	0.07	0.12	0.70	0
NO2-N	Nitrite as N	mg/L	5	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	5	0.05	0.05	0.05	**0.05**	0.05	0.06	0.07	0
PO4-	Phosphate as P	mg/L	5	0.01	0.01	0.01	**0.01**	0.01	0.02	0.04	0
As	Arsenic	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	5	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	5	0.00100	0.00100	0.00140	**0.00100**	0.00140	0.00300	0.00140	1
Pb	Lead	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	5	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	5	0.01200	0.01840	0.07640	**0.02600**	0.09120	0.28000	0.00800	5
Nox	Nox	mg/L	5	0.03	0.04	0.06	**0.05**	0.08	0.12	0.15	0

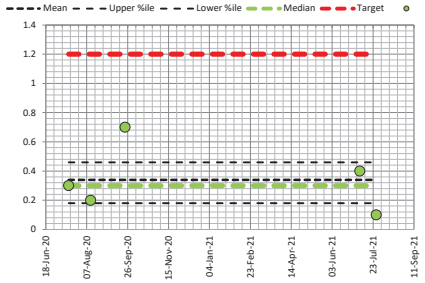
pH



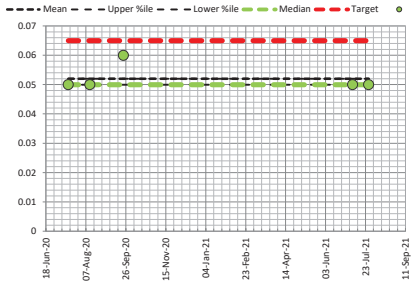
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

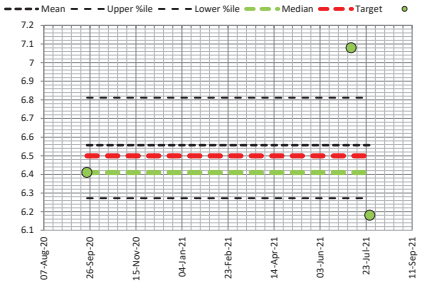
SW13 Surface Water Monitoring Site 13

Easting 391955 | Northing 6446453 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

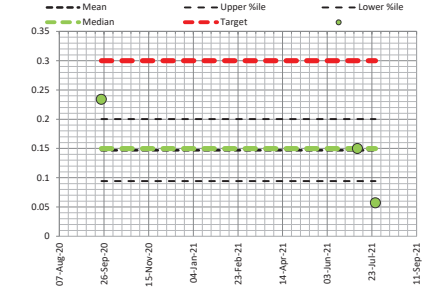
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
GWL mAHD	Groundwater Level mAHD	mAHD	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
T	Temperature	°C	3	14.30	14.46	16.87	**14.70**	18.84	21.60		0
EC	Electrical Conductivity	mS/cm	3	0.06	0.09	0.147	**0.15**	0.20	0.23	0.30	0
pH	pH	pH	3	6.18	6.27	6.56	**6.41**	6.81	7.08	6.50	1
DO%	Dissolved Oxygen	%	3	16.80	38.52	53.07	**71.10**	71.22	71.30		0
TN	Total Nitrogen	mg/L	3	0.20	0.28	0.50	**0.40**	0.70	0.90	1.20	0
TKN	Total Kej Nitrogen	mg/L	3	0.20	0.28	0.47	**0.40**	0.64	0.80		0
NH3-N	Ammonia as N	mg/L	3	0.01	0.01	0.02	**0.01**	0.03	0.05	1.90	0
NO_3-N	Nitrate as N	mg/L	3	0.01	0.01	0.01	**0.01**	0.01	0.01	0.70	0
NO2-N	Nitrite as N	mg/L	3	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	3	0.05	0.05	0.10	**0.05**	0.15	0.21	0.07	1
PO4-	Phosphate as P	mg/L	3	0.00	0.01	0.01	**0.01**	0.02	0.02	0.04	0
As	Arsenic	mg/L	3	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	3	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	3	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	3	0.00100	0.00100	0.00200	**0.00100**	0.00280	0.00400	0.00140	1
Pb	Lead	mg/L	3	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	3	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	3	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	3	0.01000	0.02280	0.11733	**0.04200**	0.19680	0.30000	0.00800	3
Nox	Nox	mg/L	3	0.01	0.01	0.01	**0.01**	0.01	0.01	0.15	0

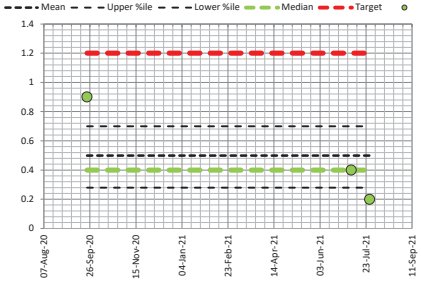
pH



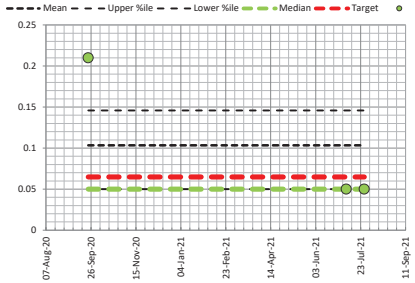
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

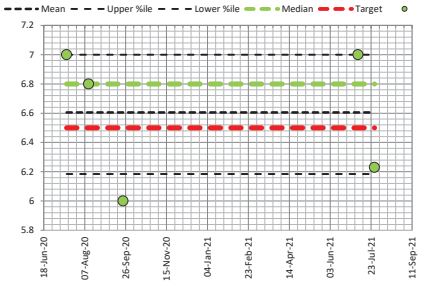
SW14 Surface Water Monitoring Site 14

Easting 391929 | Northing 6446612 | Data Analysis Period Start Date 1/06/2020 | Data Analysis Period End Date 31/12/2021

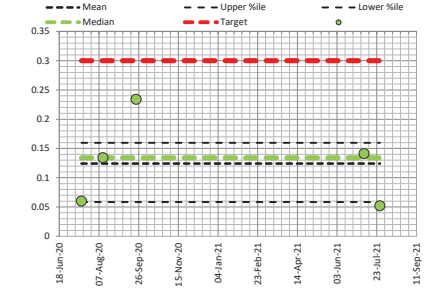
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
GWL mAHD	Groundwater Level mAHD	mAHD	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
T	Temperature	°C	5	14.10	14.34	15.76	**15.70**	17.18	17.50		0
EC	Electrical Conductivity	mS/cm	5	0.05	0.06	0.124	**0.13**	0.16	0.23	0.30	0
pH	pH	pH	5	6.00	6.18	6.61	**6.80**	7.00	7.00	6.50	3
DO%	Dissolved Oxygen	%	5	19.60	40.64	51.38	**53.20**	61.90	81.10		0
TN	Total Nitrogen	mg/L	5	0.20	0.20	0.46	**0.40**	0.60	1.00	1.20	0
TKN	Total Kej Nitrogen	mg/L	5	0.20	0.20	0.44	**0.40**	0.52	1.00		0
NH3-N	Ammonia as N	mg/L	5	0.01	0.02	0.04	**0.03**	0.06	0.08	1.90	0
NO_3-N	Nitrate as N	mg/L	5	0.01	0.01	0.02	**0.02**	0.03	0.06	0.70	0
NO2-N	Nitrite as N	mg/L	5	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	5	0.05	0.05	0.12	**0.05**	0.12	0.37	0.07	1
PO4-	Phosphate as P	mg/L	5	0.01	0.01	0.05	**0.01**	0.06	0.18	0.04	1
As	Arsenic	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	5	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	5	0.00100	0.00100	0.00140	**0.00100**	0.00200	0.00200	0.00140	2
Pb	Lead	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	5	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	5	0.00800	0.01200	0.05260	**0.03600**	0.06880	0.16000	0.00800	4
Nox	Nox	mg/L	5	0.01	0.01	0.02	**0.02**	0.03	0.07	0.15	0

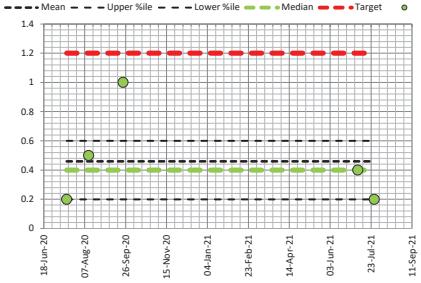
pH



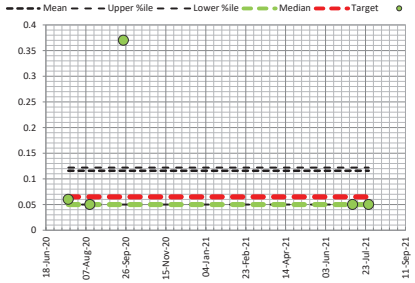
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

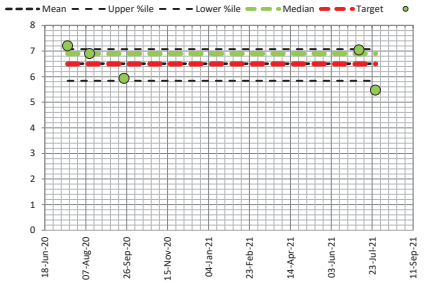
SW15 Surface Water Monitoring Site 15

Easting 391989
Northing 6446845
Data Analysis Period Start Date 1/06/2020
Data Analysis Period End Date 31/12/2021

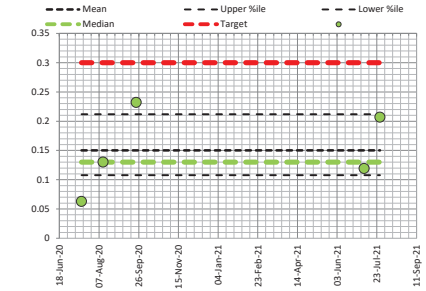
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
GWL mAHD	Groundwater Level mAHD	mAHD	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
T	Temperature	°C	5	14.40	14.96	15.80	**15.30**	16.38	18.30		0
EC	Electrical Conductivity	mS/cm	5	0.06	0.11	0.150	**0.13**	0.21	0.23	0.30	0
pH	pH	pH	5	5.47	5.84	6.51	**6.90**	7.07	7.20	6.50	3
DO%	Dissolved Oxygen	%	5	13.10	43.50	55.96	**64.10**	72.60	81.00		0
TN	Total Nitrogen	mg/L	5	0.10	0.18	0.44	**0.20**	0.58	1.30	1.20	1
TKN	Total Kej Nitrogen	mg/L	5	0.10	0.18	0.42	**0.20**	0.50	1.30		0
NH3-N	Ammonia as N	mg/L	5	0.01	0.01	0.07	**0.03**	0.10	0.26	1.90	0
NO_3-N	Nitrate as N	mg/L	5	0.01	0.01	0.02	**0.01**	0.03	0.07	0.70	0
NO2-N	Nitrite as N	mg/L	5	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	5	0.05	0.05	0.14	**0.05**	0.14	0.48	0.07	1
PO4-	Phosphate as P	mg/L	5	0.01	0.01	0.04	**0.01**	0.04	0.19	0.04	1
As	Arsenic	mg/L	5	0.00100	0.00100	0.00120	**0.00100**	0.00120	0.00200	0.02400	0
Cd	Cadmium	mg/L	5	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	5	0.00100	0.00100	0.00160	**0.00100**	0.00220	0.00300	0.00140	2
Pb	Lead	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	5	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	5	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	5	0.00700	0.04220	0.05740	**0.05300**	0.08560	0.09200	0.00800	4
Nox	Nox	mg/L	5	0.01	0.01	0.03	**0.01**	0.03	0.09	0.15	0

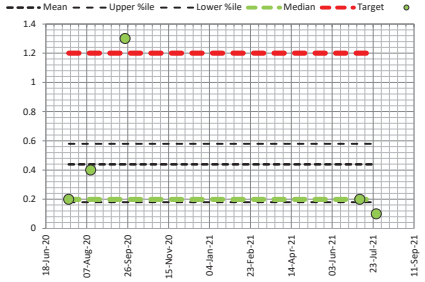
pH



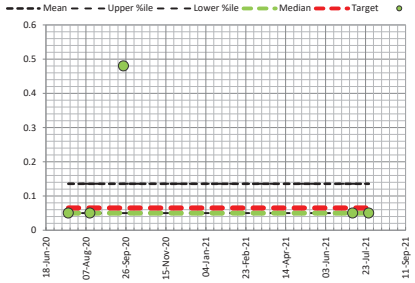
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

H20002 Glen Iris GC

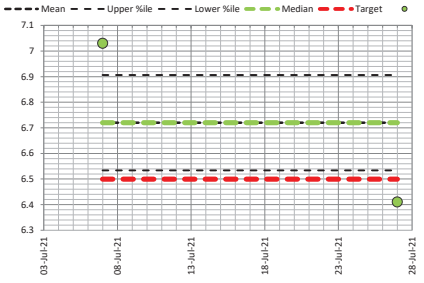
SW16 Surface Water Monitoring Site 16

Easting
Northing
Data Analysis Period Start Date 1/06/2020
Data Analysis Period End Date 31/12/2021

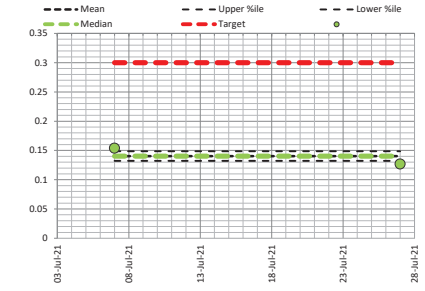
Report Date : 28/08/2023

Parameter	Description	Units	Samples	Minimum	Low %ile 20	Mean	Median	High %ile 80	Maximum	Target ANZECC 95%	Times Exceeded
GWL bTOC	GW Level below Top of Casing	mBTOC	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
GWL mAHD	Groundwater Level mAHD	mAHD	0	0.00	0.00	0.00	**0.00**	0.00	0.00		0
T	Temperature	°C	2	13.60	13.82	14.15	**14.15**	14.48	14.70		0
EC	Electrical Conductivity	mS/cm	2	0.13	0.13	0.141	**0.14**	0.15	0.15	0.30	0
pH	pH	pH	2	6.41	6.53	6.72	**6.72**	6.91	7.03	6.50	1
DO%	Dissolved Oxygen	%	2	50.60	54.88	61.30	**61.30**	67.72	72.00		0
TN	Total Nitrogen	mg/L	2	0.40	0.42	0.45	**0.45**	0.48	0.50	1.20	0
TKN	Total Kej Nitrogen	mg/L	2	0.40	0.40	0.40	**0.40**	0.40	0.40		0
NH3-N	Ammonia as N	mg/L	2	0.03	0.03	0.04	**0.04**	0.04	0.04	1.90	0
NO_3-N	Nitrate as N	mg/L	2	0.02	0.03	0.04	**0.04**	0.06	0.07	0.70	0
NO2-N	Nitrite as N	mg/L	2	0.01	0.01	0.01	**0.01**	0.01	0.01		0
TP	Total Phosphorous	mg/L	2	0.05	0.05	0.06	**0.06**	0.06	0.06	0.07	0
PO4-	Phosphate as P	mg/L	2	0.01	0.01	0.02	**0.02**	0.02	0.02	0.04	0
As	Arsenic	mg/L	2	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.02400	0
Cd	Cadmium	mg/L	2	0.00010	0.00010	0.00010	**0.00010**	0.00010	0.00010	0.00020	0
Cr	Chromium	mg/L	2	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00100	0
Cu	Copper	mg/L	2	0.00100	0.00120	0.00150	**0.00150**	0.00180	0.00200	0.00140	1
Pb	Lead	mg/L	2	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.00340	0
Hg	Mercury	mg/L	2	0.00005	0.00005	0.00005	**0.00005**	0.00005	0.00005	0.00060	0
Ni	Nickel	mg/L	2	0.00100	0.00100	0.00100	**0.00100**	0.00100	0.00100	0.01100	0
Zn	Zinc	mg/L	2	0.03200	0.03440	0.03800	**0.03800**	0.04160	0.04400	0.00800	2
Nox	Nox	mg/L	2	0.03	0.03	0.05	**0.05**	0.06	0.07	0.15	0

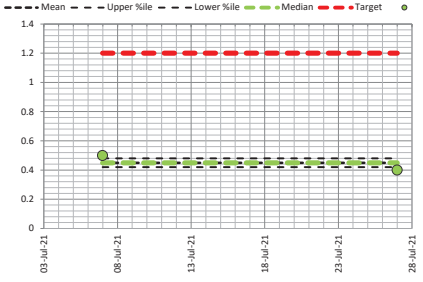
pH



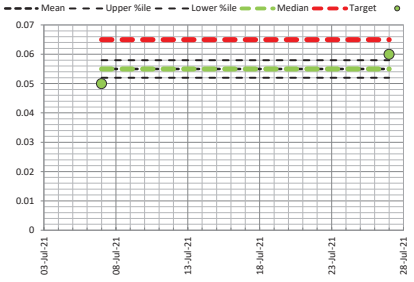
Electrical Conductivity



Total Nitrogen



Total Phosphorous



FieldDAE
Field Data Analysis & Evaluation System

FieldDAE
Field Data Analysis & Evaluation System

Water Quality Monitoring Data

	Site Name/Type	Date	Site	Monitored By	Monitoring Comment	GWL bTOC mBTOC	GWL mAHD mAHD	T °C	EC mS/cm	pH pH	DO% %	TN mg/L	TKN mg/L	NH3-N mg/L	NO_3-N mg/L	NO2-N mg/L	TP mg/L	PO4- mg/L	As mg/L	Cd mg/L	Cr mg/L	Cu mg/L	Pb mg/L	Hg mg/L	Ni mg/L	Zn mg/L	Nox mg/L
1	Site Monitoring Bore 1	17/06/2020	MW1	SO		8.74	22.79																				
2	Site Monitoring Bore 2	17/06/2020	MW2	SO		5.37	22.45																				
3	Site Monitoring Bore 3	17/06/2020	MW3	SO		8.49	21.84																				
4	Site Monitoring Bore 4	17/06/2020	MW4	SO		4.25	22.02																				
5	Site Monitoring Bore 5	17/06/2020	MW5	SO		4.64	22.80																				
6	Site Monitoring Bore 6	17/06/2020	MW6	SO		6.56	22.60																				
7	Site Monitoring Bore 7	17/06/2020	MW7	SO		5.67	22.63																				
8	Site Monitoring Bore 8	17/06/2020	MW8	SO		3.50	23.22																				
9	Site Monitoring Bore 9	17/06/2020	MW9	SO		5.85	22.58																				
10	DWER Bore 1	17/06/2020	J310	SO		3.13	23.56																				
11	DWER Bore 2	17/06/2020	JM45A	SO		3.91	24.02																				
12	DWER Bore 3	17/06/2020	JM2	SO		6.19	22.04																				
13	DWER Bore 4	17/06/2020	JM12	SO		13.23	21.45																				
14	Site Monitoring Bore 1	16/07/2020	MW1	SO and SS		8.71	22.82	19.10	0.600	6.00	18.2	0.800	0.400	0.012	0.420	0.007	0.050	0.005	0.001	0.0001	0.001	0.011	0.002	0.00005	0.007	0.063	0.427
15	Site Monitoring Bore 2	16/07/2020	MW2	SO and SS		5.32	22.50	19.00	0.127	6.40	18.2	0.300	0.300	0.005	0.031	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.002	0.00005	0.001	0.002	0.036
16	Site Monitoring Bore 3	16/07/2020	MW3	SO and SS		8.44	21.89	19.10	0.529	5.30	72.8	1.500	0.200	0.005	1.300	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	1.305
17	Site Monitoring Bore 4	16/07/2020	MW4	SO and SS		4.13	22.14	19.30	0.555	6.00	24.3	0.800	0.800	0.210	0.005	0.005	0.050	0.005	0.010	0.0001	0.001	0.001	0.001	0.00005	0.001	0.002	0.010
18	Site Monitoring Bore 5	16/07/2020	MW5	SO and SS		4.58	22.86	18.90	0.684	4.50	33.6	1.400	1.400	0.490	0.005	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.036	0.010
19	Site Monitoring Bore 6	16/07/2020	MW6	SO and SS		6.44	22.72	18.90	0.653	4.70	28.5	1.500	1.200	0.300	0.270	0.005	0.150	0.005	0.004	0.0001	0.001	0.002	0.001	0.00005	0.001	0.020	0.275
20	Site Monitoring Bore 7	16/07/2020	MW7	SO and SS		5.54	22.76	18.90	0.505	5.80	34.7	1.200	0.700	0.110	0.510	0.008	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.015	0.518
21	Site Monitoring Bore 8	16/07/2020	MW8	SO and SS		3.42	23.30	20.30	0.255	6.00	28.8	0.800	0.800	0.150	0.011	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.005	0.016
22	Site Monitoring Bore 9	16/07/2020	MW9	SO and SS		5.72	22.71	19.80	0.498	5.30	29.7	1.100	1.100	0.620	0.005	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.010	0.010
23	DWER Bore 2	16/07/2020	JM45A	SO and SS		3.83	24.10																				
24	DWER Bore 3	16/07/2020	JM2	SO and SS		6.09	22.14																				
25	DWER Bore 4	16/07/2020	JM12	SO and SS		13.12	21.56																				
26	Surface Water Monitoring Site 1	16/07/2020	SW1	SO and SS	Flowing			15.80	0.047	6.90	82.2	0.200	0.200	0.014	0.028	0.007	0.050	0.011	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.002	0.035
27	Surface Water Monitoring Site 3	16/07/2020	SW3	SO and SS	Flowing			17.00	0.082	6.90	74.0	0.300	0.300	0.016	0.020	0.005	0.050	0.026	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.005	0.025
28	Surface Water Monitoring Site 4	16/07/2020	SW4	SO and SS	Bubble up pond			16.00	0.072	7.10	73.1	0.300	0.300	0.022	0.037	0.006	0.050	0.044	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.004	0.043
29	Surface Water Monitoring Site 6	16/07/2020	SW6	SO and SS	Bubble up pond			16.20	0.039	7.00	72.4	0.200	0.100	0.005	0.042	0.005	0.050	0.008	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.003	0.047
30	Surface Water Monitoring Site 7	16/07/2020	SW7	SO and SS	Bubble up pond			16.90	0.083	6.60	41.5	0.200	0.200	0.020	0.049	0.005	0.050	0.012	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.005	0.054
31	Surface Water Monitoring Site 8	16/07/2020	SW8	SO and SS	Bubble up pond			16.50	0.059	6.70	60.6	0.500	0.500	0.005	0.037	0.005	0.050	0.009	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.006	0.042
32	Surface Water Monitoring Site 9	16/07/2020	SW9	SO and SS	Flowing			15.80	0.060	6.70	81.8	1.600	1.600	0.005	0.013	0.005	0.150	0.023	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.013	0.018
33	Surface Water Monitoring Site 10	16/07/2020	SW10	SO and SS	Bubble up pond			16.80	0.070	6.70	69.9	0.600	0.600	0.005	0.014	0.006	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.007	0.020
34	Surface Water Monitoring Site 11	16/07/2020	SW11	SO and SS	Bubble up pond			17.50	0.721	7.40	65.2	0.300	0.200	0.006	0.033	0.005	0.050	0.007	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.012	0.038
35	Surface Water Monitoring Site 12	16/07/2020	SW12	SO and SS	Flowing			16.60	0.098	7.10	72.6	0.300	0.200	0.024	0.062	0.007	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.012	0.069
36	Surface Water Monitoring Site 14	16/07/2020	SW14	SO and SS	Bubble up pond			17.50	0.060	7.00	81.1	0.200	0.200	0.019	0.015	0.005	0.060	0.034	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.013	0.020
37	Surface Water Monitoring Site 15	16/07/2020	SW15	SO and SS	Bubble up pond			18.30	0.063	7.20	81.0	0.200	0.200	0.029	0.015	0.006	0.050	0.008	0.002	0.0001	0.001	0.001	0.001	0.00005	0.001	0.007	0.021
38	Site Monitoring Bore 1	12/08/2020	MW1	SO		8.54	22.99																				
39	Site Monitoring Bore 3	12/08/2020	MW3	SO		8.37	21.96																				
40	Site Monitoring Bore 4	12/08/2020	MW4	SO		3.98	22.29																				
41	Site Monitoring Bore 5	12/08/2020	MW5	SO		4.39	23.05																				
42	Site Monitoring Bore 6	12/08/2020	MW6	SO		6.27	22.89																				
43	Site Monitoring Bore 7	12/08/2020	MW7	SO		5.36	22.94																				
44	Site Monitoring Bore 8	12/08/2020	MW8	SO		3.25	23.47																				
45	Site Monitoring Bore 9	12/08/2020	MW9	SO		5.39	23.04																				
46	DWER Bore 1	16/08/2020	J310	SO		2.89	23.81																				
47	DWER Bore 2	12/08/2020	JM45A	SO		3.67	24.26																				
48	DWER Bore 3	12/08/2020	JM2	SO		5.95	22.28																				
49	DWER Bore 4	12/08/2020	JM12	SO		12.92	21.76																				
50	Surface Water Monitoring Site 1	12/08/2020	SW1	SO				16.30	0.141	6.90	52.5	0.300	0.200	0.014	0.056	0.005	0.050	0.009	0.001	0.0001	0.001	0.003	0.001	0.00005	0.001	0.012	0.061
51	Surface Water Monitoring Site 4	12/08/2020	SW4	SO				14.70	0.074	6.70	24.3	0.300	0.300	0.005	0.013	0.005	0.050	0.039	0.001	0.0001	0.001	0.002	0.001	0.00005	0.001	0.009	0.018
52	Surface Water Monitoring Site 7	12/08/2020	SW7	SO				15.00	0.068	6.70	35.8	0.200	0.200	0.014	0.056	0.005	0.050	0.009	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.007	0.061
53	Surface Water Monitoring Site 8	12/08/2020	SW8	SO				15.40	0.073	6.60	33.2	0.200	0.100	0.011	0.044	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.006	0.049
54	Surface Water Monitoring Site 9	12/08/2020	SW9	SO				14.20	0.123	6.80	18.7	0.300	0.300	0.005	0.005	0.005	0.050	0.016	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.007	0.010
55	Surface Water Monitoring Site 10	12/08/2020	SW10	SO				15.20	0.069	6.60	36.7	0.300	0.200	0.007	0.076	0.005	0.300	0.012	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.043	0.081
56	Surface Water Monitoring Site 12	12/08/2020	SW12	SO				15.50	0.072	6.80	47.5	0.200	0.200	0.011	0.049	0.005	0.050	0.012	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.044	0.054
57	Surface Water Monitoring Site 14	12/08/2020	SW14	SO				15.70	0.134	6.80	45.9	0.500	0.400	0.052	0.060	0.008	0.050	0.013	0.001	0.0001	0.001	0.002	0.001	0.00005	0.001	0.046	0.068
58	Surface Water Monitoring Site 15	12/08/2020	SW15	SO				15.30	0.130	6.90	51.1	0.400	0.300	0.056	0.074	0.011	0.050	0.006	0.001	0.0001	0.001	0.003	0.001	0.00005	0.001	0.051	0.085

FieldDAE
Field Data Analysis & Evaluation System

Water Quality Monitoring Data

	Site Name/Type	Date	Site	Monitored By	Monitoring Comment	GWL bTOC mBTOC	GWL mAHD mAHD	T °C	EC mS/cm	pH pH	DO% %	TN mg/L	TKN mg/L	NH3-N mg/L	NO_3-N mg/L	NO2-N mg/L	TP mg/L	PO4- mg/L	As mg/L	Cd mg/L	Cr mg/L	Cu mg/L	Pb mg/L	Hg mg/L	Ni mg/L	Zn mg/L	Nox mg/L
59	Site Monitoring Bore 1	23/09/2020	MW1	SO and ASM		8.38	23.15																				
60	Site Monitoring Bore 2	23/09/2020	MW2	SO and ASM		5.08	22.74																				
61	Site Monitoring Bore 3	23/09/2020	MW3	SO and ASM		8.22	22.11																				
62	Site Monitoring Bore 4	23/09/2020	MW4	SO and ASM		3.85	22.42																				
63	Site Monitoring Bore 5	23/09/2020	MW5	SO and ASM		4.22	23.22																				
64	Site Monitoring Bore 6	23/09/2020	MW6	SO and ASM		6.03	23.13																				
65	Site Monitoring Bore 7	23/09/2020	MW7	SO and ASM		5.14	23.16																				
66	Site Monitoring Bore 8	23/09/2020	MW8	SO and ASM		3.06	23.66																				
67	Site Monitoring Bore 9	23/09/2020	MW9	SO and ASM		5.22	23.21																				
68	DWER Bore 1	8/09/2020	J310	SO and ASM		2.65	24.05																				
69	DWER Bore 2	23/09/2020	JM45A	SO and ASM		3.54	24.39																				
70	DWER Bore 3	23/09/2020	JM2	SO and ASM		5.83	22.40																				
71	DWER Bore 4	23/09/2020	JM12	SO and ASM		12.81	21.87																				
72	Surface Water Monitoring Site 1	23/09/2020	SW1	SO and ASM				17.80	0.231	7.06	58.0	0.300	0.200	0.011	0.100	0.005	0.070	0.042	0.001	0.0001	0.001	0.100	0.001	0.00005	0.006	0.059	0.110
73	Surface Water Monitoring Site 4	23/09/2020	SW4	SO and ASM				18.30	0.224	6.62	13.6	0.600	0.600	0.110	0.005	0.005	0.190	0.110	0.001	0.0001	0.001	0.004	0.001	0.00005	0.001	0.016	0.005
74	Surface Water Monitoring Site 7	23/09/2020	SW7	SO and ASM				16.70	0.162	6.57	11.4	0.400	0.400	0.100	0.068	0.013	0.180	0.043	0.001	0.0001	0.001	0.002	0.001	0.00005	0.001	0.007	0.081
75	Surface Water Monitoring Site 8	23/09/2020	SW8	SO and ASM				17.70	0.163	6.34	11.4	0.500	0.500	0.094	0.005	0.005	0.080	0.017	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.010	0.005
76	Surface Water Monitoring Site 9	23/09/2020	SW9	SO and ASM				16.70	0.224	6.36	6.2	0.800	0.800	0.013	0.005	0.005	0.140	0.033	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.012	0.005
77	Surface Water Monitoring Site 11	23/09/2020	SW11	SO and ASM				18.40	0.157	6.38	10.0	1.900	1.900	0.130	0.019	0.005	0.340	0.010	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.049	0.024
78	Surface Water Monitoring Site 12	23/09/2020	SW12	SO and ASM				23.50	0.190	6.51	34.5	0.700	0.500	0.061	0.120	0.005	0.060	0.023	0.001	0.0001	0.001	0.003	0.001	0.00005	0.001	0.280	0.120
79	Surface Water Monitoring Site 13	23/09/2020	SW13	SO and ASM				21.60	0.234	6.41	16.8	0.900	0.800	0.050	0.014	0.005	0.210	0.022	0.001	0.0001	0.001	0.004	0.001	0.00005	0.001	0.300	0.014
80	Surface Water Monitoring Site 14	23/09/2020	SW14	SO and ASM				17.10	0.234	6.00	19.6	1.000	1.000	0.078	0.005	0.005	0.370	0.180	0.001	0.0001	0.001	0.002	0.001	0.00005	0.001	0.160	0.005
81	Surface Water Monitoring Site 15	23/09/2020	SW15	SO and ASM				15.90	0.232	5.93	13.1	1.300	1.300	0.260	0.005	0.005	0.480	0.190	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.053	0.005
82	Site Monitoring Bore 1	22/10/2020	MW1	SG and SO		8.48	23.05	24.90	0.930	6.42	32.3	3.800	0.700	0.018	3.100	0.005	0.050	0.005	0.001	0.0001	0.001	0.072	0.004	0.00005	0.007	0.089	3.100
83	Site Monitoring Bore 2	22/10/2020	MW2	SG and SO		5.17	22.65	21.80	1.169	5.94	34.7	2.500	0.300	0.005	2.200	0.006	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	2.200
84	Site Monitoring Bore 3	22/10/2020	MW3	SG and SO		8.25	22.08	22.60	0.582	5.51	53.8	2.200	0.200	0.005	1.900	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.002	1.900
85	Site Monitoring Bore 4	22/10/2020	MW4	SG and SO		3.98	22.29	23.10	0.871	5.65	31.4	0.800	0.800	0.280	0.005	0.005	0.050	0.005	0.009	0.0001	0.001	0.001	0.001	0.00005	0.001	0.002	0.005
86	Site Monitoring Bore 5	22/10/2020	MW5	SG and SO		4.39	23.05	21.80	1.044	4.14	32.6	1.200	1.000	0.270	0.190	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.004	0.006	0.200
87	Site Monitoring Bore 6	22/10/2020	MW6	SG and SO		6.21	22.95	21.20	0.596	4.50	45.9	5.300	1.500	0.240	3.800	0.005	0.050	0.005	0.003	0.0001	0.002	0.001	0.001	0.00005	0.001	0.005	3.800
88	Site Monitoring Bore 7	22/10/2020	MW7	SG and SO		5.32	22.98	22.10	0.606	5.16	42.4	1.700	0.700	0.070	0.930	0.013	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.003	0.940
89	Site Monitoring Bore 8	22/10/2020	MW8	SG and SO		3.23	23.49	21.10	0.357	5.43	24.4	1.100	1.100	0.120	0.005	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.013	0.005
90	Site Monitoring Bore 9	22/10/2020	MW9	SG and SO		5.53	22.90	23.10	0.536	4.94	34.2	1.200	1.200	0.690	0.005	0.005	0.050	0.005	0.001	0.0001	0.001	0.017	0.001	0.00005	0.001	0.004	0.005
91	DWER Bore 2	22/10/2020	JM45A	SG and SO		3.54	24.39																				
92	DWER Bore 3	22/10/2020	JM2	SG and SO		5.85	22.38																				
93	DWER Bore 4	22/10/2020	JM12	SG and SO		12.92	21.76																				
94	Site Monitoring Bore 1	26/11/2020	MW1	SO		8.54	22.99																				
95	Site Monitoring Bore 2	26/11/2020	MW2	SO		5.11	22.71																				
96	Site Monitoring Bore 3	26/11/2020	MW3	SO		8.22	22.11																				
97	Site Monitoring Bore 4	26/11/2020	MW4	SO		3.94	22.33																				
98	Site Monitoring Bore 5	26/11/2020	MW5	SO		4.24	23.20																				
99	Site Monitoring Bore 6	26/11/2020	MW6	SO		6.05	23.11																				
100	Site Monitoring Bore 7	26/11/2020	MW7	SO		5.18	23.12																				
101	Site Monitoring Bore 8	26/11/2020	MW8	SO		3.06	23.66																				
102	Site Monitoring Bore 9	26/11/2020	MW9	SO		5.02	23.41																				
103	DWER Bore 2	26/11/2020	JM45A	SO		3.68	24.25																				
104	DWER Bore 3	26/11/2020	JM2	SO		5.96	22.27																				
105	DWER Bore 4	26/11/2020	JM12	SO		12.89	21.79																				
106	Site Monitoring Bore 1	11/12/2020	MW1	SO and ASM		8.74	22.79																				
107	Site Monitoring Bore 2	11/12/2020	MW2	SO and ASM		5.19	22.63																				
108	Site Monitoring Bore 3	11/12/2020	MW3	SO and ASM		8.32	22.01																				
109	Site Monitoring Bore 4	11/12/2020	MW4	SO and ASM		4.02	22.25																				
110	Site Monitoring Bore 5	11/12/2020	MW5	SO and ASM		4.36	23.08																				
111	Site Monitoring Bore 6	11/12/2020	MW6	SO and ASM		6.17	22.99																				
112	Site Monitoring Bore 7	11/12/2020	MW7	SO and ASM		5.29	23.01																				
113	Site Monitoring Bore 8	11/12/2020	MW8	SO and ASM		3.20	23.52																				
114	Site Monitoring Bore 9	11/12/2020	MW9	SO and ASM		5.39	23.04																				
115	DWER Bore 2	11/12/2020	JM45A	SO and ASM		3.74	24.19																				
116	DWER Bore 3	11/12/2020	JM2	SO and ASM		6.11	22.12																				
117	DWER Bore 4	11/12/2020	JM12	SO and ASM		12.97	21.71																				
118	Site Monitoring Bore 1	27/01/2021	MW1	SO		9.02	22.51	21.40	0.626	6.49	29.4	1.400	0.400	0.011	1.000	0.005	0.050	0.005	0.001	0.0001	0.001	0.076	0.002	0.00005	0.007	0.065	1.000

FieldDAE
Field Data Analysis & Evaluation System

Water Quality Monitoring Data

	Site Name/Type	Date	Site	Monitored By	Monitoring Comment	GWL bTOC mBTOC	GWL mAHD mAHD	T °C	EC mS/cm	pH pH	DO% %	TN mg/L	TKN mg/L	NH3-N mg/L	NO_3-N mg/L	NO2-N mg/L	TP mg/L	PO4- mg/L	As mg/L	Cd mg/L	Cr mg/L	Cu mg/L	Pb mg/L	Hg mg/L	Ni mg/L	Zn mg/L	Nox mg/L
119	Site Monitoring Bore 2	27/01/2021	MW2	SO		5.49	22.33	21.00	1.213	5.57	13.1	1.800	0.400	0.048	1.300	0.007	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	1.300
120	Site Monitoring Bore 3	27/01/2021	MW3	SO		8.57	21.76	22.40	0.642	5.61	41.6	2.600	0.400	0.005	2.200	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	2.200
121	Site Monitoring Bore 4	27/01/2021	MW4	SO		4.29	21.98	23.20	0.975	5.69	14.2	0.500	1.200	0.260	0.005	0.005	0.050	0.005	0.009	0.0001	0.001	0.001	0.003	0.00005	0.001	0.001	0.005
122	Site Monitoring Bore 5	27/01/2021	MW5	SO		4.62	22.82	22.40	0.590	4.45	13.3	1.400	1.400	0.450	0.005	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	0.005
123	Site Monitoring Bore 6	27/01/2021	MW6	SO		6.42	22.74	23.00	0.575	4.61	13.1	2.100	1.300	0.260	0.810	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	0.810
124	Site Monitoring Bore 7	27/01/2021	MW7	SO		5.55	22.75	22.50	0.549	5.26	10.5	2.100	1.200	0.040	0.910	0.024	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	0.930
125	Site Monitoring Bore 8	27/01/2021	MW8	SO		3.44	23.28	26.00	0.248	5.10	12.5	0.800	0.800	0.250	0.005	0.005	0.050	0.007	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	0.005
126	Site Monitoring Bore 9	27/01/2021	MW9	SO		5.49	22.94	23.90	0.563	4.99		1.100	1.100	0.540	0.005	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	0.005
127	DWER Bore 2	27/01/2021	JM45A	SO		3.96	23.97																				
128	DWER Bore 3	27/01/2021	JM2	SO		6.44	21.79																				
129	DWER Bore 4	27/01/2021	JM12	SO		13.22	21.46																				
130	Site Monitoring Bore 1	17/02/2021	MW1	SO		9.05	22.48																				
131	Site Monitoring Bore 2	17/02/2021	MW2	SO		5.44	22.38																				
132	Site Monitoring Bore 3	17/02/2021	MW3	SO		8.57	21.76																				
133	Site Monitoring Bore 4	17/02/2021	MW4	SO		4.26	22.01																				
134	Site Monitoring Bore 5	17/02/2021	MW5	SO		4.68	22.76																				
135	Site Monitoring Bore 6	17/02/2021	MW6	SO		6.51	22.65																				
136	Site Monitoring Bore 7	17/02/2021	MW7	SO		5.62	22.68																				
137	Site Monitoring Bore 8	17/02/2021	MW8	SO		3.50	23.22																				
138	Site Monitoring Bore 9	17/02/2021	MW9	SO		5.64	22.79																				
139	DWER Bore 2	17/02/2021	JM45A	SO		4.02	23.91																				
140	DWER Bore 3	17/02/2021	JM2	SO		6.46	21.77																				
141	DWER Bore 4	17/02/2021	JM12	SO		13.25	21.43																				
142	Site Monitoring Bore 1	30/03/2021	MW1	SO		9.14	22.39																				
143	Site Monitoring Bore 2	30/03/2021	MW2	SO		5.55	22.27																				
144	Site Monitoring Bore 3	30/03/2021	MW3	SO		8.64	21.69																				
145	Site Monitoring Bore 4	30/03/2021	MW4	SO		4.39	21.88																				
146	Site Monitoring Bore 5	30/03/2021	MW5	SO		4.76	22.68																				
147	Site Monitoring Bore 6	30/03/2021	MW6	SO		6.62	22.54																				
148	Site Monitoring Bore 7	30/03/2021	MW7	SO		5.73	22.57																				
149	Site Monitoring Bore 8	30/03/2021	MW8	SO		3.36	23.36																				
150	Site Monitoring Bore 9	30/03/2021	MW9	SO		5.68	22.75																				
151	DWER Bore 2	30/03/2021	JM45A	SO		4.12	23.81																				
152	DWER Bore 3	30/03/2021	JM2	SO	Corrected Reading	6.59	21.64																				
153	DWER Bore 4	30/03/2021	JM12	SO		13.33	21.35																				
154	Site Monitoring Bore 1	29/04/2021	MW1	SO & GR		9.15	22.38	21.40	0.570	6.460	35.000	0.400	0.400	0.053	0.005	0.005	0.050	0.005	0.001	0.0001	0.001	0.100	0.003	0.00005	0.011	0.087	0.005
155	Site Monitoring Bore 2	29/04/2021	MW2	SO & GR		5.57	22.25	20.60	0.850	6.280	24.400	4.100	0.100	0.005	4.000	0.009	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	4.000
156	Site Monitoring Bore 3	29/04/2021	MW3	SO & GR		8.68	21.65	21.10	0.530	6.240	61.600	1.400	0.200	0.005	1.200	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.008	1.200
157	Site Monitoring Bore 4	29/04/2021	MW4	SO & GR		4.43	21.84	22.20	0.600	5.950	27.700	0.700	0.700	0.100	0.050	0.050	0.050	0.005	0.004	0.0001	0.001	0.001	0.002	0.00005	0.001	0.001	0.050
158	Site Monitoring Bore 5	29/04/2021	MW5	SO & GR		4.78	22.66	21.40	0.640	5.230	21.200	1.200	1.200	0.430	0.005	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	0.005
159	Site Monitoring Bore 6	29/04/2021	MW6	SO & GR		6.60	22.56	21.50	0.550	5.110	26.200	1.400	1.400	0.310	0.005	0.005	0.050	0.005	0.005	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	0.005
160	Site Monitoring Bore 7	29/04/2021	MW7	SO & GR		5.73	22.57	21.40	0.620	5.660	26.100	1.900	1.400	0.005	0.490	0.017	0.050	0.005	0.001	0.0001	0.002	0.004	0.001	0.00005	0.001	0.001	0.005
161	Site Monitoring Bore 8	29/04/2021	MW8	SO & GR		3.61	23.11	22.70	0.250	6.010	26.900	0.600	0.600	0.220	0.005	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	0.500
162	Site Monitoring Bore 9	29/04/2021	MW9	SO & GR		5.67	22.76	21.30	0.530	5.050	22.900	1.300	1.300	0.670	0.005	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	0.005
163	DWER Bore 2	29/04/2021	JM45A	SO & GR		4.19	23.74																				
164	DWER Bore 3	29/04/2021	JM2	SO & GR		6.58	21.65																				
165	DWER Bore 4	29/04/2021	JM12	SO & GR		13.39	21.29																				
166	Site Monitoring Bore 1	28/05/2021	MW1	SO & GR		9.06	22.47																				
167	Site Monitoring Bore 2	28/05/2021	MW2	SO & GR		5.44	22.38																				
168	Site Monitoring Bore 3	28/05/2021	MW3	SO & GR		8.60	21.73																				
169	Site Monitoring Bore 4	28/05/2021	MW4	SO & GR		4.28	21.99																				
170	Site Monitoring Bore 5	28/05/2021	MW5	SO & GR		4.73	22.71																				
171	Site Monitoring Bore 6	28/05/2021	MW6	SO & GR		6.60	22.56																				
172	Site Monitoring Bore 7	28/05/2021	MW7	SO & GR		5.72	22.58																				

FieldDAE
Field Data Analysis & Evaluation System

Water Quality Monitoring Data

	Site Name/Type	Date	Site	Monitored By	Monitoring Comment	GWL bTOC mBTOC	GWL mAHD mAHD	T °C	EC mS/cm	pH pH	DO% %	TN mg/L	TKN mg/L	NH3-N mg/L	NO_3-N mg/L	NO2-N mg/L	TP mg/L	PO4- mg/L	As mg/L	Cd mg/L	Cr mg/L	Cu mg/L	Pb mg/L	Hg mg/L	Ni mg/L	Zn mg/L	Nox mg/L
173	Site Monitoring Bore 8	28/05/2021	MW8	SO & GR		3.63	23.09																				
174	Site Monitoring Bore 9	28/05/2021	MW9	SO & GR		5.78	22.65																				
175	DWER Bore 2	28/05/2021	JM45A	SO & GR		4.15	23.78																				
176	DWER Bore 3	28/05/2021	JM2	SO & GR		6.47	21.76																				
177	DWER Bore 4	28/05/2021	JM12	SO & GR		13.27	21.41																				
178	Surface Water Monitoring Site 1	7/07/2021	SW1	SO & GR				11.40	0.140	7.30	67.100	0.300	0.30	0.005	0.005	0.005	0.050	0.011	0.001	0.0001	0.001	0.004	0.001	0.00005	0.001	0.019	0.006
179	Surface Water Monitoring Site 2	7/07/2021	SW2	SO & GR				15.10	0.096	7.51	80.500	0.200	0.20	0.005	0.006	0.005	0.050	0.006	0.001	0.0001	0.001	0.002	0.001	0.00005	0.001	0.012	0.008
180	Surface Water Monitoring Site 4	7/07/2021	SW4	SO & GR				14.30	0.124	7.35	71.500	0.200	0.20	0.007	0.015	0.005	0.050	0.015	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.007	0.017
181	Surface Water Monitoring Site 5	7/07/2021	SW5	SO & GR				16.00	0.149	7.36	64.700	0.300	0.30	0.005	0.018	0.005	0.050	0.009	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.009	0.020
182	Surface Water Monitoring Site 6	7/07/2021	SW6	SO & GR				11.60	0.140	7.39	80.300	0.100	0.10	0.005	0.009	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.010	0.010
183	Surface Water Monitoring Site 7	7/07/2021	SW7	SO & GR				14.50	0.047	7.19	80.400	0.100	0.010	0.005	0.024	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.021	0.025
184	Surface Water Monitoring Site 8	7/07/2021	SW8	SO & GR				13.00	0.189	7.01	82.600	0.200	0.20	0.005	0.008	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.013	0.009
185	Surface Water Monitoring Site 9	7/07/2021	SW9	SO & GR				14.80	0.059	7.45	68.600	0.100	0.010	0.005	0.028	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.005	0.029
186	Surface Water Monitoring Site 10	7/07/2021	SW10	SO & GR				11.40	0.157	7.08	65.700	0.200	0.20	0.005	0.005	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.052	0.005
187	Surface Water Monitoring Site 11	7/07/2021	SW11	SO & GR				14.80	0.046	7.41	74.200	0.400	0.30	0.013	0.061	0.005	0.50	0.007	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.025	0.061
188	Surface Water Monitoring Site 12	7/07/2021	SW12	SO & GR				14.60	0.069	7.18	71.400	0.400	0.30	0.015	0.039	0.005	0.050	0.006	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.026	0.04
189	Surface Water Monitoring Site 13	7/07/2021	SW13	SO & GR				14.70	0.150	7.08	71.100	0.400	0.40	0.008	0.012	0.005	0.050	0.010	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.042	0.013
190	Surface Water Monitoring Site 14	7/07/2021	SW14	SO & GR				14.40	0.141	7.00	53.200	0.400	0.40	0.028	0.019	0.005	0.050	0.009	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.036	0.02
191	Surface Water Monitoring Site 15	7/07/2021	SW15	SO & GR				15.10	0.119	7.04	70.500	0.200	0.20	0.005	0.010	0.005	0.050	0.005	0.001	0.0001	0.001	0.002	0.001	0.00005	0.001	0.092	0.014
192	Surface Water Monitoring Site 16	7/07/2021	SW16	SO & GR				14.70	0.154	7.03	72.000	0.500	0.40	0.044	0.065	0.005	0.050	0.008	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.044	0.067
193	Site Monitoring Bore 1	7/07/2021	MW1	SO & GR		8.89	22.64																				
194	Site Monitoring Bore 2	7/07/2021	MW2	SO & GR		5.26	22.56																				
195	Site Monitoring Bore 3	7/07/2021	MW3	SO & GR		8.41	21.92																				
196	Site Monitoring Bore 4	7/07/2021	MW4	SO & GR		4.02	22.25																				
197	Site Monitoring Bore 5	7/07/2021	MW5	SO & GR		4.51	22.93																				
198	Site Monitoring Bore 6	7/07/2021	MW6	SO & GR		6.36	22.80																				
199	Site Monitoring Bore 7	7/07/2021	MW7	SO & GR		5.46	22.84																				
200	Site Monitoring Bore 8	7/07/2021	MW8	SO & GR		3.29	23.43																				
201	Site Monitoring Bore 9	7/07/2021	MW9	SO & GR		5.58	22.85																				
202	DWER Bore 2	7/07/2021	JM45A	SO & GR		3.87	24.06																				
203	DWER Bore 3	7/07/2021	JM2	SO & GR		6.23	22.00																				
204	DWER Bore 4	7/07/2021	JM12	SO & GR		12.99	21.69																				
205	Site Monitoring Bore 1	27/07/2021	MW1	SO & GR		8.43	23.10	19.40	0.745	5.57	37.500	2.2	0.4	0.008	1.800	0.005	0.05	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.008	1.800
206	Site Monitoring Bore 2	27/07/2021	MW2	SO & GR		4.86	22.96	18.00	1.098	5.69	32.400	3.5	0.4	0.029	3.100	0.005	0.05	0.005	0.001	0.0001	0.001	0.001	0.002	0.00005	0.001	0.001	3.100
207	Site Monitoring Bore 3	27/07/2021	MW3	SO & GR		8.06	22.27	19.20	0.529	5.59	65.500	2.5	0.3	0.005	2.300	0.005	0.05	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.003	2.300
208	Site Monitoring Bore 4	27/07/2021	MW4	SO & GR		3.46	22.81	19.10	0.390	5.76	31.500	0.8	0.8	0.140	0.005	0.005	0.05	0.005	0.004	0.0001	0.001	0.001	0.002	0.00005	0.001	0.005	0.005
209	Site Monitoring Bore 5	27/07/2021	MW5	SO & GR		3.96	23.48	17.90	0.649	3.85	34.700	1.5	0.9	0.350	0.590	0.011	0.05	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.002	0.001	0.600
210	Site Monitoring Bore 6	27/07/2021	MW6	SO & GR		5.79	23.37	18.20	0.472	4.38	31.400	13.0	1.3	0.010	11.000	0.005	0.05	0.005	0.001	0.0001	0.002	0.002	0.001	0.00005	0.002	0.002	11.000
211	Site Monitoring Bore 7	27/07/2021	MW7	SO & GR		4.86	23.44	17.00	0.553	5.56	33.900	1.3	1.5	0.045	0.015	0.005	0.05	0.005	0.001	0.0001	0.002	0.002	0.001	0.00005	0.001	0.010	0.015
212	Site Monitoring Bore 8	27/07/2021	MW8	SO & GR		2.87	23.85	17.70	0.329	5.65	36.300	1.5	1.3	0.058	0.067	0.005	0.05	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.006	0.067
213	Site Monitoring Bore 9	27/07/2021	MW9	SO & GR		5.02	23.41	18.70	0.535	5.06	38.000	1.3	0.2	0.560	0.005	0.005	0.05	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.006	0.005
214	DWER Bore 2	27/07/2021	JM45A	SO & GR		3.35	24.58																				
215	DWER Bore 3	27/07/2021	JM2	SO & GR		5.69	22.54																				
216	DWER Bore 4	27/07/2021	JM12	SO & GR		12.52	22.16																				
217	Surface Water Monitoring Site 1	27/07/2021	SW1	SO & GR				14.50	0.486	6.11	68.300	0.2	0.2	0.005	0.012	0.005	0.05	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.016	0.013
218	Surface Water Monitoring Site 4	27/07/2021	SW4	SO & GR				15.50	0.218	6.18	68.400	0.2	0.2	0.008	0.030	0.005	0.05	0.009	0.001	0.0001	0.001	0.002	0.001	0.00005	0.001	0.013	0.031
219	Surface Water Monitoring Site 5	27/07/2021	SW5	SO & GR				15.80	0.131	6.86	59.500	0.2	0.2	0.014	0.026	0.005	0.13	0.007	0.001	0.0001	0.001	0.002	0.001	0.00005	0.001	0.006	0.028
220	Surface Water Monitoring Site 6	27/07/2021	SW6	SO & GR				15.10	0.098	6.96	71.400	0.1	0.1	0.016	0.009	0.005	0.05	0.005	0.001	0.0001	0.001	0.002	0.001	0.00005	0.001	0.003	0.010
221	Surface Water Monitoring Site 7	27/07/2021	SW7	SO & GR				15.40	0.085	6.30	64.400	0.1	0.1	0.005	0.029	0.005	0.05	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.007	0.030
222	Surface Water Monitoring Site 8	27/07/2021	SW8	SO & GR				15.50	0.056	6.31	59.900	0.1	0.1	0.005	0.041	0.005	0.05	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.005	0.042
223	Surface Water Monitoring Site 9	27/07/2021	SW9	SO & GR				14.10	0.148	6.34	64.000	0.1	0.1	0.005	0.005	0.005	0.05	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.013	0.005
224	Surface Water Monitoring Site 10	27/07/2021	SW10	SO & GR				15.10	0.235	6.29	44.600	0.2	0.2	0.005	0.005	0.005	0.08	0.008	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.052	0.005
225	Surface Water Monitoring Site 11	27/07/2021	SW11	SO & GR				15.10	0.085	6.45	71.500	0.2	0.2	0.005	0.015	0.005	0.15	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.014	0.016
226	Surface Water Monitoring Site 12	27/07/2021	SW12	SO & GR				15.00	0.106	6.62	70.100	0.1	0.1	0.005	0.026	0.005	0.05	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.020	0.027

FieldDAE
Field Data Analysis & Evaluation System

Water Quality Monitoring Data

	Site Name/Type	Date	Site	Monitored By	Monitoring Comment	GWL bTOC mBTOC	GWL mAHD mAHD	T °C	EC mS/cm	pH pH	DO% %	TN mg/L	TKN mg/L	NH3-N mg/L	NO_3-N mg/L	NO2-N mg/L	TP mg/L	PO4- mg/L	As mg/L	Cd mg/L	Cr mg/L	Cu mg/L	Pb mg/L	Hg mg/L	Ni mg/L	Zn mg/L	Nox mg/L
227	Surface Water Monitoring Site 13	27/07/2021	SW13	SO & GR				14.30	0.057	6.18	71.300	0.2	0.2	0.009	0.005	0.005	0.05	0.003	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.010	0.005
228	Surface Water Monitoring Site 14	27/07/2021	SW14	SO & GR				14.10	0.052	6.23	57.100	0.2	0.2	0.005	0.005	0.005	0.05	0.014	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.008	0.005
229	Surface Water Monitoring Site 15	27/07/2021	SW15	SO & GR				14.40	0.207	5.47	64.100	0.1	0.1	0.005	0.005	0.005	0.05	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.084	0.005
230	Surface Water Monitoring Site 16	27/07/2021	SW16	SO & GR				13.60	0.127	6.41	50.600	0.4	0.4	0.030	0.023	0.005	0.06	0.023	0.001	0.0001	0.001	0.002	0.001	0.00005	0.001	0.032	0.025
231	Site Monitoring Bore 1	12/08/2021	MW1	SO & GR		8.17	23.36																				
232	Site Monitoring Bore 2	12/08/2021	MW2	SO & GR		4.72	23.10																				
233	Site Monitoring Bore 3	12/08/2021	MW3	SO & GR		7.89	22.44																				
234	Site Monitoring Bore 4	12/08/2021	MW4	SO & GR		3.28	22.99																				
235	Site Monitoring Bore 5	12/08/2021	MW5	SO & GR		3.75	23.69																				
236	Site Monitoring Bore 6	12/08/2021	MW6	SO & GR		5.52	23.64																				
237	Site Monitoring Bore 7	12/08/2021	MW7	SO & GR		4.60	23.70																				
238	Site Monitoring Bore 8	12/08/2021	MW8	SO & GR		2.49	24.23																				
239	Site Monitoring Bore 9	12/08/2021	MW9	SO & GR		4.84	23.59																				
240	DWER Bore 2	12/08/2021	JM45A	SO & GR		3.15	24.78																				
241	DWER Bore 3	12/08/2021	JM2	SO & GR		5.48	22.75																				
242	DWER Bore 4	12/08/2021	JM12	SO & GR		12.34	22.34																				
243	DWER Bore 1	27/10/2020	J310	WC		2.98	23.71																				
244	DWER Bore 1	26/11/2020	J310	WC		2.93	23.76																				
245	DWER Bore 1	10/12/2020	J310	WC		2.99	23.70																				
246	DWER Bore 1	8/01/2021	J310	WC		3.18	23.51																				
247	DWER Bore 1	4/02/2021	J310	WC		3.33	23.36																				
248	DWER Bore 1	30/06/2021	J310	WC		3.40	23.29																				
249	DWER Bore 1	28/07/2021	J310	WC		2.60	24.09																				
250	DWER Bore 1	31/08/2021	J310	WC		2.46	24.23																				
251	Site Monitoring Bore 1	30/09/2021	MW1	GR		8.12	23.41																				
252	Site Monitoring Bore 2	30/09/2021	MW2	GR		4.68	23.14																				
253	Site Monitoring Bore 3	30/09/2021	MW3	GR		7.76	22.57																				
254	Site Monitoring Bore 4	30/09/2021	MW4	GR		3.32	22.95																				
255	Site Monitoring Bore 5	30/09/2021	MW5	GR		3.74	23.70																				
256	Site Monitoring Bore 6	30/09/2021	MW6	GR		5.56	23.60																				
257	Site Monitoring Bore 7	30/09/2021	MW7	GR		4.63	23.67																				
258	Site Monitoring Bore 8	30/09/2021	MW8	GR		2.48	24.24																				
259	Site Monitoring Bore 9	30/09/2021	MW9	GR		4.76	23.67																				
260	DWER Bore 1	30/09/2021	J310	GR		2.47	24.22																				
261	DWER Bore 2	30/09/2021	JM45A	GR		3.06	24.87																				
262	DWER Bore 3	30/09/2021	JM2	GR		5.34	22.89																				
263	DWER Bore 4	30/09/2021	JM12	GR		12.29	22.39																				
264	Site Monitoring Bore 1	28/10/2021	MW1	GR & SO		7.26	24.27	20.10	0.609	6.64	33.600	0.70	0.5	0.11	0.250	0.005	0.050	0.012	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.027	0.250
265	Site Monitoring Bore 2	28/10/2021	MW2	GR & SO		4.59	23.23	18.90	0.607	6.12	28.930	0.40	0.2	0.005	0.190	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	0.190
266	Site Monitoring Bore 3	28/10/2021	MW3	GR & SO		7.67	22.66	19.10	0.480	5.80	62.840	2.70	0.2	0.005	2.400	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	2.400
267	Site Monitoring Bore 4	28/10/2021	MW4	GR & SO		3.29	22.98	20.00	0.501	6.07	31.000	1.10	1.1	0.21	0.050	0.050	0.050	0.005	0.003	0.0001	0.001	0.001	0.001	0.00005	0.002	0.001	0.050
268	Site Monitoring Bore 5	28/10/2021	MW5	GR & SO		3.63	23.81	19.10	0.954	4.31	31.530	1.30	1.3	0.41	0.006	0.005	0.050	0.005	0.002	0.0001	0.001	0.001	0.001	0.00005	0.004	0.001	0.011
269	Site Monitoring Bore 6	28/10/2021	MW6	GR & SO		5.52	23.64	18.90	0.488	5.21	30.220	5.00	0.9	0.16	3.700	0.430	0.050	0.005	0.001	0.0001	0.002	0.001	0.001	0.00005	0.002	0.001	4.100
270	Site Monitoring Bore 7	28/10/2021	MW7	GR & SO		4.60	23.70	18.60	0.770	5.68	22.980	1.70	1.7	0.15	0.005	0.005	0.050	0.006	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	0.005
271	Site Monitoring Bore 8	28/10/2021	MW8	GR & SO		2.44	24.28	19.70	0.290	6.24	19.340	1.00	1.0	0.07	0.005	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	0.005
272	Site Monitoring Bore 9	28/10/2021	MW9	GR & SO		4.80	23.63	19.80	0.362	5.38	30.880	1.30	1.3	0.64	0.005	0.005	0.050	0.005	0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	0.005
273	DWER Bore 2	28/10/2021	JM45A	GR & SO		3.00	24.93																				
274	DWER Bore 3	28/10/2021	JM2	GR & SO		5.25	22.98																				
275	DWER Bore 4	28/10/2021	JM12	GR & SO		12.32	22.36																				
276	Site Monitoring Bore 1	1/12/2021	MW1	GR & SO		7.30	24.23																				
277	Site Monitoring Bore 2	1/12/2021	MW2	GR & SO		4.61	23.21																				
278	Site Monitoring Bore 3	1/12/2021	MW3	GR & SO		7.71	22.62																				
279	Site Monitoring Bore 4	1/12/2021	MW4	GR & SO		3.48	22.79																				
280	Site Monitoring Bore 5	1/12/2021	MW5	GR & SO		3.74	23.70																				

FieldDAE
Field Data Analysis & Evaluation System

Water Quality Monitoring Data

	Site Name/Type	Date	Site	Monitored By	Monitoring Comment	GWL bTOC mBTOC	GWL mAHD mAHD	T °C	EC mS/cm	pH pH	DO% %	TN mg/L	TKN mg/L	NH3-N mg/L	NO_3-N mg/L	NO2-N mg/L	TP mg/L	PO4- mg/L	As mg/L	Cd mg/L	Cr mg/L	Cu mg/L	Pb mg/L	Hg mg/L	Ni mg/L	Zn mg/L	Nox mg/L
281	Site Monitoring Bore 6	1/12/2021	MW6	GR & SO		5.54	23.62																				
282	Site Monitoring Bore 7	1/12/2021	MW7	GR & SO		4.68	23.62																				
283	Site Monitoring Bore 8	1/12/2021	MW8	GR & SO		2.47	24.25																				
284	DWER Bore 2	1/12/2021	JM45A	GR & SO		3.13	24.80																				
285	DWER Bore 3	1/12/2021	JM2	GR & SO		5.52	22.71																				
286	DWER Bore 4	1/12/2021	JM12	GR & SO		12.36	22.32																				

APPENDIX G
Lithological Logs

Lithological Log

Hyd2o
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

Date :	3/06/2020				
Client :	ECP Acquisitions 6 Pty Ltd	Job Number :	H20002	Bore Name	
Project:	Glen Iris LWMS	Start Hole :	9.30 am		
Easting	392219	End Hole :	10 am	MW1	
Northing	6447400	Logged by :	SO		
Datum:	AHD	Total Depth :	12 m		
Drill type:	Drill Rig Hollow Auger	RL Top of Casing	31.53 mAHD		
Hole diameter:	2.5 Inch	RL Nat Surface :	30.93 mAHD		

support	backfill	water	Slot / Screen Depth	Depth (metres)	Soil Characteristics					
					Colour	Particle Size	Texture	Organic Content	Moisture	Comment
PVC (Class 9)				2.0m	Yellow Grey	Fine to Medium	Sand	Nil	Slightly Moist	
					Light Yellow					
				4.0m	Light Yellow Brown					
					Orange Brown					
				6.0m	Light Orange Brown					
					Yellow					
		▽		8.0m	Yellow Grey					
				10.0m	Light Yellow Grey				Moist	
					Dark Brown					Slight Traces of Coffee Rock but Not Cemeneted
				12.0m						

COLOUR : Black, White, Biege
Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue
Composition : Solid , Blemish, Mottle

PARTICLE SIZE : Fine, Medium, Course

TEXTURE : Sand, Loamy Sand, Clayey Sand
Silt, Loam, Sandy Loam, Clayey Loam
Clay, Sandy Clay

ORGANICS : High, Medium, Low

MOISTURE : Dry, Slightly Moist, Moist, Saturated

Static Water Level

Date

Stickup above NS (m)

Water Level bTOC (m)

Water Level bNS (m)

Lithological Log

Hyd2o
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

Date :	3/06/2020				
Client :	ECP Acquisitions 6 Pty Ltd	Job Number :	H20002	Bore Name	
Project:	Glen Iris LWMS	Start Hole :	10.15 am		
Easting	392008	End Hole :	10.45 am	MW2	
Northing	6447916	Logged by :	SO		
Datum:	AHD	Total Depth :	9.5 m		
Drill type:	Drill Rig Hollow Auger	RL Top of Casing	27.82 mAHD		
Hole diameter:	2.5 Inch	RL Nat Surface :	27.22 mAHD		

support	backfill	water	Slot / Screen Depth	Depth (metres)	Soil Characteristics					
					Colour	Particle Size	Texture	Organic Content	Moisture	Comment
PVC (Class 9)				1.0m	Dark Grey Brown	Fine to Medium	Sand	Low	Slightly Moist	
				2.0m	Grey Brown					
				3.0m	Light Yellow Grey			Nil		
				4.0m	Light Grey					
				5.0m	Light Grey					
				6.0m	White					
		▽		7.0m						
				8.0m	Light Grey				Moist	
				9.0m	White					
				10.0m						

COLOUR : Black, White, Biege
Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue
Composition : Solid , Blemish, Mottle

PARTICLE SIZE : Fine, Medium, Course

TEXTURE : Sand, Loamy Sand, Clayey Sand
Silt, Loam, Sandy Loam, Clayey Loam
Clay, Sandy Clay

ORGANICS : High, Medium, Low

MOISTURE : Dry, Slightly Moist, Moist, Saturated

Static Water Level

Date

Stickup above NS (m)

Water Level bTOC (m)

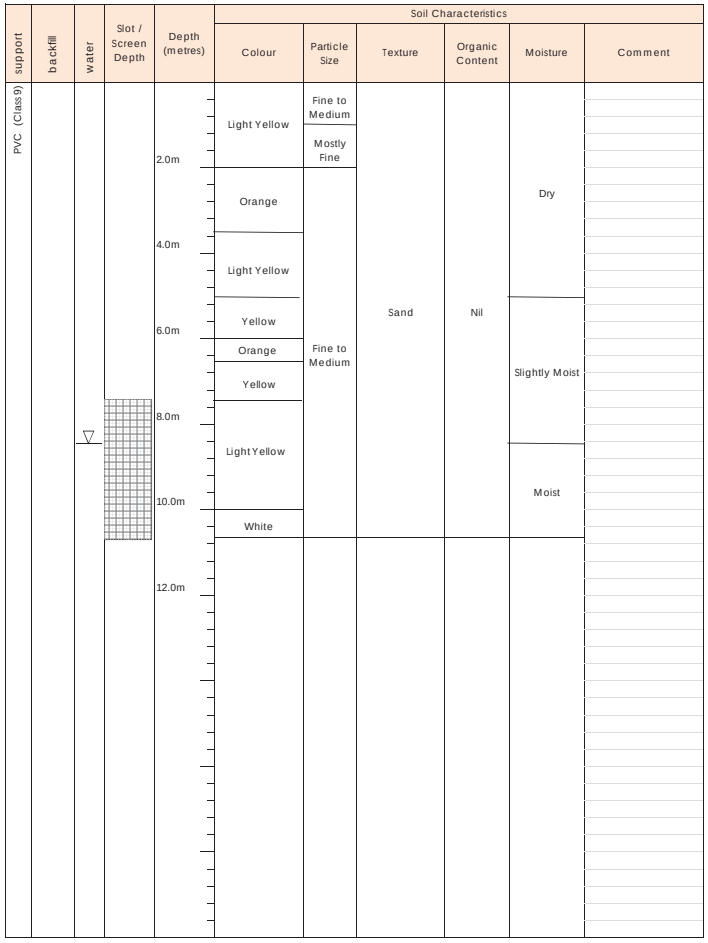
Water Level bNS (m)

Lithological Log

Hyd2o
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

Date :	3/06/2020				
Client :	ECP Acquisitions 6 Pty Ltd	Job Number :	H20002	Bore Name	
Project:	Glen Iris LWMS	Start Hole :	11.00 am		
Easting	391661	End Hole :	11.30 am	MW3	
Northing	6446084	Logged by :	SO		
Datum:	AHD	Total Depth :	11 m		
Drill type:	Drill Rig Hollow Auger	RL Top of Casing	30.33		
Hole diameter:	2.5 Inch	RL Nat Surface :	29.73		



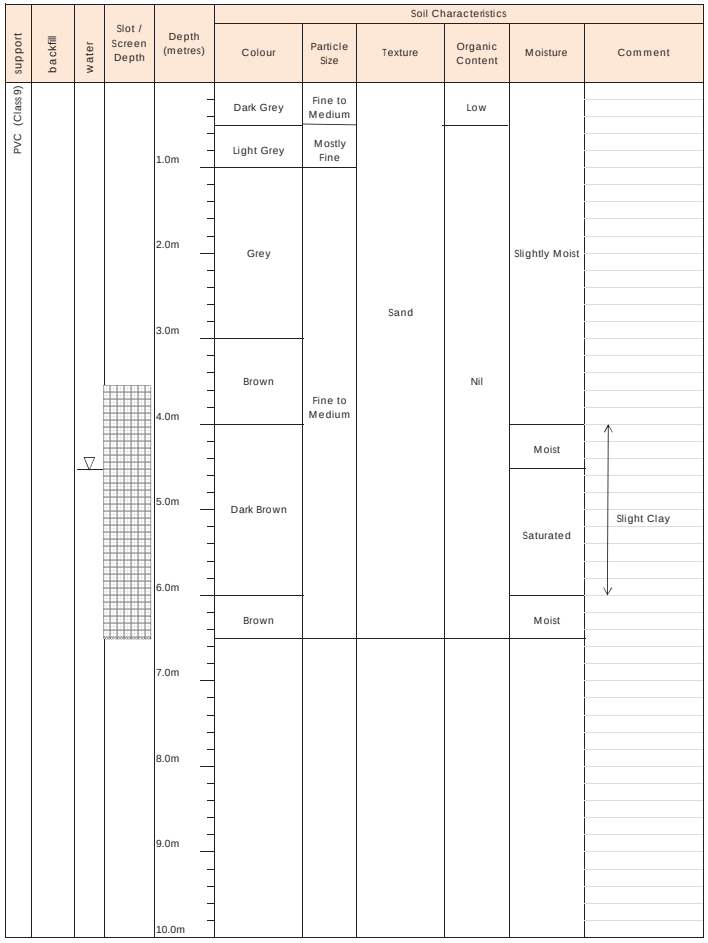
COLOUR :	Black, White, Biege Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue Composition : Solid , Blemish, Mottle		Static Water Level
PARTICLE SIZE :	Fine, Medium, Course		
TEXTURE :	Sand, Loamy Sand, Clayey Sand Silt, Loam, Sandy Loam, Clayey Loam Clay, Sandy Clay	Date	
		Stickup above NS (m)	
ORGANICS :	High, Medium, Low	Water Level bTOC (m)	
MOISTURE :	Dry, Slightly Moist, Moist, Saturated	Water Level bNS (m)	

Lithological Log

Hyd2o
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

Date :	3/06/2020				
Client :	ECP Acquisitions 6 Pty Ltd	Job Number :	H20002	Bore Name	
Project:	Glen Iris LWMS	Start Hole :	11.45 am		
Easting	391708	End Hole :	12.15 pm	MW4	
Northing	6447579	Logged by :	SO		
Datum:	AHD	Total Depth :	6.5 m		
Drill type:	Drill Rig Hollow Auger	RL Top of Casing	26.27		
Hole diameter:	2.5 Inch	RL Nat Surface :	25.67		



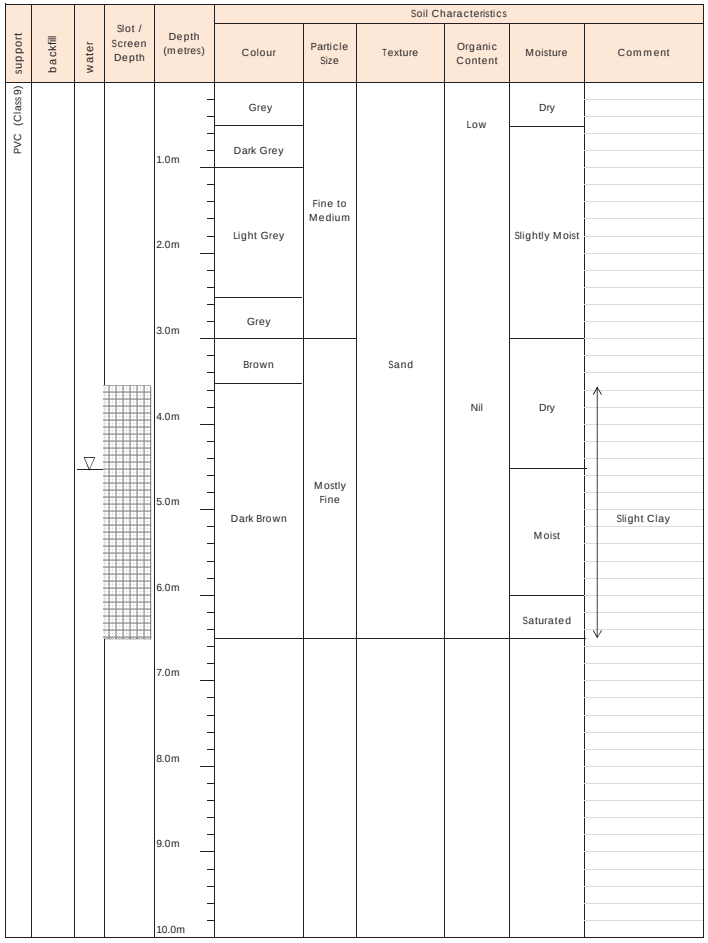
COLOUR :	Black, White, Biege Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue Composition : Solid , Blemish, Mottle		Static Water Level
PARTICLE SIZE :	Fine, Medium, Course		
TEXTURE :	Sand, Loamy Sand, Clayey Sand Silt, Loam, Sandy Loam, Clayey Loam Clay, Sandy Clay	Date	
		Stickup above NS (m)	
ORGANICS :	High, Medium, Low	Water Level bTOC (m)	
MOISTURE :	Dry, Slightly Moist, Moist, Saturated	Water Level bNS (m)	

Lithological Log

Hyd2o
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

Date :	3/06/2020				
Client :	ECP Acquisitions 6 Pty Ltd	Job Number :	H20002	Bore Name	
Project:	Glen Iris LWMS	Start Hole :	12.30 pm		
Easting	392170	End Hole :	1.00 pm	MW5	
Northing	6447202	Logged by :	SO		
Datum:	AHD	Total Depth :	6.5 m		
Drill type:	Drill Rig Hollow Auger	RL Top of Casing	27.44		
Hole diameter:	2.5 Inch	RL Nat Surface :	26.84		



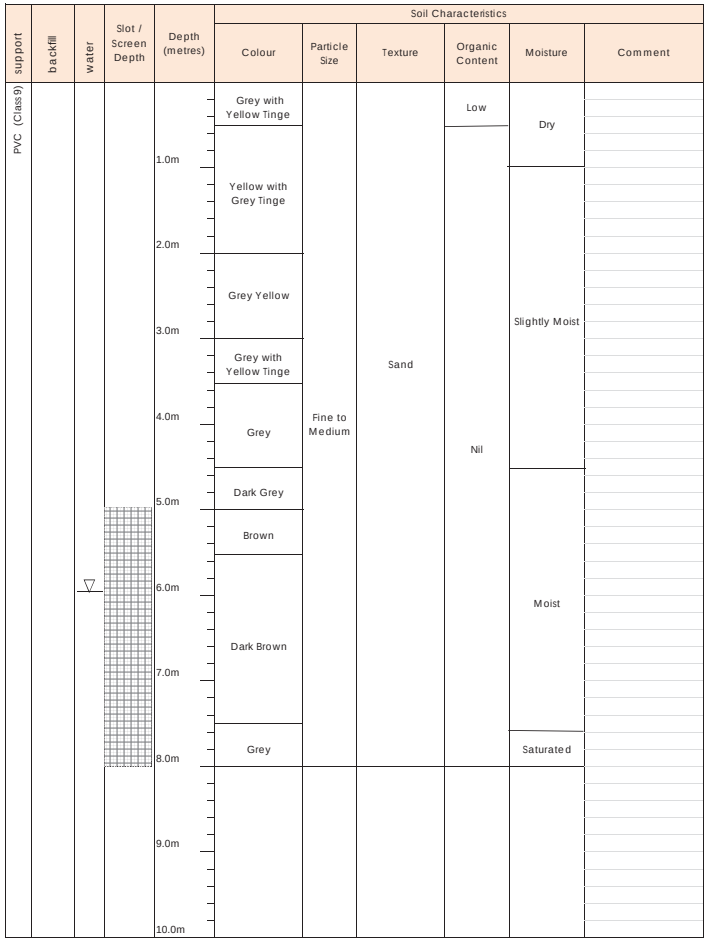
COLOUR :	Black, White, Biege Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue Composition : Solid , Blemish, Mottle		Static Water Level
PARTICLE SIZE :	Fine, Medium, Course		
TEXTURE :	Sand, Loamy Sand, Clayey Sand Silt, Loam, Sandy Loam, Clayey Loam Clay, Sandy Clay	Date	
		Stickup above NS (m)	
ORGANICS :	High, Medium, Low	Water Level bTOC (m)	
MOISTURE :	Dry, Slightly Moist, Moist, Saturated	Water Level bNS (m)	

Lithological Log

Hyd2o
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

Date :	4/06/2020				
Client :	ECP Acquisitions 6 Pty Ltd	Job Number :	H20002	Bore Name	
Project:	Glen Iris LWMS	Start Hole :	8.30 am		
Easting	392027	End Hole :	9.00 am	MW6	
Northing	6446878	Logged by :	SO		
Datum:	AHD	Total Depth :	8 m		
Drill type:	Drill Rig Hollow Auger	RL Top of Casing	29.16		
Hole diameter:	2.5 Inch	RL Nat Surface :	28.56		



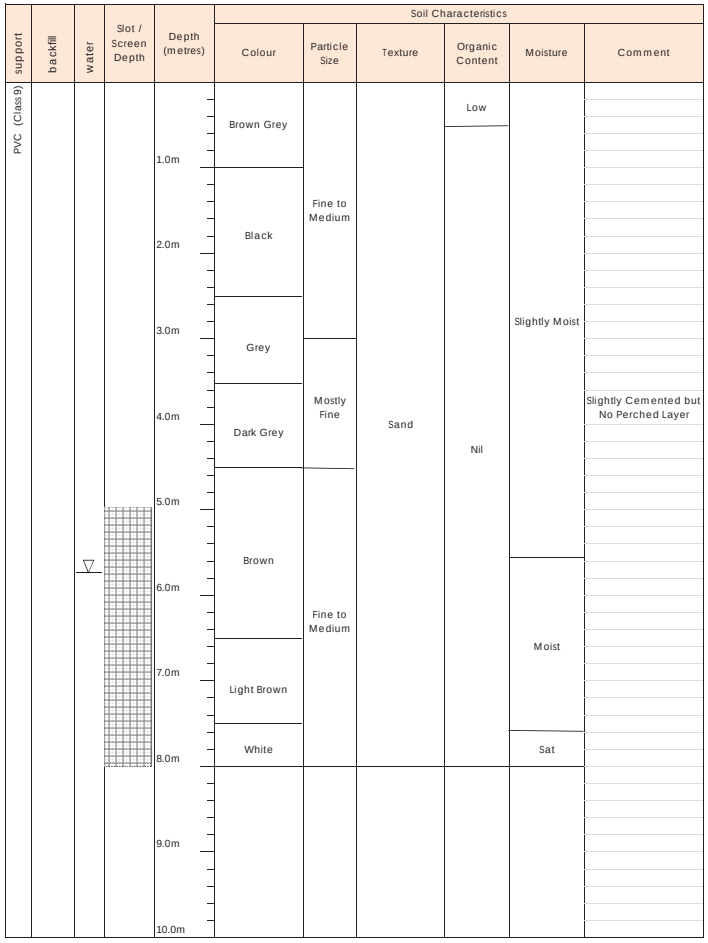
COLOUR :	Black, White, Biege Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue Composition : Solid , Blemish, Mottle		Static Water Level
PARTICLE SIZE :	Fine, Medium, Course		
TEXTURE :	Sand, Loamy Sand, Clayey Sand Silt, Loam, Sandy Loam, Clayey Loam Clay, Sandy Clay	Date	
		Stickup above NS (m)	
ORGANICS :	High, Medium, Low	Water Level bTOC (m)	
MOISTURE :	Dry, Slightly Moist, Moist, Saturated	Water Level bNS (m)	

Lithological Log

Hyd2o
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

Date :	4/06/2020				
Client :	ECP Acquisitions 6 Pty Ltd	Job Number :	H20002	Bore Name	
Project:	Glen Iris LWMS	Start Hole :	7.45 am		
Easting	391965	End Hole :	8.15 am	MW7	
Northing	6446606	Logged by :	SO		
Datum:	AHD	Total Depth :	8 m		
Drill type:	Drill Rig Hollow Auger	RL Top of Casing	391965		
Hole diameter:	2.5 Inch	RL Nat Surface :	6446606		



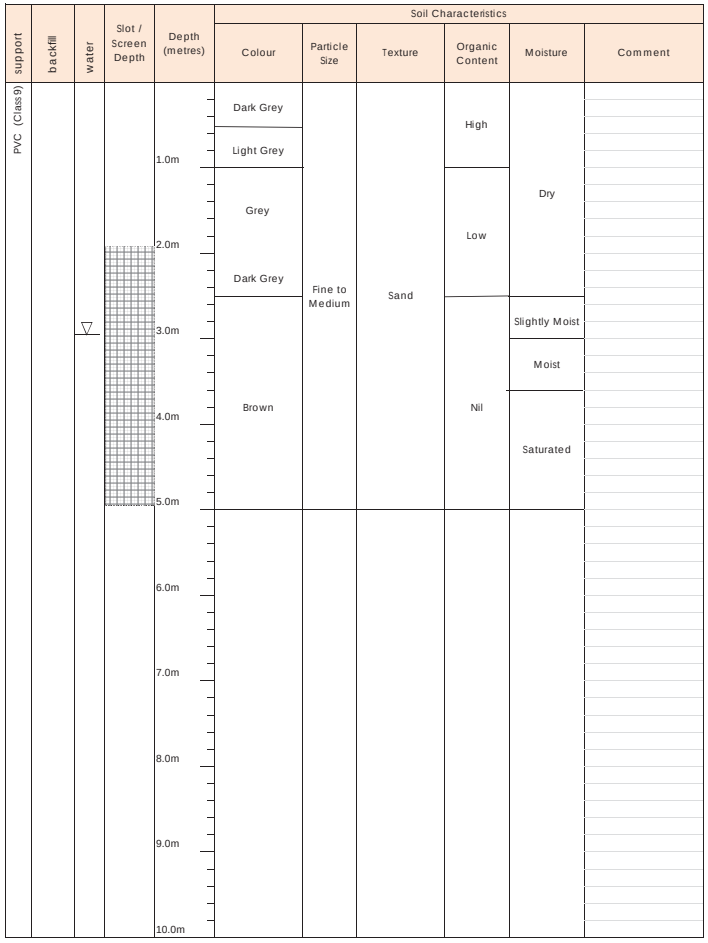
COLOUR :	Black, White, Biege Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue Composition : Solid , Blemish, Mottle		Static Water Level
PARTICLE SIZE :	Fine, Medium, Course		
TEXTURE :	Sand, Loamy Sand, Clayey Sand Silt, Loam, Sandy Loam, Clayey Loam Clay, Sandy Clay	Date	
		Stickup above NS (m)	
ORGANICS :	High, Medium, Low	Water Level bTOC (m)	
MOISTURE :	Dry, Slightly Moist, Moist, Saturated	Water Level bNS (m)	

Lithological Log

Hyd2o
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

Date :	4/06/2020				
Client :	ECP Acquisitions 6 Pty Ltd	Job Number :	H20002	Bore Name	
Project:	Glen Iris LWMS	Start Hole :	1.15 pm		
Easting	392151	End Hole :	1.45 pm	MW8	
Northing	6446249	Logged by :	SO		
Datum:	AHD	Total Depth :	5 m		
Drill type:	Drill Rig Hollow Auger	RL Top of Casing	26.72		
Hole diameter:	2.5 Inch	RL Nat Surface :	26.12		



COLOUR :	Black, White, Biege Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue Composition : Solid , Blemish, Mottle		Static Water Level
PARTICLE SIZE :	Fine, Medium, Course		
TEXTURE :	Sand, Loamy Sand, Clayey Sand Silt, Loam, Sandy Loam, Clayey Loam Clay, Sandy Clay	Date	
		Stickup above NS (m)	
ORGANICS :	High, Medium, Low	Water Level bTOC (m)	
MOISTURE :	Dry, Slightly Moist, Moist, Saturated	Water Level bNS (m)	

Lithological Log

Hyd2o
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

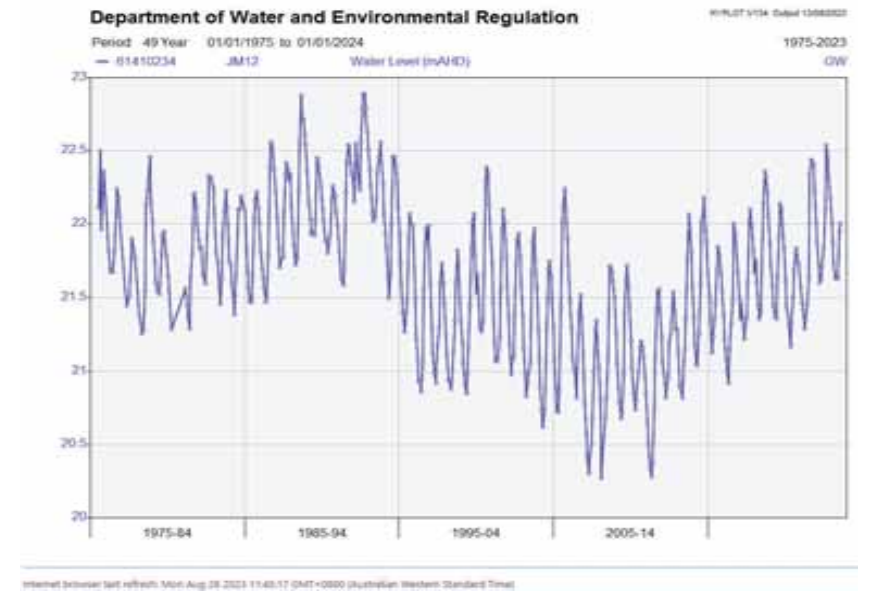
Date :	3/06/2020				
Client :	ECP Acquisitions 6 Pty Ltd	Job Number :	H20002	Bore Name	
Project:	Glen Iris LWMS	Start Hole :	9.15 am		
Easting	392221	End Hole :	9.45 am	MW9	
Northing	6446790	Logged by :	SO		
Datum:	AHD	Total Depth :	8 m		
Drill type:	Drill Rig Hollow Auger	RL Top of Casing	28.43		
Hole diameter:	2.5 Inch	RL Nat Surface :	27.73		

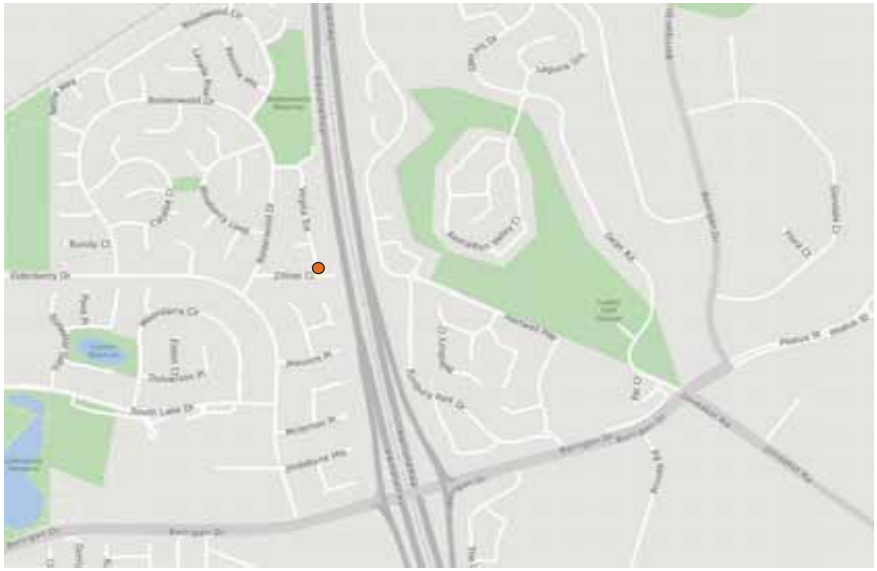
support	backfill	water	Slot / Screen Depth	Depth (metres)	Soil Characteristics					
					Colour	Particle Size	Texture	Organic Content	Moisture	Comment
PVC (Class 9)					Yellow with Grey Tinge	Fine to Medium	Sand	Low	Slightly Moist	
				1.0m						
					Black				Dry	
				2.0m						
					Dark Grey					
				3.0m						
					Grey			Nil		
				4.0m						
				5.0m						
		▽							Slightly Moist	
				6.0m						
					Dark Brown				Moist	
				7.0m						
									Saturated	
				8.0m						
				9.0m						
				10.0m						

COLOUR :	Black, White, Biege Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue Composition : Solid , Blemish, Mottle		Static Water Level
PARTICLE SIZE :	Fine, Medium, Course		
TEXTURE :	Sand, Loamy Sand, Clayey Sand Silt, Loam, Sandy Loam, Clayey Loam Clay, Sandy Clay	Date	
		Stickup above NS (m)	
ORGANICS :	High, Medium, Low	Water Level bTOC (m)	
MOISTURE :	Dry, Slightly Moist, Moist, Saturated	Water Level bNS (m)	

APPENDIX H
DWER Groundwater Monitoring Data

Date: 26/08/2023 Job No. H22046





Source: Department of Water and Environmental Regulation (2023)

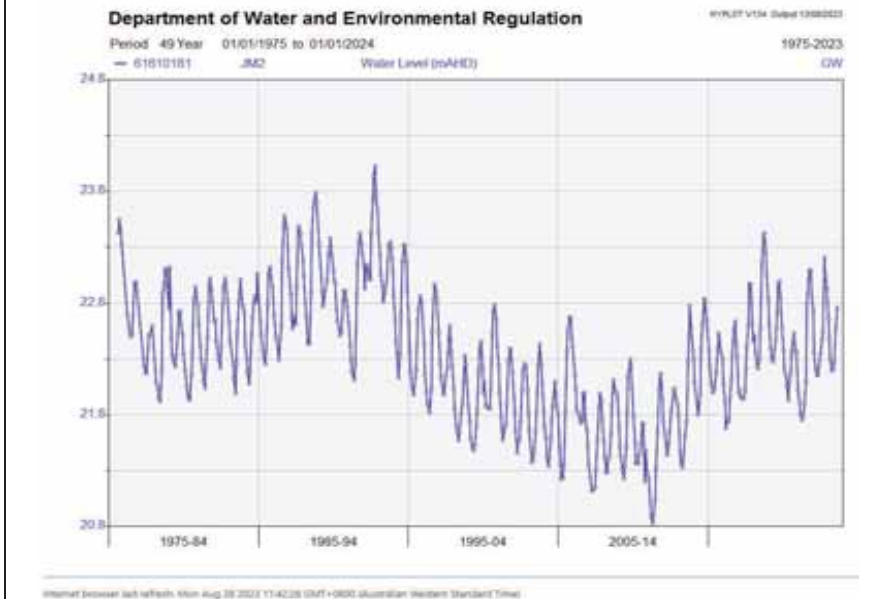
hyd2o

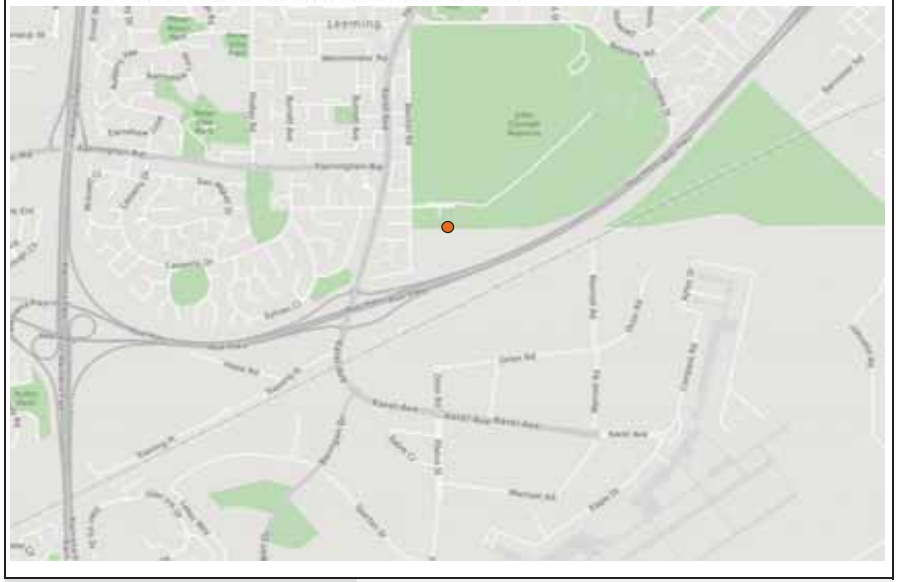
Glen Iris Jandakot Local Water Management Strategy

DWER Bore Hydrographs : JM12

Appendix H1

Date: 26/08/2023 Job No. H22046





Source: Department of Water and Environmental Regulation (2023)

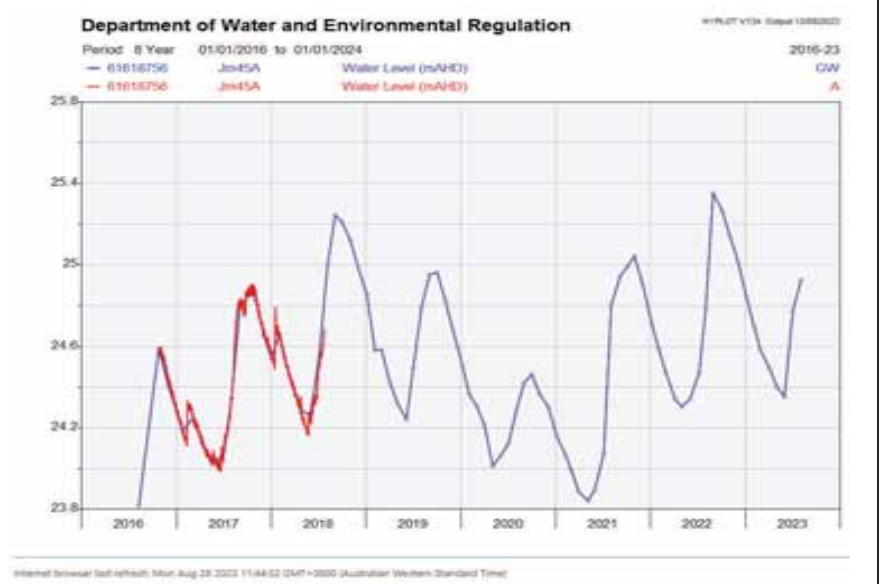
hyd2o

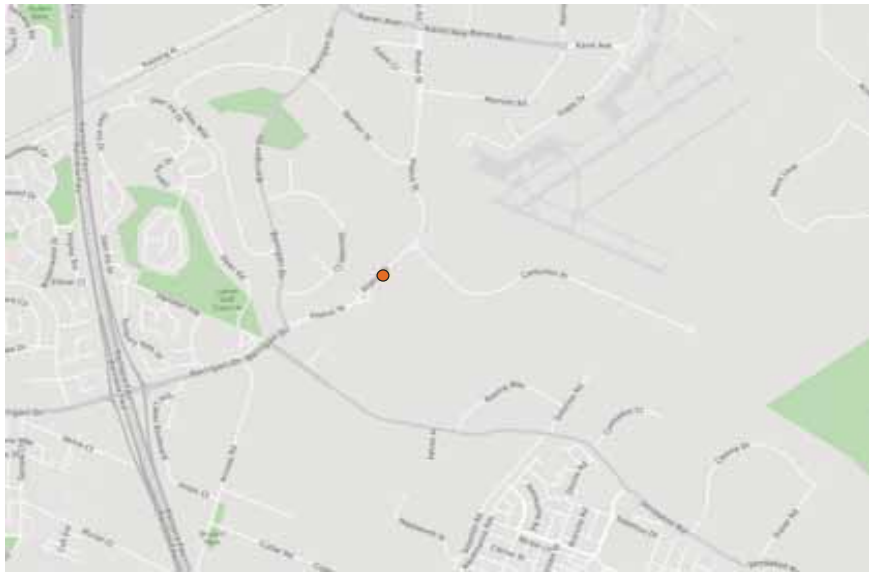
Glen Iris Jandakot Local Water Management Strategy

DWER Bore Hydrographs : JM2

Appendix H2

Date: 26/08/2023 Job No. H22046





Source: Department of Water and Environmental Regulation (2023)

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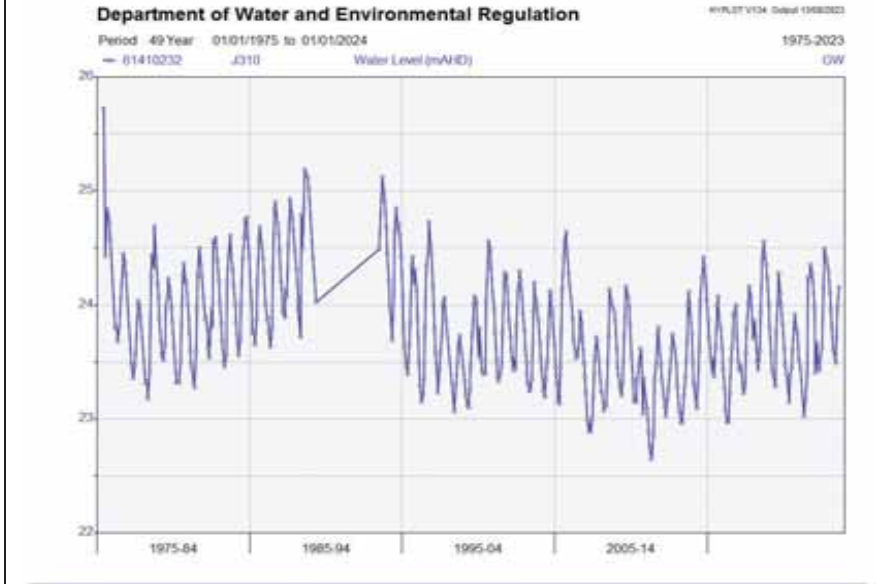
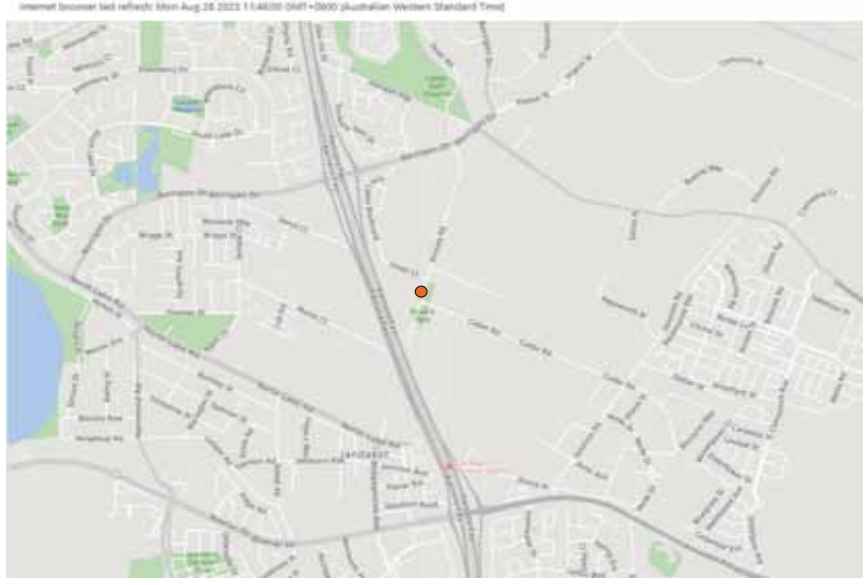
Glen Iris Jandakot Local Water Management Strategy

DWER Bore Hydrographs : JM45A

Appendix H3

Date: 26/08/2023 Job No. H22046





Source: Department of Water and Environmental Regulation (2023)

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Glen Iris Jandakot Local Water Management Strategy

DWER Bore Hydrographs : J310

Appendix H4

APPENDIX I
UNDO Nutrient Modelling

Government of **Western Australia**
Department of **Water and Environmental Regulation**

Project: Glen Iris Pre Development

Date: 26/04/2021

Version: Version 1.2.0.19289

Subregion name: Existing Golf Course

Landuse	Percent (%)	Area (ha)	Input load Nitrogen (kg)	Input load Phosphorus (kg)
Residential	0	0.00	0.00	0.00
Industrial, commercial & schools	0	0.00	0.00	0.00
Rural living	0	0.00	0.00	0.00
Public open space	100	53.00	8427.00	360.40
Road reserve	0	0.00	0.00	0.00

Total area (ha)	Total percent (%)
53.00	100

Nitrogen input (kg/yr)	Phosphorus input (kg/yr)
8704.19	368.35

Nitrogen export (kg/yr)	Phosphorus (kg/yr)
656.38	2.46

Public Open Space (POS)

Landuse	Percent (%)	Area (ha)
Native gardens	0	0.00
Non-native gardens	0	0.00
Not fertilised	0	0.00
Nature	0	0.00
Sport	0	0.00
Recreation	0	0.00
Golf course	100	53.00
Bowling green	0	0.00
Impervious	0	0.00
Water body	0	0.00

Total area (ha)	Total percent (%)
53.00	100

Nitrogen input (kg)	Phosphorus input (kg)
8427.00	360.40

Soil and drainage information

Type of drainage	**Infiltration**	**Does it contain imported fill?**	**No**
Soil type	**Bassendean**	**Does subregion contain onsite sewage diposal system?**	**No**
Depth to groundwater (m)	**10**		
Groundwater slope (%)	**0.15**		
Soil PRI	**5.0**		

Note: Please attach the results of soil tests to this report when submitting.

Summary: Nutrient stripping devices

Treatment Name	Size (m²)	Treated area (ha)	Treating	N removed (kg/yr)	P removed (kg/yr)
Load removed				**0.00**	**0.00**
Net export				**715.09**	**2.46**

Summary: Nutrient load exports

Region	Area (ha)	P export (kg/yr)	N export (kg/yr)
Existing Golf Course	53.00	2.46	656.38

PRE-TREATMENT LOAD (kg/yr)		LOAD REMOVED (kg/yr)		NET LOAD EXPORT (kg/yr)	
NITROGEN	PHOSPHORUS	NITROGEN	PHOSPHORUS	NITROGEN	PHOSPHORUS
656.38	2.46	0.00	0.00	715.09	2.46

Government of **Western Australia**
Department of **Water and Environmental Regulation**

Project: Glen Iris Post Development
Date: 26-Apr-21
Version: Version 1.2.0.19289

Subregion name: Lots & POS

Landuse	Percent (%)	Area (ha)	Input load Nitrogen (kg)	Input load Phosphorus (kg)
Residential	68	27.03	2342.78	629.10
Industrial, commercial & schools	2	0.80	20.99	5.09
Rural living	0	0.00	0.00	0.00
Public open space	30	11.93	660.65	71.85
Road reserve	0	0.00	0.00	0.00

Total area (ha)	Total percent (%)
39.75	75

Nitrogen input (kg/yr)	Phosphorus input (kg/yr)
3232.31	712.00

Nitrogen export (kg/yr)	Phosphorus (kg/yr)
243.75	4.76

Residential

Size (m²)	Percent (%)	Area (ha)	Input load Nitrogen (kg)	Input load Phosphorus (kg)
<400	16	4.32	101.60	29.77
400-500 m²	0	0.00	0.00	0.00
501-600 m²	84	22.71	2241.18	599.34
601-730 m²	0	0.00	0.00	0.00
>730 m²	0	0.00	0.00	0.00
Multiple dwellings	0	0.00	0.00	0.00

Total area (ha)	Total percent (%)
27.03	68

Nitrogen input (kg)	Phosphorus input (kg)
2342.78	629.10

Commercial, Industry and Schools

Landuse	Percent (%)	Area (ha)
Light industrial	0	0.00
Heavy industrial	0	0.00
Commercial / Offices	100	0.80
Schools	0	0.00
Public buildings	0	0.00

Total area (ha)	Total percent (%)
0.80	2

Nitrogen input (kg)	Phosphorus input (kg)
20.99	5.09

Public Open Space (POS)

Landuse	Percent (%)	Area (ha)
Native gardens	25	2.98
Non-native gardens	20	2.39
Not fertilised	0	0.00
Nature	0	0.00
Sport	0	0.00
Recreation	50	5.96
Golf course	0	0.00
Bowling green	0	0.00
Impervious	5	0.60
Water body	0	0.00

Total area (ha)	Total percent (%)
11.93	30

Nitrogen input (kg)	Phosphorus input (kg)
660.65	71.85

Soil and drainage information

Type of drainage	**Infiltration**	**Does it contain imported fill?**	**No**
Soil type	**Bassendean**	**Does subregion contain onsite sewage diposal system?**	**No**
Depth to groundwater (m)	**10**		
Groundwater slope (%)	**0.15**		
Soil PRI	**5.0**		

Note: Please attach the results of soil tests to this report when submitting.

Subregion name: Roads

Landuse	Percent (%)	Input load Area (ha)	Nitrogen (kg)	Phosphorus (kg)
Residential	0	0.00	0.00	0.00
Industrial, commercial & schools	0	0.00	0.00	0.00
Rural living	0	0.00	0.00	0.00
Public open space	0	0.00	0.00	0.00
Road reserve	100	13.25	315.35	40.35

Total area (ha)	Total percent (%)
13.25	25

Nitrogen input (kg/yr)	Phosphorus input (kg/yr)
384.65	42.33

Nitrogen export (kg/yr)	Phosphorus (kg/yr)
23.34	1.98

Road reserve

Landuse	Percent (%)	Area (ha)
Roads	40	5.30
Road reserve - impervious	30	3.98
Road reserve - native garden	5	0.66
Road reserve - non-native garden	0	0.00
Road reserve - turf	20	2.65
Road reserve - not fertilised	5	0.66

Total area (ha)	Total percent (%)
13.25	100

Nitrogen input (kg)	Phosphorus input (kg)
315.35	315.35

Soil and drainage information

Type of drainage	**Piped drainage**	**Does it contain imported fill?**	**No**
Soil type	**Bassendean**	**Does subregion contain onsite sewage diposal system?**	**No**
Depth to groundwater (m)	**10**		
Groundwater slope (%)	**0.15**		
Soil PRI	**5.0**		

Note: Please attach the results of soil tests to this report when submitting.

Summary: Nutrient stripping devices

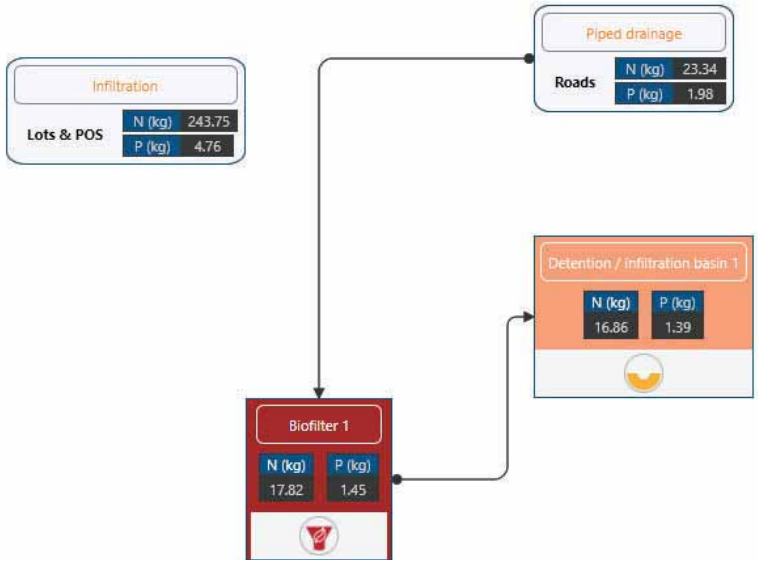
Treatment	Name	Size (m²)	Treated area (ha)	Treating	N removed (kg/yr)	P removed (kg/yr)
Biofilter	Biofilter 1	5300.00	13.25	Sandy soils – Runoff only (infiltration on lots)	5.52	0.53
Detention / infiltration basin	Detention / infiltration basin 1	15900.00	13.25	Sandy soils – Runoff only (infiltration on lots)	0.96	0.06
Load removed					**6.48**	**0.59**
Net export					**260.61**	**6.15**

Summary: Nutrient load exports

Region	Area (ha)	P export (kg/yr)	N export (kg/yr)
Lots & POS	39.75	4.76	243.75
Roads	13.25	1.98	23.34

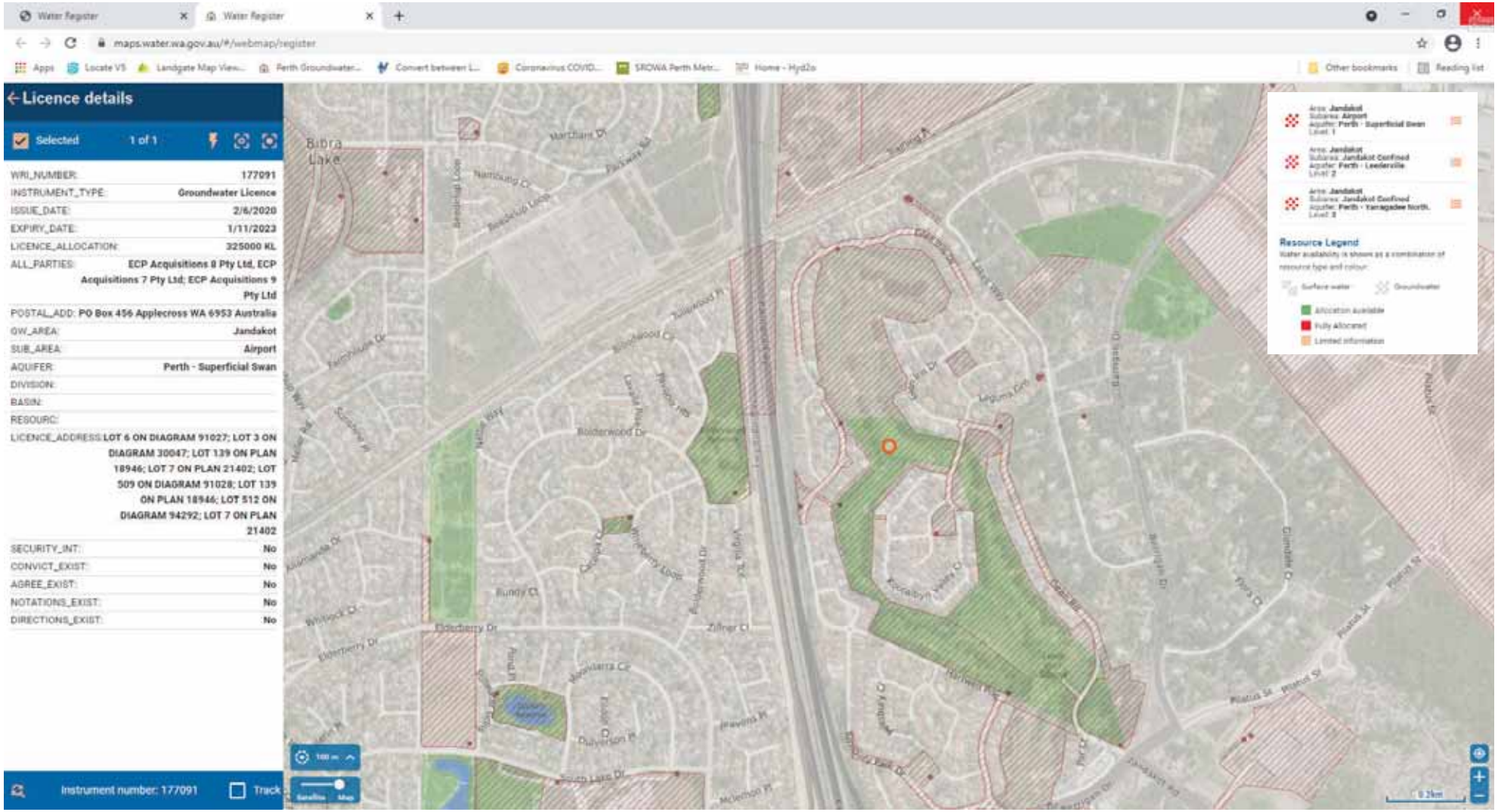
PRE-TREATMENT LOAD (kg/yr)		LOAD REMOVED (kg/yr)		NET LOAD EXPORT (kg/yr)	
NITROGEN	PHOSPHORUS	NITROGEN	PHOSPHORUS	NITROGEN	PHOSPHORUS
267.09	6.74	6.48	0.59	260.61	6.15

Treatment diagram



APPENDIX J
Groundwater Licence & Water Register Extracts

DWER WATER REGISTER EXTRACT



File No:
DWERVT5684

Government of Western Australia
Department of Water and Environmental Regulation

Instrument No. GWL177091(2)

LICENCE TO TAKE WATER

Granted by the Minister under section 5C of the Rights in Water and Irrigation Act 1914

Licensee(s)	ECP Acquisitions 8 Pty Ltd ECP Acquisitions 7 Pty Ltd ECP Acquisitions 9 Pty Ltd		
Description of Water Resource	Jandakot Perth - Superficial Swan	**Annual Water Entitlement**	325,000kL
Location of Water Source	Lot 139 On Plan 18946 Volume/Folio 1947/547 Lot 139 Imlah Ct Jandakot Back Nine Lot 7 On Plan 21402 Volume/Folio 2195/189 Lot 7 Jandakot Hartwell Paw		

Authorised Activities	**Taking of water for**	**Location of Activity**
	Irrigation of up to 29 ha of golf course	LOT 139 ON PLAN 18946 - Volume/Folio 1947/547 - Lot 139 Lot 139 On Plan 18946 Volume/Folio 1947/547 Lot 139 Imlah Ct Jandakot Back Nine LOT 3 ON DIAGRAM 30047 - Volume/Folio 2190/500 - Lot 3 DEAN RD JANDAKOT LOT 509 ON DIAGRAM 91028 - Volume/Folio 2183/871 - Lot 509 DEAN RD JANDAKOT LOT 512 ON DIAGRAM 94292 - Volume/Folio 2183/872 - Lot 512 LOT 6 ON DIAGRAM 91027 - Volume/Folio 2765/992 - Lot 6 LOT 7 ON PLAN 21402 - Volume/Folio 2195/189 - Lot 7 Lot 7 On Plan 21402 Volume/Folio 2195/189 Lot 7 Jandakot Hartwell Paw
Duration of Licence	From 2 June 2020 to 1 November 2023	

This Licence is subject to the following terms, conditions and restrictions:

1. The annual water year for water taken under this licence is defined as 1 July to 30 June.

2. The licensee shall not use water for irrigation between 9 am and 6 pm except for the establishment of newly planted areas. For newly planted areas water may be used within these hours for a period of up to 28 consecutive days, commencing from the date of planting.

3. Between 1 June and 31 August in any year, the licence-holder must not water a lawn, garden, or grass-covered area ("turf") by reticulation, provided always that this restriction shall not apply; watering with a hand held hose; or watering, by way of reticulation: golf course tees and greens, turf wickets, bowling greens and active sporting areas; newly planted areas for a period of up to 28 days from the date of planting; for renovating turf; or for maintenance of reticulation systems

End of terms, conditions and restrictions

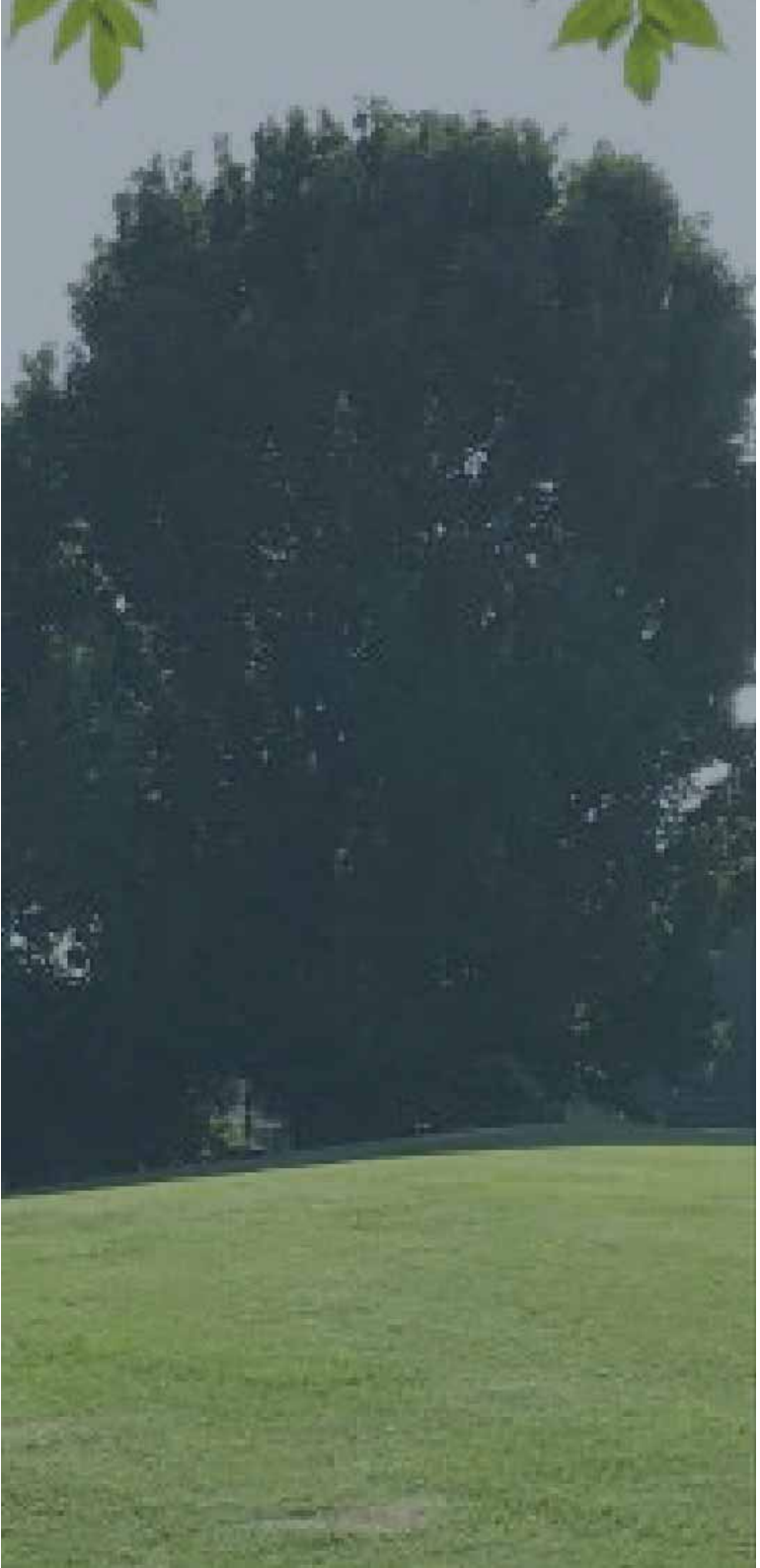
APPENDIX K
Landscape Masterplan

Glen Iris Estate

Landscape Strategy for Local Structure Plan
Eastcourt

July 2023

emerge ASSOCIATES



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1.4 Public Realm Strategy 4
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REVISION	DATE	ISSUE OR AMENDMENT	BY	REVIEWED
A	June 2021	Issued for approval	CN	CN
B	Sept 2021	Issued for approval	CN	CN
C	March 2022	Issued for Text Update to page19	CN	CN
D	April 2022	Issued for Text Update to page 5	CN	CN
E	July 2023	Structure Plan Modifications	XZ	SM

1.1 General

The proposed redevelopment of the former Glen Iris golf course has created the need for a planning design to create residential housing including the provision of considerable areas of landscaped open space in a generally somewhat constrained space. The redevelopment includes planning for between 550 and 600 residential dwellings of varying densities in areas between the existing residential uses adjoining and surrounding the site. The use of landscaped open space is critical in providing for the needs of new and providing additional amenity to all existing residents. The project broadly consists of north, central and southern residential precincts.

It was noted during the extensive community consultation phase of the design process that the opportunity exists for a more diversified and broader accessible open space network than the previous fenced and single use golf course. The planning layout and landscape design have worked together to maximise the access and usability of the open space areas as a broader green link network with the aim of connecting precincts both within the new development and with the existing development surrounding the site.

1.2 Landscape Approach

The nature of the project as an infill redevelopment offers the opportunity to both create new existing open space precincts in its own contemporary style and also to be complimentary and mindful of the retention and expression of the sites existing older character. The overall intent of the landscaped open space design is encompassed below:

- To reflect and respond to the key existing landscape elements and character of the site in order to maintain visual continuity between existing and new precincts wherever reasonably possible. This includes built form and landscape treatments within streetscapes and open space.
- To provide safe external environment for the quiet enjoyment of the residents, guests and the general public.
- To best cater for the lifestyle needs and aesthetic desires of the existing residential community within the bounds of the capacity of the development to do so.
- To best cater for the lifestyle needs and expected desires of the new future residential community in reference to their anticipated demographics.
- To provide integrated public access that links with the existing residential, street and path network with a strong sense of movement opportunity, options and legibility as part of a broader open space green link strategy.
- To retain mature trees where ever reasonable and practical to do so within the bounds of the projects delivery and approval requirements.
- To provide a more environmentally sustainable outcome than the prior land use as a golf course, inclusive of the use of sustainable design practices as applied to new works.
- To consider habitat retention and creation in various methods including vegetation retention and replanting.

- To clearly define various landscape design typologies as applicable to all areas of open space to assist in the provision of facilities and legibility.
- To manage fire risk in a creative and aesthetic manner while meeting required standards and obligations.
- To respond to the local colour palette with either matching or complimentary colours and textures with the aim of visually minimizing visual impacts and blending where possible.

1.3 Private Realm Strategy

The project's private realm consists of landscaped open space within private residential lots in both front and rear yards. In the case of higher density strata development areas, the open space consists of common areas for access and the use of those strata residents as well as private open space to balconies and courtyards in accordance with R-Code requirements.

It is envisaged that landscape guidelines will be provided to residents as part of their purchase process to assist them in making informed landscape choices around design, aesthetics, sustainability and maintenance. In all cases the private realm will be under the care and control of the individual resident or the strata body.

1.4 Public Realm Strategy

Generally the public realm includes primarily the landscaped open space and path network within the proposed development and its linkages to the existing adjacent and surrounding open spaces networks and streetscapes. The landscape design aims to:

- Provide clear, direct, safe and compliant access around and through the proposed development
- Positioned to ensure the retention of a significant number of existing mature trees in new parks and linear interface buffers adjoining existing residences.
- Be designed and installed to integrate and manage fire risk to the required areas of the landscape treatment
- Provide open usable informal grass recreation space for new and existing residents visitors and the general public.
- Provide shaded seating as a point of refuge on the pedestrian and cycle networks
- Provide suitably sized central play facility befitting the character and history of the site.
- Provide small informal play area for general public use.
- Provide shady endemic native and exotic trees for respite.
- Provide signage elements for clarity of pedestrian and cycle movement.
- To cater for a range of demographics, user groups and skill levels.

Braithwaite Park, Emerge Associates

Newhaven, Emerge Associates

Secret Harbour, Emerge Associates

1.5 Changing Demographics

The demographics of the existing Glen Iris locality is generally characterized as a mature suburb with a large proportion of long standing residents. There is a lower than average number of children or adolescents and young people living in the locality. It is understood that grandchildren are somewhat present when visiting the existing residents. The anticipated demographics of new residents is younger than the existing Glen Iris age cohort. New residents will bring a range of children ranging in ages from school age children to older teens as part of a general second and third home buyer profile. It is not currently expected that first home buyers will be significantly present within the new development based on proximity, lot size and anticipated pricing structures.

1.6 Open Space Distribution

The proposed open space typologies are arranged to provide a range of experiences and also a range of facilities within both vehicular and walking proximity to all new and existing residents of Glen Iris and Jandakot generally. The landscape plans attached identify the open space distribution and strategy.

1.7 Open Space Typologies

Broadly the open space areas within the project consist of set landscape and use typologies. These typologies are determined by a number of factors including size of the open space, grade / levels and grade within the open space, the amount and location of gravity surface runoff, tree retention ability, habitat retention and creation, usable and safe walkable linkages.

The four open space typologies include:

1. Focal open space

The proposed design consists of four distributed larger open space areas suitable for community gathering and active informal recreation. These four parks are distributed reasonably evenly throughout the proposed redevelopment. These parks cater for a range of informal active recreation uses and a mix of passive recreation uses. These larger areas of open space have the ability to cater for tree retention and larger areas of surface runoff drainage storage and management.

2. Access open space

The proposed design consists of a series of access open space areas. These open space areas are characterized by providing a strong open space link between other open space typologies. In so doing, these open spaces provide a critical role in creation of a continuous green link option for pedestrian and cycle movement around the redevelopment. The linear nature of these open space links allows for the retention of vegetation, while the width of these open spaces enables the inclusion of series of public facilities accessible for existing and new residents.

3. Pocket park open space

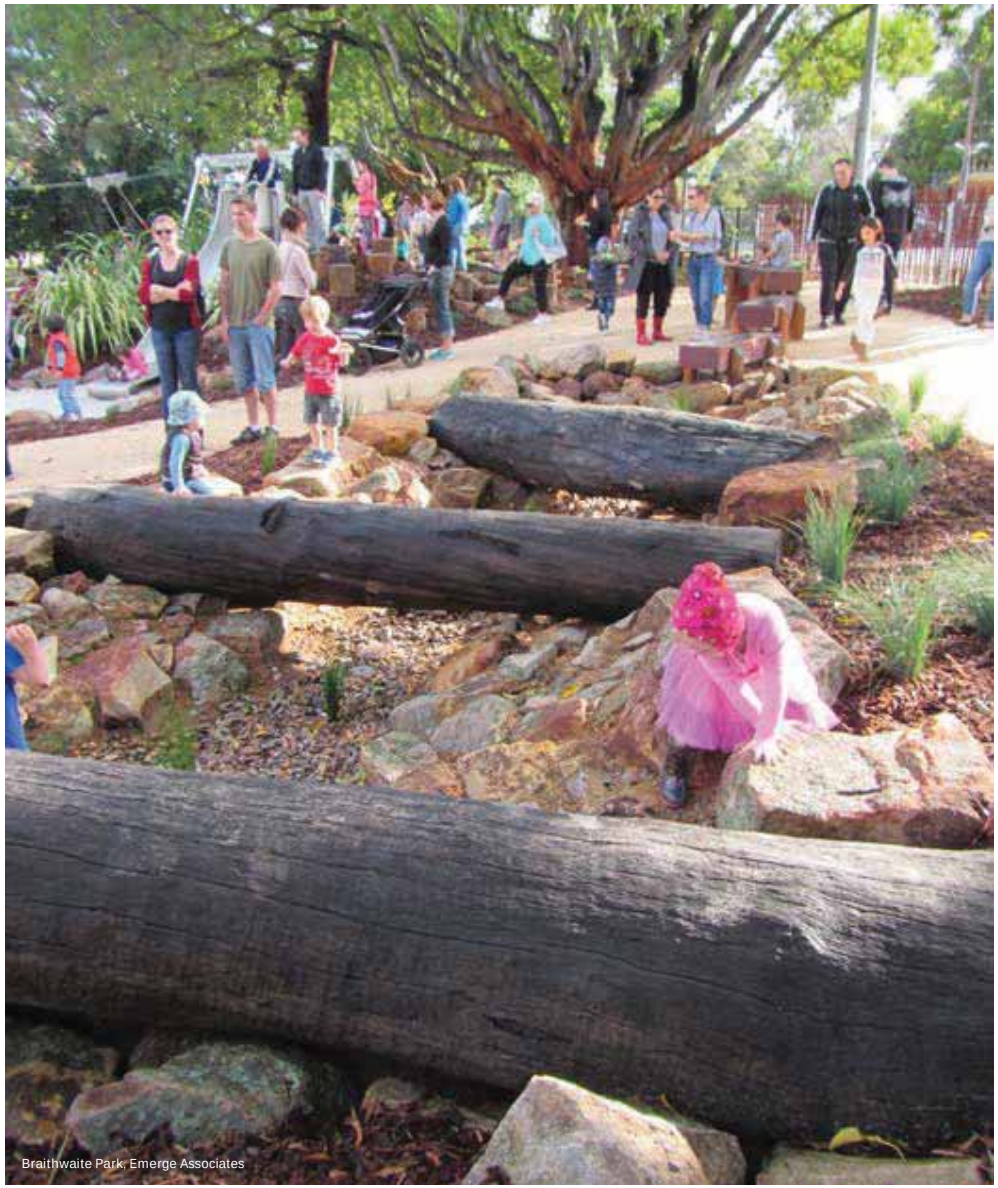
The proposed design locates a number of smaller open space areas set within the residential zone. These smaller open space areas are located to provide a range of localized incidental benefits including visual softening among the residential zone, walkability rest and respite via shade and seating, and in some cases specific associated needs such as low point drainage management and existing landmark specimen tree retention.

4. Buffer and linking open space

The proposal consists of a series of linear open space links. The nature of these open space areas ranges from road reserves with a widened verge to one side, to narrow buffers suitable to cater for a linking path and low planting between existing and new residences. The internal function of these spaces is to act as an access link.

Bibra Lake Regional Playground, Emerge Associates

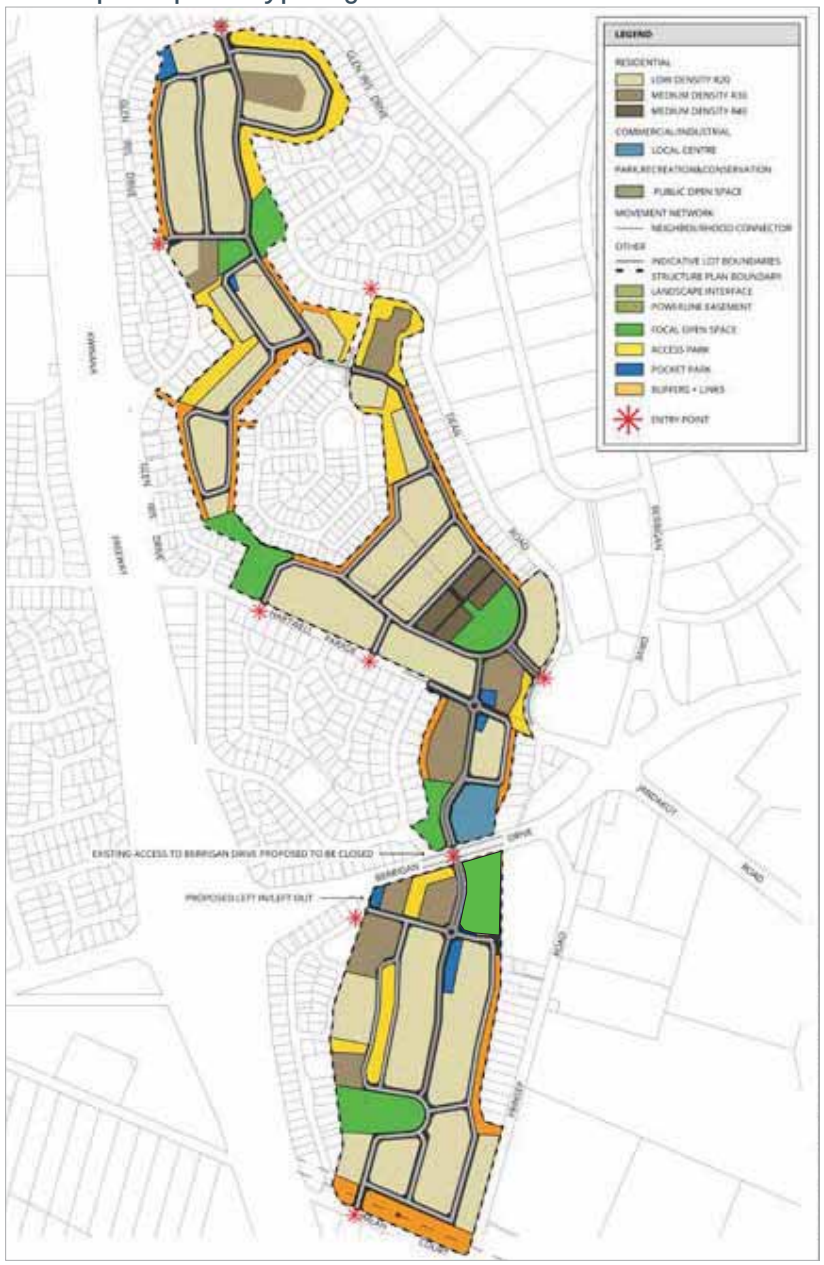
Bibra Lake Regional Playground, Emerge Associates



Braithwaite Park, Emerge Associates

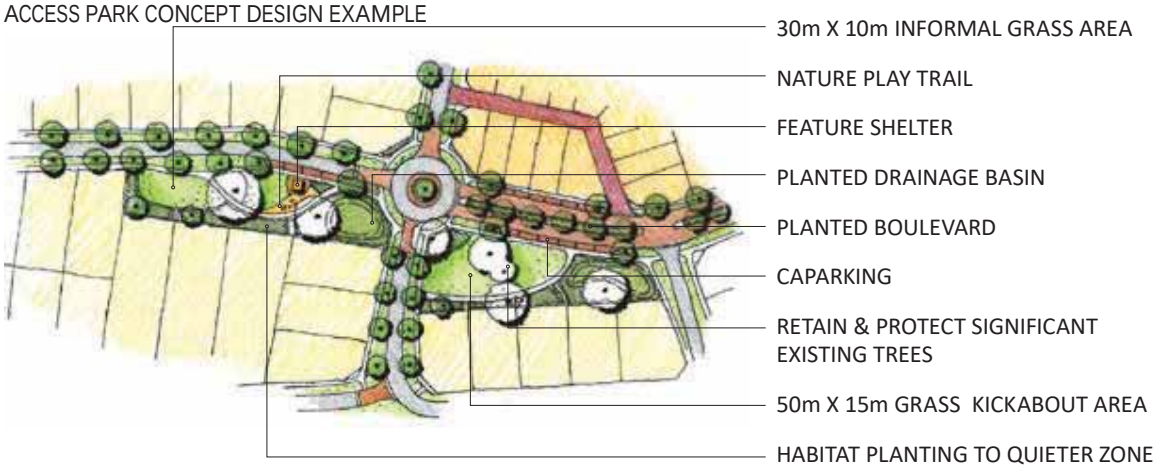
Evermore Heights, Emerge Associates

1.8 Open Space Typologies Visual

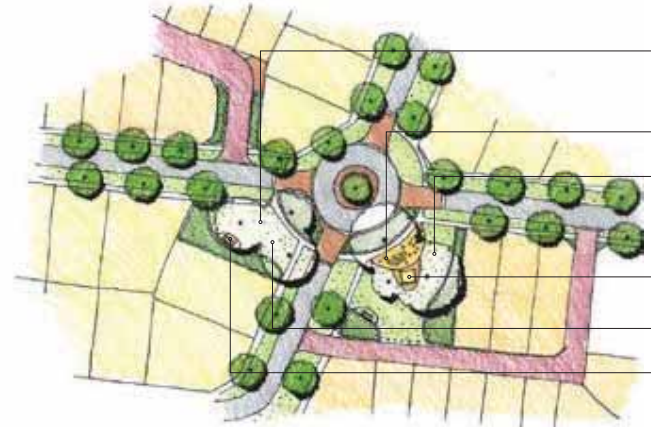


FOCAL OPEN SPACE CONCEPT DESIGN EXAMPLE

ACCESS PARK CONCEPT DESIGN EXAMPLE



POCKET PARK CONCEPT DESIGN EXAMPLE



RETAIN & PROTECT SIGNIFICANT EXISTING TREES

NATURE PLAY TRAIL

INFORMAL GRASS AREA

FEATURE SHELTER

SHADY GRASS AREA

BENCH SEAT

LANDSCAPE BUFFER WITH ROAD FRONTAGE CONCEPT DESIGN EXAMPLE

PLANTED DRAINAGE BASIN

NEW RESIDENCES

OPEN GRASS AREA

RETAIN & PROTECT SIGNIFICANT EXISTING TREES

PEDESTRIAN FOOTPATH

RIGHT OF WAY PEDESTRIAN CONNECTION

LANDSCAPE BUFFER WITHOUT ROAD FRONTAGE CONCEPT DESIGN EXAMPLE

NEW RESIDENCES

ACTIVE OPEN SPACE

PEDESTRIAN FOOTPATH SET AMONGST LOW SHRUB PLANTNG & GRASS

LIGHTING SET AT LOW PHYSICAL LEVEL

SHADY TREES AT REGULAR INTERVALS

EXISTING RESIDENCES

Glen Iris Estate

1.9 Landscape Masterplan

KWINANA FREEWAY
GLEN IRIS DRIVE
PARADE
KOORALBYN VALLEY CRESCENT
FAIRWAY PARK
DEAN ROAD
GLEN IRIS DRIVE
CAPRICORN PARK
LAKES WAY
A
A
B
B
C
C
D
D

Glen Iris Estate

1.10 Functional Layout Masterplan

KWINANA FREEWAY
GLEN IRIS DRIVE
PARADE
KOORALBYN
VALLEY
FAIRWAY PARK
CRESCENT
GLEN
IRIS
DRIVE
CAPRICORN PARK
DEAN ROAD
LAKES WAY

1.11 Public Facilities

The development proposes to build upon existing public facilities whilst catering for new residents via a range of new publicly accessible facilities. The extensive community consultation process and discussions with the City of Cockburn technical staff have identified a number of desirable public facilities including:

1. Informal larger play areas disbursed through the focal parks to cater for informal recreation activities eg: informal touch football, ball games, unstructured training, frisbee, kite flying, dog exercise and the like.
2. Defined personal training areas. It is envisaged that areas set aside for small gatherings of residents and visitors to allow for use/hiring for personal training and bootcamp type events. This is intended to cater for a variety of local age groups and skill levels. The landscape design can provide definition to these areas via small level changes and path and wall layouts.
3. 3. Playground facilities – it is noted that the need for a major regional facility is already catered for externally to the development area. It is proposed that a mid order play facility is located within the development to cater for the expected increase in local use and change in demographics. The aim is to design play elements that complement the existing retained play elements within Glen Iris rather than copy them, this will better provide a range of user experiences.
4. 4. Smaller play elements generally associated with nature play items located in discrete locations along the green links as part of a broader play trail running through the proposed development. This caters for smaller residential local precincts and also acts as a combined whole with each nature play area having a different type of play offering to those retained play elements currently in the Glen Iris.
5. Shelter structures with picnic settings to select locations where residents are encouraged to stop and stay for a while. These are generally associated with play elements and view axis lines from adjacent roads.
6. Electric BBQs are proposed to a couple of select locations as part of a social gathering and mixing initiative catering for smaller family groups and family scaled events.
7. Fitness elements are proposed as part of the broader green link design approach. This is in response to community feedback gained from the community consultation process.
8. Walking trails are proposed to occur through the green link network and are to be denoted via signage and colour coded elements to identify trails of various lengths and difficulty to suit a variety of users (eg: 1km, 3km, 5km, 7km). It is envisaged these trails will form a key tool in encouraging greater social interaction between existing and new residents.
9. Cycle trails are proposed to meander through the proposed development primarily on a path system with suitable signage and in some locations this may also occur partly onto the road system where low vehicle flow is to occur.
10. Dog walking trails and facilities are proposed to be included generally in alignment with the walking trails. These may include rest points in shade, taps and fixed dog bowls and discrete areas containing dog agility elements as part of a broader walking network.
11. A hard surface ball court is proposed to provide an active focus for teens. The final location of these facilities will be subject to detail design to mitigate noise impacts to adjacent residents but also to maintain clear and open view lines for passive surveillance.
12. Embayment carparking is proposed adjacent to the larger areas of open space and along certain streets. The car bays will cater for local visitors and a variety of social events and informal activities.
13. Street furniture is proposed to occur to defined set locations for the comfort of open space users. This will be inclusive of seating, table settings, drink fountains, select bollards and the like.
14. Public art is proposed to occur either as a larger landmark element on key view lines or as smaller discrete art elements to be discovered as part of the green link approach perhaps set into paving or on to low walls and the like.
15. A 3 phase power outlet is proposed for the larger open community gathering grass space to cater for possible periodic larger scaled community events.

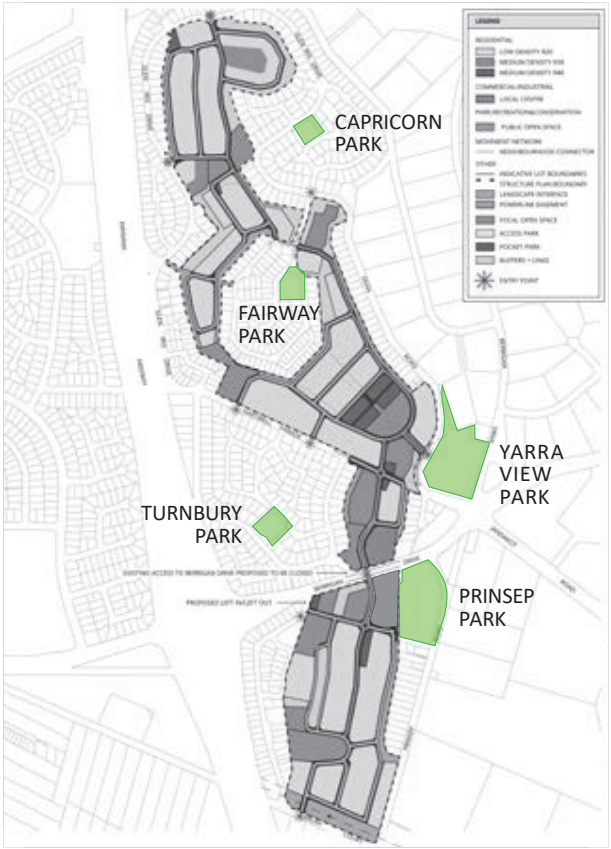
Dalyellup Beach, Emerge Associates

Evermore Heights, Emerge Associates

Osprey Waters, Emerge Associates

1.12 Existing Open Space Facilities

Glen Iris has 5 existing parks that form part of the current local urban layout that are well used and loved by the local community. Each has differing sizes and facilities catering for the local population and visiting public as summarised below. It is not proposed that any reduction in the existing public open space areas is to occur. The new open space network aims to be complimentary to the existing parks and their facilities.



A. Prinsep Park

This is a large neighbourhood scale park with minimal facilities. There is a large open grass kickabout area centrally located to the park bounded by clumps of taller native trees and stands of native bushland shrub vegetation forming bushland. The park appears to be well maintained but somewhat underutilised for its scale with limited public facilities. A simple path system and a shelter and table setting front onto the central grass area. Access into the park is currently difficult as it occurs mainly off major roads and intersections bounding the park.

It is noted that officers from the City of Cockburn have indicated there is the current need for a formal oval playing surface somewhere in the Glen Iris area as part of a broader growing need within Jandakot and Treeby. One possible option suggested by the City is its inclusion by reimagining the existing Prinsep Park on the corner of Berrigan Drive and Prinsep Road given the parks size can cater for an oval. Should the City wish to pursue this option it will be subject to a separate application process led by the City and is not part of the proponents proposal.

B. Yarra View Park

This is a large neighbourhood scale park with numerous facilities including a dedicated carpark for approx 20 cars. Existing native mature trees are located internally within the park with mature exotic street trees located to street edges. There is a large grass kick about area that doubles as a drainage overflow basin. There are 2 off lead fenced dog agility areas that exist with gate access and a variety of dog agility elements that cater for local and visiting dog walkers.

An existing off the shelf plastic playground is set in a sand base which caters for a variety of play and user ages from 4 to 10. Individual standalone small play elements exist in grass outside of the main play area for 2 – 4 year old users. Bench seating is set into the park near existing path system and there is a picnic shelter and table setting overlooking the usable grass area. There is a partly fenced basketball court in a raised area within the park that caters for teens.

C. Turnbury Park

This is a local scale park that is well maintained with central open grass kickabout area and numerous exotic shade trees set in grass. A central off the shelf plastic playground currently caters for 2-10 years of age and includes an off the shelf climbing wall and swings. A small basketball half court caters for teens as active semi formal play. There is a BBQ located in the park but no table setting. There is bench seating located under trees overlooking the grass area.

A large feature brick arbor at the main entry point adds formality and shade but has no particular usability or shaded seating. Hedge planting along the road edge limits some views from Turnbury Park Drive. The park has its own bore. Residents directly side onto the park and view over park inclusive of areas of detailed exotic shrub planting in a domestic character and scale.

D. Fairway Park

Generally the park consists of a central open grass kickabout area bounded by a variety of shrubs and hedges interspersed with a variety of mature native and exotic nature trees. A children's play area caters for toddlers and young children in a fairy garden character inclusive of off the shelf play items and with a small amount of specialised themed equipment for imagination play with a seesaw all set in a white picket fence. The park contains a bore and is well maintained and is overlooked by adjacent residences and bounded in part by a residential scaled road system.

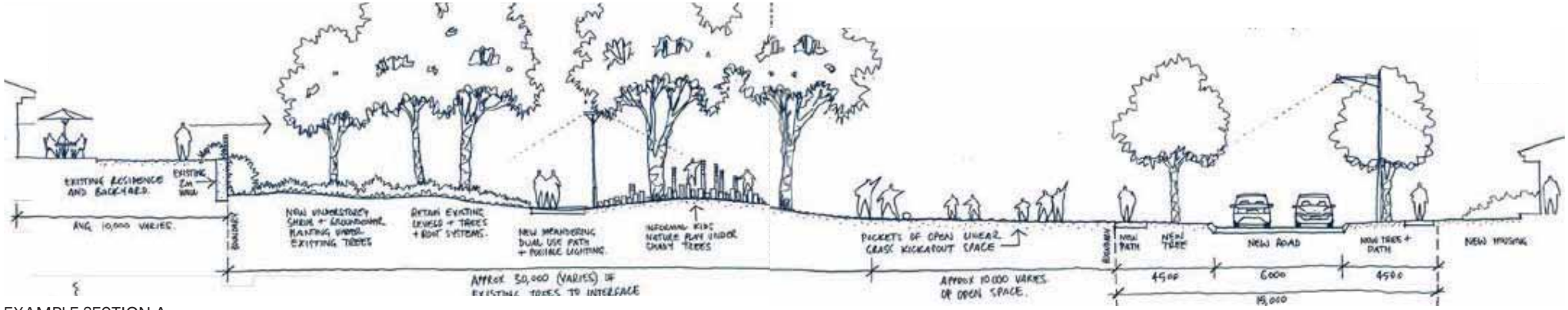
E. Capricorn Park

The park is located on a hilltop location with views to the surrounding area. Pockets of retained mature native vegetation inclusive of mature native trees exist with mature exotic trees located along adjacent street edges. A meandering concrete path is set into pockets of sloped grass set among native planting beds. An off the shelf playground set in a sand surface is nestled into bushland adjacent to residents side boundary fence with a single solar light located nearby. The playground appears well maintained and caters for children 2 - 10yrs and generally the park is in good condition. The park has low passive surveillance and is not particularly safe with limited street visibility. No seating is evident within the park.

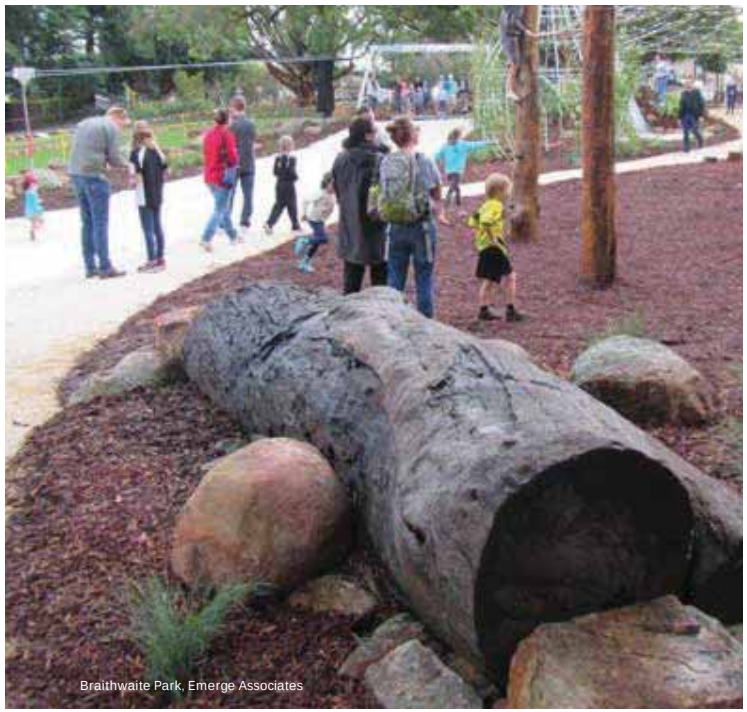
Glen Iris Estate

Sunrise, Emerge Associates

Brighton, Emerge Associates

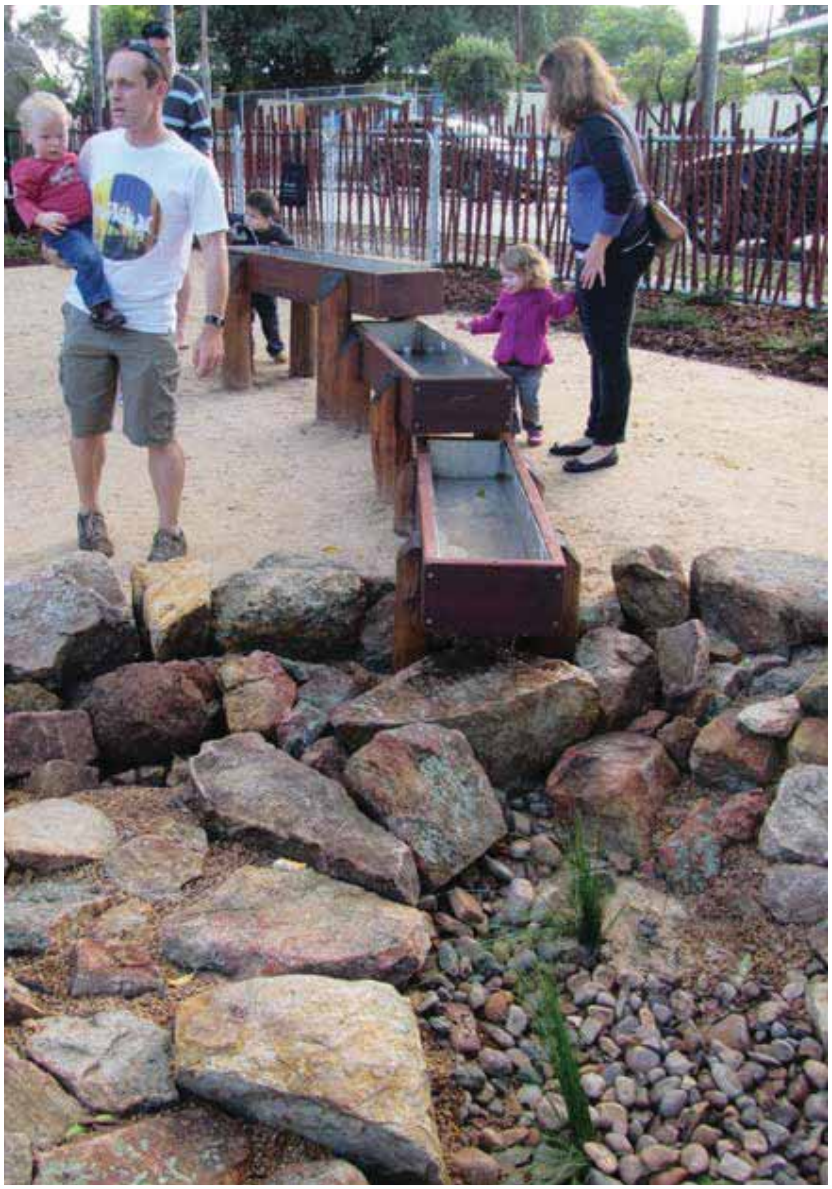


EXAMPLE SECTION A



Braithwaite Park, Emerge Associates

Spire, Emerge Associates



Braithwaite Park, Emerge Associates

Allara, Emerge Associates

1.13 Interface to Existing Residences

The former golf course was directly backed onto by existing one and two storey residential housing. Some of the adjoining existing residential land is elevated above the subject site. In all instances, private rear fences along the boundary interface generated the safety and security necessary for the respective residence. Under the proposed development approvch the edge treatment between the existing residences and the new development will be managed in a variety of ways including:

- Upgrading to the existing rear wall and fencing where suitable and necessary subject to need, levels and impact with the work to be managed by the developer at 50/50 shared expense in consultation with individual affected adjoining landowners.
- The creation of new walling and/or fencing where suitable and necessary subject to levels and the impact of any alterations proposed by the development.

The design of the interface may be managed in a variety of ways including but not limited to:

- The backing of new housing directly onto the rear of the existing residence creating a typical residential rear boundary interface.
- The creation of a road and streetscape to the rear boundary of the existing residence.
- The creation of open space to the rear boundary of the existing residence.
- The creation of an access and buffer strip to the rear boundary of the existing residence.

1.14 CPTED & Passive Surveillance Approach

The landscape design of open space and streetscapes will take into consideration various crime prevention through environmental design (CPTED) principles. Noting the extent of open space and the connected nature of the path system, passive surveillance over the open space areas is a key part of the developments safety and security approach. The design of the open space landscape treatments combined with orientation of the open space to roads, paths and new and existing residences enables passive surveillance over parks.

The height of rear boundary fencing and possible semi permeable detailing enables interaction. In addition the use of level changes where required allows for some overlooking of open space areas. The location of trees, furnishings, and play elements will be arranged to not impede views to smaller open space areas.

Shrub planting will typically be lower shrubs and groundcovers to minimize the ability for hiding. The location of key facilities will be set ion key view lines from adjacent streets inclusive of car headlights illuminating various elements. The use of lighting has been described elsewhere within this document.

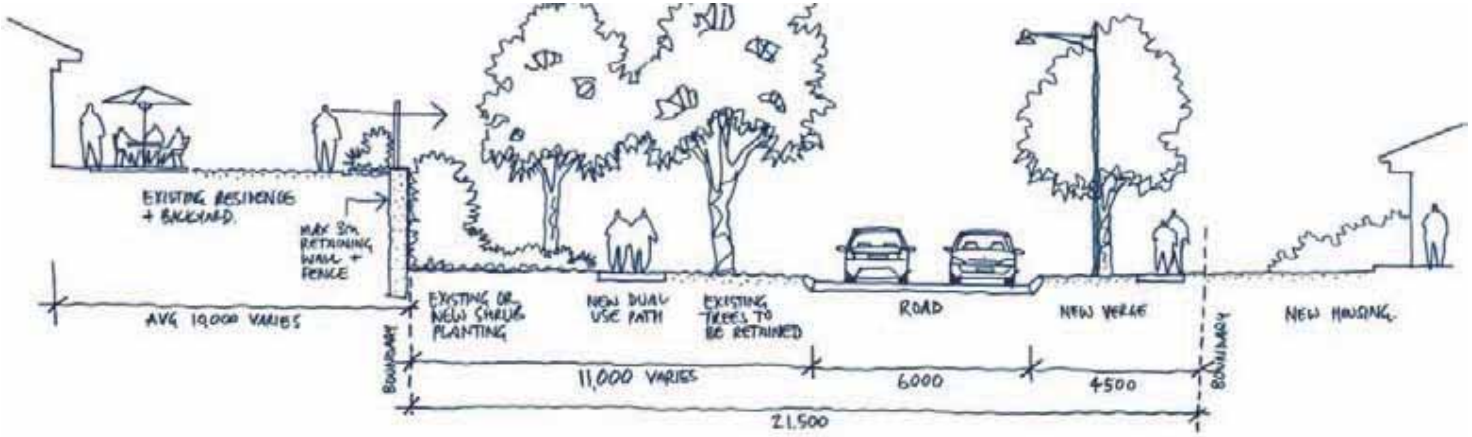
1.15 Existing Adjacent Public Open Space Upgrades

The Glen Iris precinct has a number of existing parks throughout the existing residential areas that are well used and loved by the local community. It is not proposed that any reduction in the existing public open space areas is to occur.

Osprey Waters, Emerge Associates

The Sanctuary, Emerge Associates

The Sanctuary, Emerge Associates

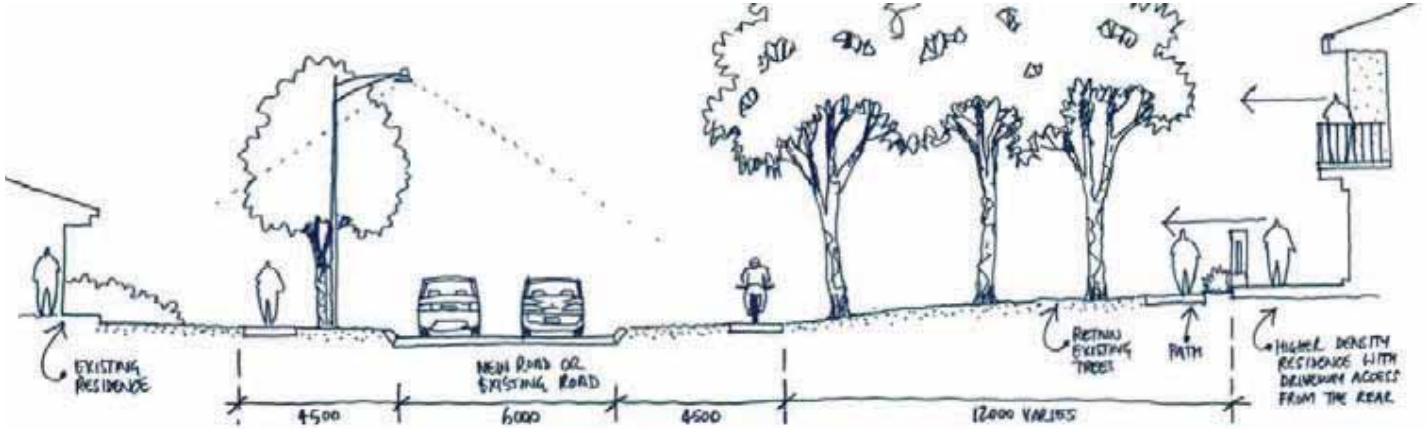


EXAMPLE SECTION B

The Sanctuary, Emerge Associates

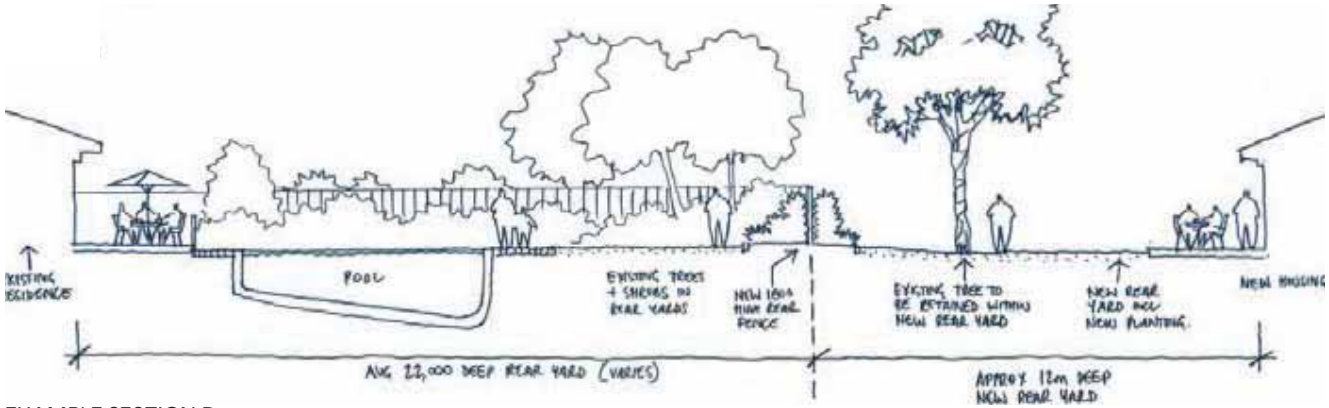
Heritage Park, Emerge Associates

Shoreline, Emerge Associates



EXAMPLE SECTION C

Lakeway, Claremont



EXAMPLE SECTION D

Lakeway, Claremont

1.16 Streetscapes

Road Hierarchy

The proposed road network will consist of a variety of typologies to better define planning legibility to the user, including:

- A series of entry points into the proposed development that will aim to define the edge of the new works without being completely divorced from the character, colour and finish of the existing Glen Iris residential area.
- Collector roads. These will distribute traffic into and out of the proposed development, these will have defined larger future tree stock to recreate the meandering shady drive as the most travelled roads. The opportunity for drainage management exists based on the generally wider road verges.
- Residential streets landscape type 1: These streets are generally longer and more direct in their layout and will have a series of tree species befitting this street type.
- Residential streets landscape type 2: These are smaller shorter residential streets which act as much more localized road element in some cases as cul-de-sacs.

In all cases the provision of shade and canopy cover is paramount and in keeping with urban green canopy coverage aims and the reduction of the urban heat island effect wherever possible.

Existing Streets

The existing streetscapes in Glen Iris are one of its key defining character and landscape features. The intention is to retain the existing streetscapes as is, and to aim to replicate elements of this avenue approach in the proposed streets where possible. It is proposed that in the order of 500 existing mature trees will be retained within the proposed open space areas, and more than 1,000 new trees will be planted across the new development in open space and streetscape areas. This is in addition to the trees to be retained within existing streetscapes in and around the surrounds of the site.

Widened Road Reserves

Select streets are proposed to have an offset road carriageway and a widened verge to cater for a widened 2.5m dual use footpath and a shady double tree avenue either side of the path, which will act as a key part of the broader safe and secure green link movement network through the proposed development. This enables access to occur off street and can cater for visitors carparking in select locations in addition to flush kerbing and drainage swales in select locations - subject to future detail design.

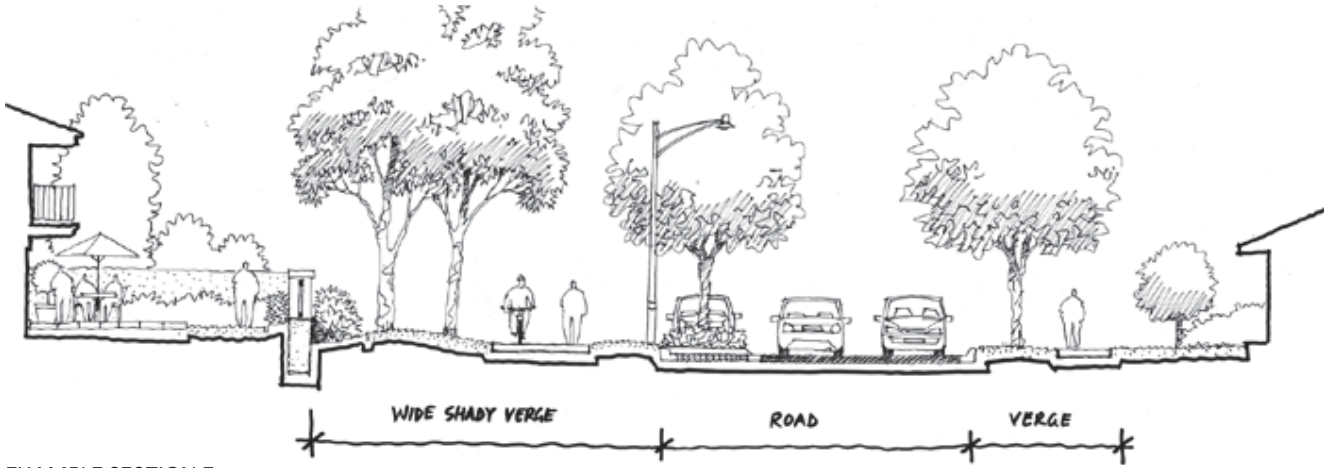
New Roads

New road design will cater for street tree planting and the broader safe and secure green link network. Street tree planting will be selective and will be variable to bring a variable character to different streets.

Traffic Calming

In locations of longer lengths of straight residential roads the inclusion of traffic calming may be employed to assist in slowing traffic speeds and allowing crossing points are suitable locations and allow for additional landscape softening. Locations of traffic calming will need to pay due regard to driveways and lot access and footpath road crossings.

Bushmead



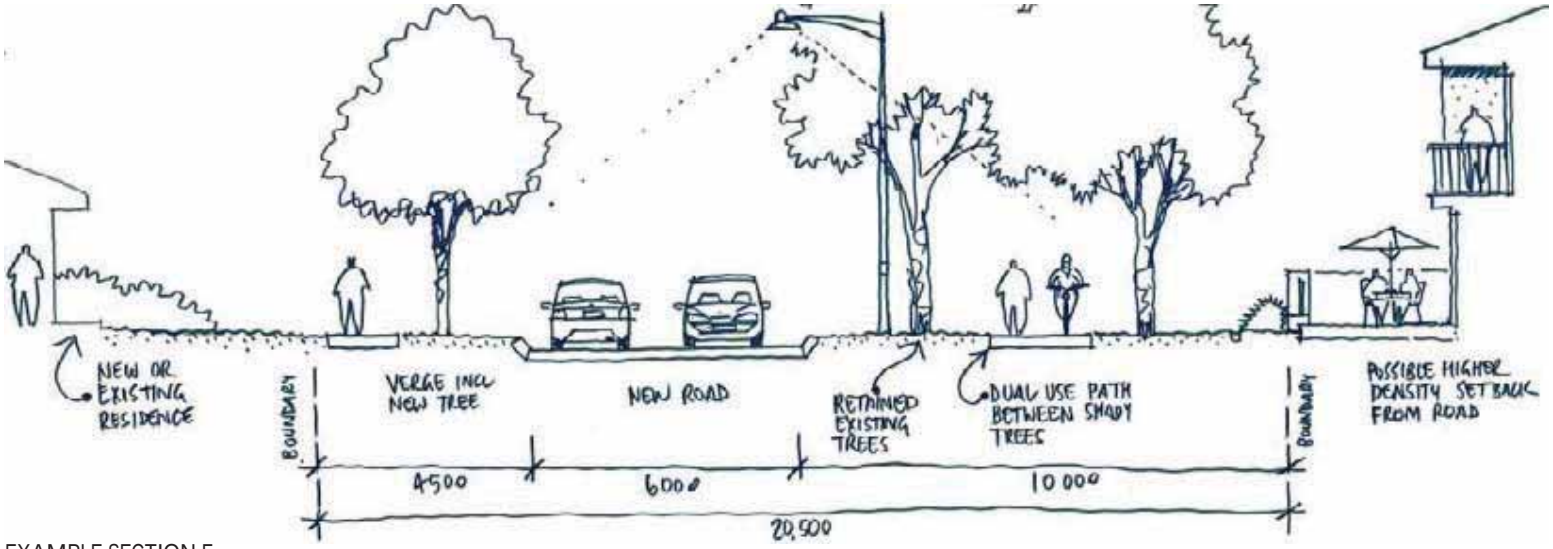
EXAMPLE SECTION E

Jacob's Ridge, Queensland

Lakeway, Claremont

Newhaven, Emerge Associates

Baldivis Town Centre, Emerge Associates

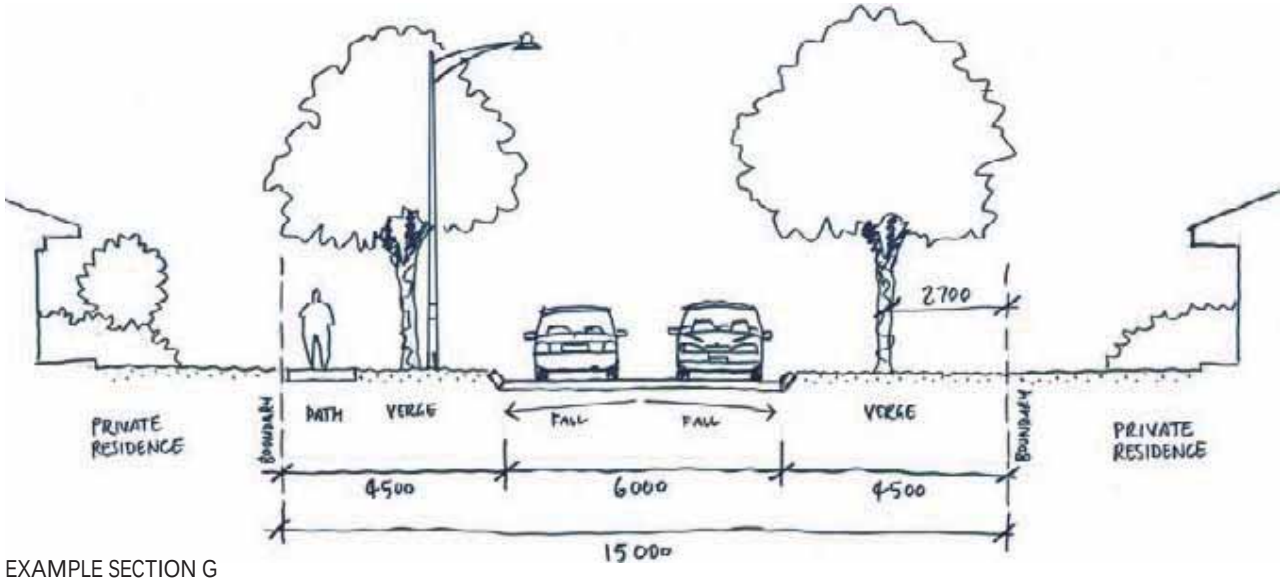


EXAMPLE SECTION F

Baldivis Town Centre, Emerge Associates

Vale, Emerge Associates

Bushmead



EXAMPLE SECTION G

Honeywood, Emerge Associates

Lakeway, Claremont

1.17 Tree and Plant Species

An indicative plant list and select imagery has been included within the attached drawings in support of the proposal. While the list is subject to refinement in consultation with the City of Cockburn, it clearly defines the plant species approach and intent. Planting will consist of a mix of mature stock for specific uses and high profile location purposes, and smaller nursery hardened off stock for mass planting purposes.

The planting strategy consists of the following three principal approaches:

a. Retained trees. The retention of existing trees from the golf course rough areas in between the various former fairways is proposed. This creates instant visual effect, retains shade and habitat and maintains an element of the site's former use.

b. Transplanted trees. The preparation and transplanting of existing trees is possible based on the diversity of species currently located on the site. Existing transplantable trees include but are not limited to: Norfolk Island Pines, Plane trees, Palms of various species, Cape lilacs (subject to approval), WA Peppermints, Liquidambers, casuarinas, ficus species, melaleuca species and grass trees.

c. New tree planting. The proposed development intends on undertaking a new tree planting regime for streetscapes and parkland areas. The final extent and species mix will be subject to approvals and availability. In addition to planting in public areas, the planting of trees is also encouraged in the private realm noting the generally larger sized residential lots proposed for this development.

The new planting selections are aimed at achieving the below criteria:

- Being of local character.
- Preferably being endemic and native to the site area.
- Not being invasive by habit and not containing any declared weed species.
- Being hardy to local soils, wind and salt tolerant and with lower water needs.
- Where required and suitable, being of low fire fuel creation and load as a key part of fire management to the margins of the development.
- Promoting the local ecosystem as habitat for a range of endemic fauna.
- Being of a series of attractive and contrasting foliage, colour and form to enable design based planting and displaying the diversity of the local environment.
- Having a selection of species that ideally enable some to be seasonally flowering at all times of the year.
- Being of suitable form and habit to promote shade where suitable and to either open or screen select views.
- Being of species that are readily commercially accessible and available for future replenishment.

Verge Planting

Scaevola ‘Purple Fanfare’

Melaleuca incana ‘Nana’

Adenanthos cuneatus ‘Coral Carpet’

Hemiandra pungens

Grevillea obtusifolia prostrate

Westringia mundi

Eremophila glabra

Myoporum parvifolium purpurea

Lomandra tanika

Feature Planting

Grevillea obtusifolia prostrate

Beaufortia squarrosa orange

Westringia fruticosa ‘Smokey’

Scaevola ‘Purple Fanfare’

Hemiandra pungens purpurea

Lomandra tanika

Broad Planting

Adenanthos sericea

Pimelia ferruginea

Eremophila nivea ‘Spring Mist’

Grevillea olivacea

Grevilea olivacea

Dampiera linearis

Acacia lasiocarpa

Acacia saligna ‘Green Mulch’

Acacia pulchella

Hemiandra pungens purpurea

Chamelaucium unicnatum

Calothamnus quadrifidus

Hypocalymma angustifolium

Thryptomene baeckeacea

Grevillea thelemanniana

Beaufortia squarrosa orange

Westringia fruticosa ‘Jervis Gem’

Adenanthos cuneatus

Ricinocarpus ‘Bridal Star’

Callistemon phoeniceus

1.18 Habitat Approach

The former fenced golf course created the opportunity for native fauna to use the area as part of a broader habitat area with access to shelter, shade, food and water and some degree of protection. The conclusion of the golf course use may alter aspects of this until such time as the new open space can be created and established. The City has indicated its support for the creation of a series of smaller habitat zones within the proposals open space areas that encourage the survival and retention of native fauna in the area. The final locations will be determined based on existing vegetation, suitable seclusion from humans.

Avian fauna will be able to access the site and use its existing retained trees as it always has done, albeit noting that works may see some degree of disturbance. Ultimately new tree planting will rise to provide generational change to the existing tree stock currently providing habitat. The retention of trees individually, in clumps and in avenues, encourages the retention of existing fauna.

Ground dwelling native fauna will have access to the site noting that construction will occur in stages allowing fauna to adjust to newly created open space areas as the environment transitions over time. As the landscaped areas are installed and mature over time, it is envisaged that native fauna will return to the site from adjacent bushland areas. The proposed retention of two smaller areas of existing banksia bushland provides some continuity for habitat and cover for native fauna.

The landscape design aims to provide areas suitable for fauna to reside and move through the development over time. This will be accomplished by planting types and densities, continuous cover, pockets of refuge for example logs and rocks to lesser used areas of open space, planted drainage basins with infrequent domestic animal and human use. Education of the local existing and new community around risks to native fauna and what individuals can do to promote preservation. An item possibly worthy of examination as part of future detail design is the creation of defined native fauna refuge zones with controlled suitably sized access that limits domestic animal access.

1.19 Sustainability Approach

The landscape approach will have embedded within it a series of sustainable initiatives to be further refined at the detail design stage. These include, but are not limited to:

- Tree retention above and beyond that typical for greenfield development within parks and streetscapes.
- Transplanting of existing mature tree stock saving from destruction and retaining habitat and creating instant shade.
- Larger percentage of open space (22.9% total proposed green space) beyond that typical for greenfield development.
- A variety of storm water management initiative, techniques and inclusions to provide at source recharge including possible subsurface storage tanks.
- Planted detention basins inclusive of nutrient stripping capability in place of sumps.
- A major reduction in the existing long term groundwater draw and licensing needs for public open space maintenance, and significant reduction in the use of fertilizers and herbicides and pesticides.
- Removal of existing lined lakes and their groundwater top up resulting from evaporation and use by the former golf course for irrigation purposes.
- Relocation of native fauna (as may either be temporary or permanent)
- A variety of water wise initiatives applied to the public and private realm inclusive of a new, more efficient irrigation system.
- Retention of two small pockets of existing Banksia woodland.
- Reuse of timber removed from the site as both nature play elements and in mulch and possible select public art elements.
- Preference for use of low embodied energy materials where possible and suitable.
- Use of select LED /and solar lighting where possible and suitable.
- Creation of possible fauna habitat opportunities within open space and retention of trees suitable for avian fauna.
- A maintenance minimisation in design approach to limit cost and time impacts.
- A series of maintenance initiatives to reduce pesticides, herbicides and chemical use generally.
- The aim of creating a continuous tree canopy coverage to limit urban heat island effect and maximise green canopy coverage.
- Use of predominantly native shrub and groundcover vegetation endemic to the Swan coastal plain.

1.20 Wayfinding & Signage Approach

Wayfinding

The design of the development is proposed to be undertaken to encourage intuitive orientation and movement through the development. This is to be undertaken through the use of materials and colours to define particular movement routes, visibility to key features and elements, open viewsheds to desirable destinations and screened viewsheds to assist in directing users and promote privacy where necessary. The design of the path system is aimed at promoting connectivity through the development in an expanded, safe and efficient manner.

Signage

Signage to the development will be unified in its materials and form. Signage is proposed to be located at key decision points including points of arrival, intersections of roads and paths and at reinforcement locations along longer paths.

Signage is proposed to consist of:

- Directional signage to facilitate efficient movement within the precinct.
- Educational signage relating to the local area its habitat, features and history.
- Orientation signage pertaining to direction and distances to local places of interest inclusive of information pertaining to users' fitness and outdoor activities.

1.21 Landscape Materials & Furnishings

Landscape materials will be common to the proposed development area to bring design and character unity to the precinct while also marking quality of the new development area. External landscape materials will be generally selected to be complimentary to the local character in texture, colour and style. The attraction of the local area is intended to be reflected in the materials used. In all instances materials will be robust and fit for purpose with consideration on durability, longevity and maintenance minimization over the longer term inclusive of minimized replacement, local availability and all relevant warranties and guarantees.

Furnishings will all be off the shelf proprietary elements available locally inclusive of parts, replacements, and all suitable guarantees and warranties.

The proposed range of landscape includes:

- Stone paving finish to select higher use and feature areas and to select dry stacked look limestone feature walls befitting of a more handcrafted finish.
- A mix of exposed aggregate and plain concrete finishes to select areas.
- A mix of fencing materials fit for purpose.
- Off form concrete to select feature walls and stairs.
- Metal frames decking and structures with a variety of materials panels and finishes.
- Stabilised gravel paving to select lower use paths.
- Galvanised metal finish to select landscape elements.
- Natural loose gravel paths to select private access points.
- Natural treated timber materials for nature play elements.
- Red asphalt for select paths and higher use road areas.
- A combination of large stone, concrete and steel and/or plastic garden edging.
- Minimal timber to reduce maintenance and extend longevity.
- Low fuel mulches including sand, gravels, select organic mulches to defined areas.

1.22 Landscape Lighting Strategy

Lighting to the landscaped areas will be kept to the minimum necessary to enable safe access to select key routes and areas. The intention is that lighting is subtle but effective, directed rather than broad. There is proposed to be minimal light overspill and light pollution generated by the development.

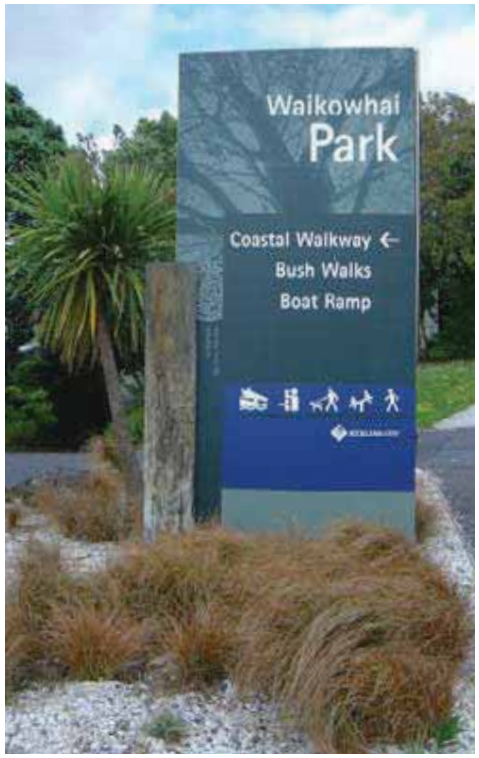
In the main, landscape lighting will be solar and/or LED or similar low electricity use equivalent and will typically be lower directed lighting to signage, doorways, roads and key paths and access routes as opposed to lighting to all access routes. Street lighting will be managed by the civil design package.

1.23 Bushfire Risk Management Landscape Response

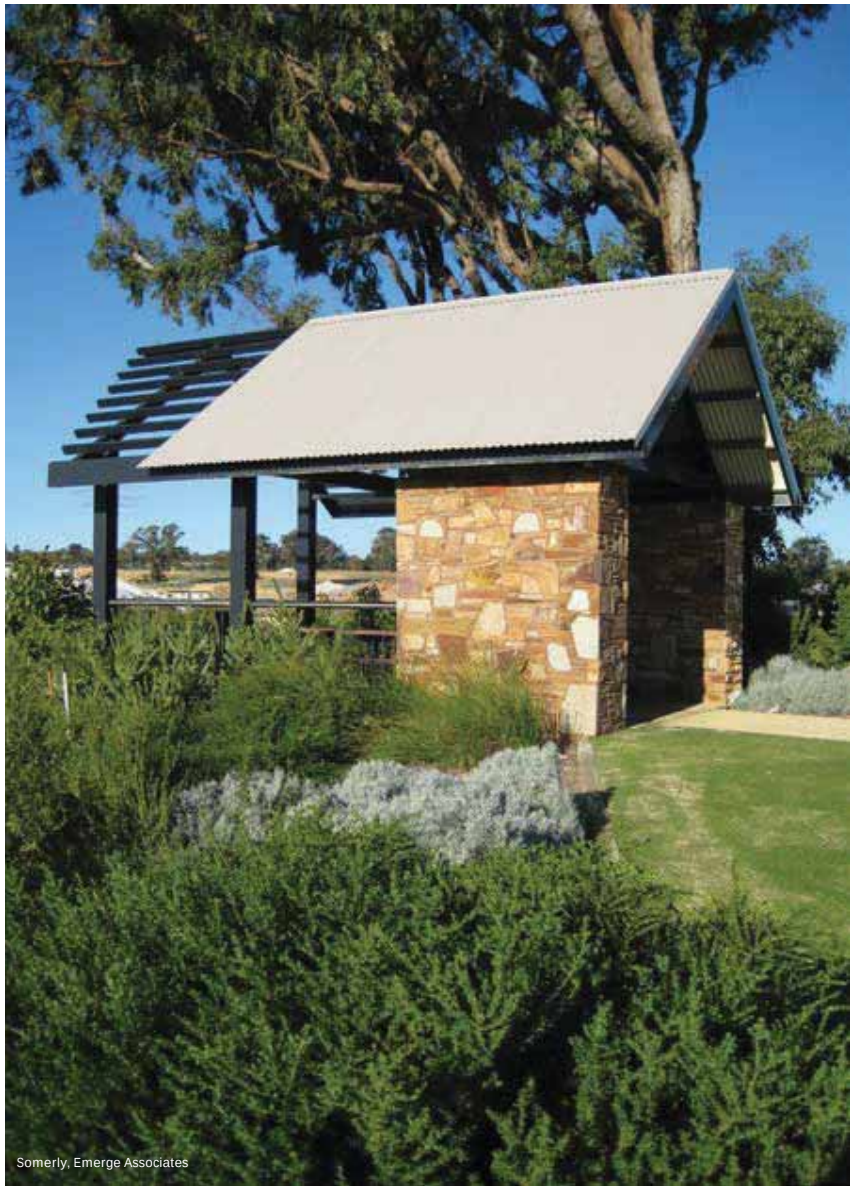
The fire setback zone occurs around most of the margins of the development where they abut a bushland fire threat. Two small areas of existing banksia bushland are proposed to be retained within the design. The resulting landscape design will respond to the projects BAL line in these two smaller defined locations and will employ the use of compliant fire management techniques to meet fire management obligations.

The landscape response will include, but not be limited to, the below in all selected effected fire management zone areas:

- Use of endemic plants and native species identified by the Department of Fire and Emergency Services (DFES) as being low fire fuel species.
- Selection, arrangement and spacing of shrub planting to meet low fire risk principles and requirements.
- Selection, arrangement and spacing of trees to meet low fire risk principles and requirements.
- Use of noncombustible and low combustible landscape materials within the fire setback zone including hard paving, gravels as paths and mulches in select areas, limited organic material, rocks and boulders.
- Provision of access for fire and emergency vehicles.
- Incorporation of a fire setback zone management and maintenance approach inclusive of removal of necessary vegetative fuel and debris at standard required intervals.



The Sanctuary, Emerge Associates


Somerly, Emerge Associates

- Proposed inclusion of irrigation to fire zones for use in advance of fire emergency. Should fire management may require fire mitigation measures in addition to setbacks, the installation of irrigation sprays to defined locations can assist in the suppression of fire prone material and flames within the fire buffer zone.

1.24 Irrigation Strategy

The former golf course has a large irrigation allocation suitable for the preparation and maintenance of healthy greens and fairways over a larger area than that proposed for the new development. This irrigation allocation remains in place.

With the removal of the golf course it is anticipated that the use of ground water will significantly decline. Initial expectations are in the vicinity of up to a 70% reduction in water usage which may be on-sold, traded and / or returned to the groundwater aquifer.

The exiting irrigation system will be removed and replaced with a new integrated irrigation system designed and installed to meet the standards of the City of Cockburn. This may include a system of sprays, drippers and bubblers to suit various circumstances and planting regimes. The existing bores are expected to be reviewed and reworked to maximise water extraction efficiency and to meet new standards. Additional bores may also be considered/ required to better distribute extraction and more efficiently cater for water distribution. Ultimately the groundwater licence and infrastructure required for the new parks will be transferred to the City.

The irrigation water source is proposed to be from the existing (or new) bore system and will be separately metered. The irrigation system will have a range of inbuilt sustainable measures including, but not limited to, rain gauges, water use monitoring, partial drip systems and hydro zoning as part of the design process, inclusive of manual override to respond to periods of excessive rain or lengthy dry periods. Conscious of continuing staged house and road construction, there is also the opportunity to consider a mainline loop system with reverse flow or to be linked to a variety of bores in order to maintain water flow irrespective of any possible future break.

Individual residences may apply for a domestic bore or uitilise mains scheme water as suitable and will be separately metered accordingly. The individual on lot and verge irrigation system will be under the care and control of the resident. In the main, the planting species palette will be local endemic species / native species requiring less water than existing system.

1.25 Landscape Surface Drainage Strategy

Generally the site has a good drainage infiltration rates and good soil permeability reducing the need for extensive drainage and water storage infrastructure. Where possible, the development will opt for at source drainage solutions to distribute drainage throughout. Landscape zones will include planted basins at key low point locations within the development and also will utilize the existing drainage basins where possible. Overflow onto adjacent grass areas may occur to cater for defined irregular larger storm events.

The residential lots and the medium density sites will seek to manage their drainage and infiltration within their lot or strata area. Where open space areas are somewhat limited in space to cater for surface drainage management, underground storage solutions are proposed in accordance with relevant standards and subject to detail design, to ensure maximum open space areas are available for the community.

Roads and paths will be generally graded to sheet drain inclusive of a mix of infiltration basins, raingardens in select locations and swales where suitable. Final drainage design will be subject to detail engineering design. The streetscapes will seek to have flush kerbing in select locations adjacent to grass swales or planted swales inclusive of defined rain gardens to select locations.

Harvest Lakes, Emerge Associates

Vivente, Emerge Associates

1.26 Maintenance Strategy

In all cases, a maintenance regime will be in place inclusive of general maintenance minimization through design practices and will aim to use sustainable maintenance practices. This includes, but is not limited to, defined edges and borders, minimal and preferably alternate approaches to pesticides, controlled and minimized fertilizer use.

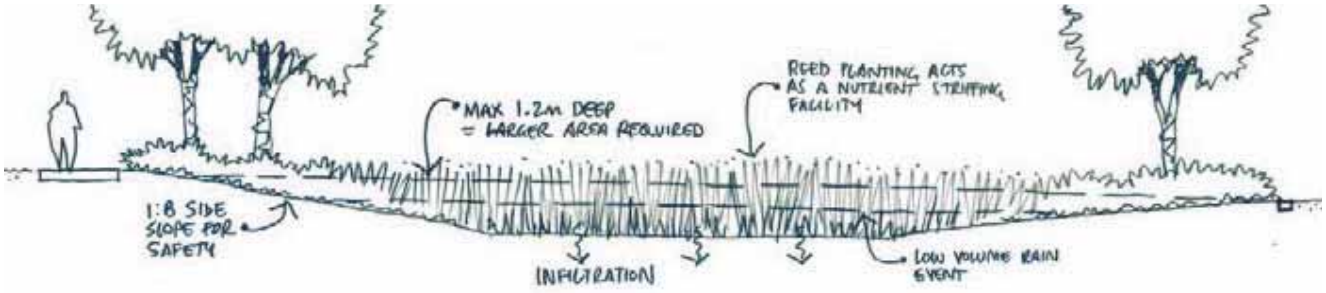
Planted revegetation areas and managed vegetation zones will include a maintenance regime as part of its bushfire management obligations. This will include but is not limited to required periodic removal of natural fuel, review of planting densities to ensure continued compliance with fire regulations and checking and testing of irrigation sprays.

Maintenance will be undertaken via general access to all public accessible areas. Light maintenance vehicles can access all public areas and can adjoin all private areas within the development. This will occur initially via the road system and then by careful access over landscaped grass areas and select areas of the pedestrian path system. Use of removable bollards will limit and control unauthorize access to link areas between roads.

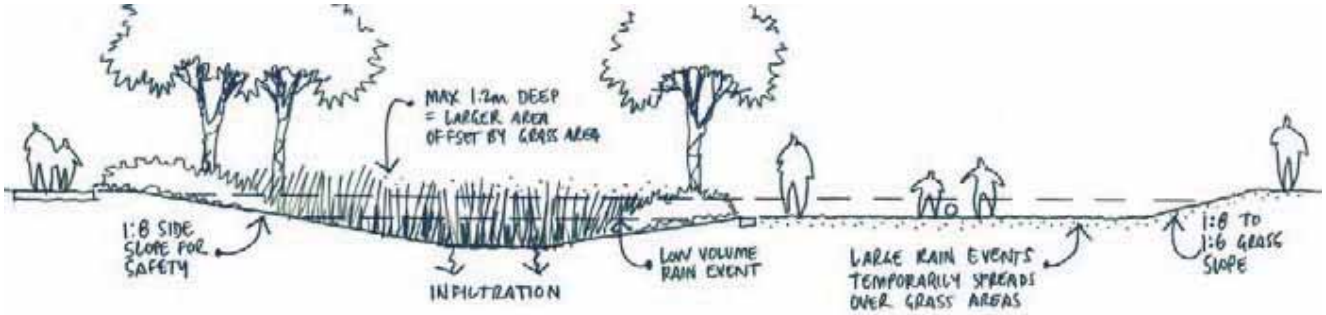
Maintenance will be managed by the development for the first 2 years minimum. The 2 year maintenance timeframe may be extended in certain locations at the developers discretion in liaison with the City.

The increased volume of open space will see additional expenditure occur as necessary in order to maintain the increase in area of open space. This additional cost is somewhat offset by the content of the additional open space (which will mainly be linear widened streetscape areas)

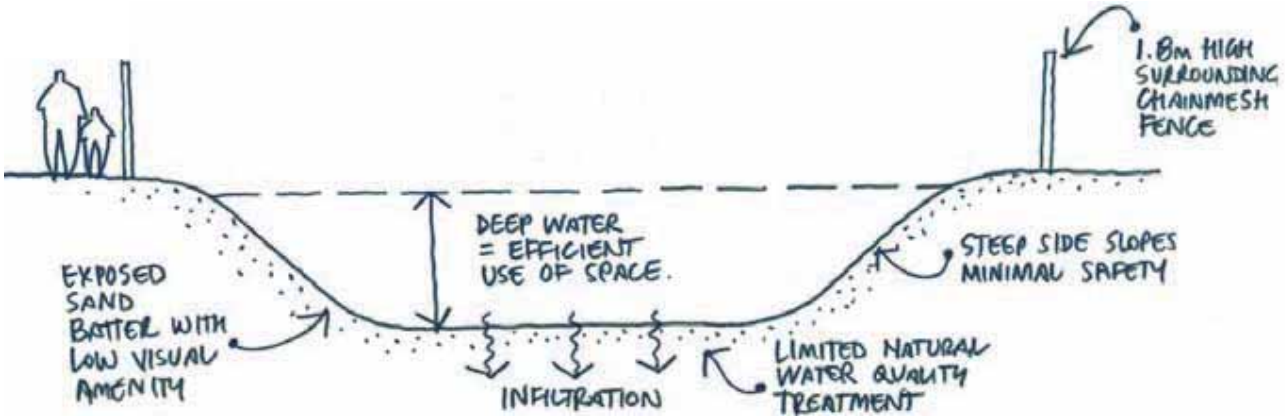
The Sanctuary, Emerge Associates



EXAMPLE SECTION H



EXAMPLE SECTION I



EXAMPLE SECTION J

which will not generally be complex in layout, detail design or material selection thus minimising maintenance costs.

The proponent has been advised by the City that the City's current typical maintenance rate is approximately $2.00/m2. Preliminary calculations indicates that the likely maintenance cost for the proposed design is approximately $2.50/m2 average.

The additional maintenance required to deliver the proposed design may be met by either:

a. The City agreeing to undertake additional maintenance based on the larger volume of open space in response to the existing residents requests and concerns as identified through the community consultation process and the resulting proposed masterplan.

b. The City agreeing to a special area rate to be applied to the new residential lots in addition to their usual rates in order to meet the additional costs over and above Council typical expenditure. This arrangement would be disclosed to the purchasers of new lots at the time of sale and written into the sale contract annexures. This arrangement requires confirmation that the City's expenditure of these funds occurs within the Glen Iris precinct.

Providence, Emerge Associates

APPENDIX L

Post Development Catchments & Runoff Rate Estimation

Land Use Breakdown and EIA's for Individual Subcatchments - Modelling Purposes

Hyd2o 25/08/2023

Internal Catchments

		Area (ha)								
		Low Density (R20)	Medium Density (R30)	Group Housing (R30/R40)	Commercial	POS/Conservation/ Lansdcape Interface	Road Res	Total	15mm EIA	1% AEP EIA
1	A1	0.98	0.64	0.00	0.00	0.70	0.97	3.29	0.67	1.32
2	A2	0.42	0.00	0.00	0.00	0.17	0.26	0.85	0.18	0.31
3	A3	0.55	0.00	0.00	0.00	0.27	0.25	1.07	0.17	0.34
4	A4	0.22	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.04
5	B1	1.87	0.00	0.00	0.00	0.40	0.66	2.93	0.46	0.94
6	B2	0.52	0.00	0.00	0.00	0.11	0.25	0.88	0.17	0.32
7	B3	1.16	0.27	0.00	0.00	0.32	0.48	2.23	0.33	0.75
8	C1	0.44	0.00	0.00	0.00	0.13	0.25	0.82	0.17	0.31
9	D1	0.00	0.00	0.55	0.00	0.32	0.00	0.87	0.00	0.24
10	D2	0.45	0.00	0.00	0.00	0.30	0.23	0.98	0.16	0.31
11	D3	1.61	0.00	0.44	0.00	0.47	0.84	3.36	0.58	1.22
12	D4	0.21	0.00	0.00	0.00	0.08	0.10	0.39	0.07	0.13
13	E1	1.61	0.00	0.00	0.00	0.34	0.50	2.45	0.34	0.75
14	E2	0.41	0.00	0.00	0.00	0.52	0.29	1.22	0.20	0.38
15	F1	0.33	0.00	0.00	0.00	0.08	0.16	0.57	0.11	0.20
16	F2	0.01	0.00	0.00	0.00	0.33	0.00	0.34	0.00	0.04
17	G1	0.45	0.00	0.00	0.00	0.68	0.13	1.26	0.09	0.27
18	G2	1.72	0.00	0.00	0.00	0.13	0.54	2.39	0.37	0.78
19	G3	0.56	0.00	0.00	0.00	0.17	0.18	0.91	0.12	0.27
20	H1*	0.42	0.00	1.37	0.00	0.86	0.53	3.18	0.37	0.62
21	I1*	0.73	0.00	1.35	0.00	0.53	0.79	3.40	0.55	0.86
22	J1	0.31	0.00	0.00	0.73	0.38	0.52	1.94	0.36	0.54
23	K1	0.00	0.00	0.32	0.00	0.92	0.20	1.44	0.14	0.39
24	K2	0.59	0.00	0.00	0.00	0.19	0.22	1.00	0.15	0.31
25	K3	1.03	0.00	0.10	0.00	0.19	0.46	1.78	0.32	0.64
26	K4	0.49	0.00	0.88	0.00	0.10	0.37	1.84	0.26	0.75
27	L1	0.36	0.00	0.00	0.00	0.14	0.00	0.50	0.00	0.08
28	L2	0.42	0.00	0.28	0.00	0.21	0.18	1.09	0.12	0.36
29	L3	0.43	0.00	0.00	0.00	0.21	0.12	0.77	0.09	0.21
30	L4	1.85	0.00	0.00	0.00	0.56	0.68	3.09	0.47	0.97
31	M1	1.16	0.00	0.00	0.00	0.25	0.44	1.85	0.30	0.61
32	M2	1.16	0.00	0.00	0.00	0.82	0.49	2.48	0.34	0.72
33	M3	0.68	0.00	0.00	0.00	0.16	0.21	1.05	0.14	0.32
	Total	23.14	0.91	5.29	0.73	11.06	11.30	52.43	7.80	16.31

External Catchments

		Area (ha)					
		Lots (R20)	POS	Road Res	Total	15mm EIA	1% AEP EIA
1	AExt1	3.30	0.00	0.99	4.29	0.68	1.44
2	AExt2	3.85	0.00	1.12	4.97	0.77	1.64
3	AExt3	1.33	0.01	0.41	1.75	0.28	0.59
4	BExt1	2.65	0.00	0.94	3.59	0.65	1.27
7	DExt1	7.04	0.34	2.76	10.14	1.91	3.65
5	EExt1	2.92	0.01	1.08	4.01	0.75	1.44
6	EExt2	2.71	0.18	1.02	3.92	0.70	1.38
8	FExt1	0.98	0.01	0.25	1.24	0.17	0.39
9	GExt1	1.13	0.00	0.78	1.91	0.54	0.87
10	GExt2	3.10	0.40	1.03	4.53	0.71	1.48
11	GExt3	1.70	0.00	0.71	2.41	0.49	0.91
12	IExt1	1.45	0.00	0.51	1.96	0.35	0.69
13	IExt2	0.72	0.00	0.74	1.46	0.51	0.76
14	JExt1	3.39	0.00	1.44	4.83	0.99	1.83
15	KExt1	0.91	0.07	0.42	1.40	0.29	0.53
16	LExt1	2.39	0.00	0.70	3.09	0.48	1.02
17	LExt2	0.80	0.00	0.31	1.11	0.21	0.41
	Total	40.37	1.03	15.19	56.60	10.48	20.29

CURRV

Calculator for Urban Runoff Rates & Volumes
27/08/2023

Project: Glen Iris Jandakot LWMS

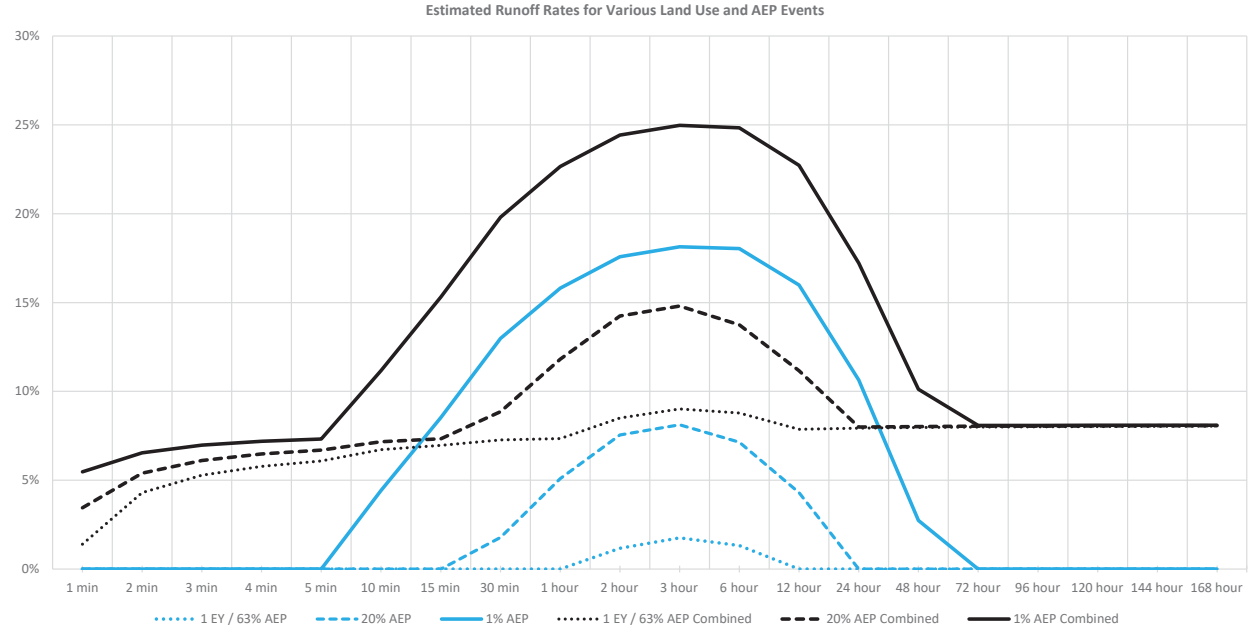
	Land Use Description	Area (ha)	Use in Calc	Imperv Initial Loss mm	Perv Initial Loss mm	Perv Continue Loss mm/hr	On Site Soak (mm)	AR&R Empty (days)	EIA/TIA System Connect Ratio	Roof %	Ext Imp %	Ext Perv %	Comment
1	Residential Lots : R20	23.1	Yes	1.5	20.0	4.0	15.0	0.25	60%	23.5	6.5	20	Soakwells, Assume only Front of Lot Runoff Contribution
2	Group Housing	5.3	Yes	1.5	20.0	4.0	15.0	0.25	60%	65	20	15	Soakwells with Overflow Connection Assumed (R30 Equiv)
3	Medium Density	0.9	Yes	1.5	20.0	4.0	15.0	0.25	60%	70	20	10	Lot Connections Assumed - Conservative
4	Commercial	0.7	Yes	1.5	20.0	4.0	0.0	0.25	0%	60	35	5	Assumed Water Managed On Site - No Contribution to Estate Storages
5	POS/Conservation/Landscape Interface	11.1	Yes	1.5	20.0	4.0	0.0	0.25	20%	0	5	95	Impervious Allowance for Paths/Hardstand Areas
6	Road Reserve	11.3	Yes	1.5	20.0	4.0	0.0	0.25	100%	0	70	30	
7	External Catchment : Lots	40.4	Yes	1.5	20.0	4.0	15.0	0.25	60%	23.5	6.5	20	Existing Developed Area
8	External Catchment : Road Reserve	1.0	Yes	1.5	20.0	4.0	0.0	0.25	100%	0	70	30	Existing Developed Area
9	External Catchment : POS	15.2	Yes	1.5	20.0	4.0	0.0	0.25	20%	0	5	95	Existing Developed Area
10								1.00					
	Total Area :	109.0											

EIA : Effective Impervious Area, TIA : Total Impervious Area

Land Use Graph Selector: 1

(11 - combined total)

Residential Lots : R20



Rainfall IFD Data (via Bureau of Meterology)
Annual Exceedence Probability / ARI

	Duration	63.2% 1.00	50% 1.44	20% 4.48	10% 10	5% 20	2% 50	1% 100
1	1 min	1.8	2.0	2.6	3.0	3.5	4.1	4.6
2	2 min	3.2	3.5	4.4	5.1	5.8	6.8	7.6
3	3 min	4.3	4.7	6.0	6.9	7.9	9.3	10.4
4	4 min	5.1	5.6	7.3	8.5	9.7	11.3	12.7
5	5 min	5.9	6.5	8.4	9.8	11.2	13.1	14.7
6	10 min	8.5	9.4	12.3	14.4	16.5	19.4	21.6
7	15 min	10.3	11.4	14.9	17.4	19.9	23.3	26.1
8	30 min	13.7	15.1	19.7	22.9	26.2	30.7	34.3
9	1 hour	15.0	19.6	25.3	29.4	33.6	39.6	44.4
10	2 hour	23.0	25.1	32.2	37.6	43.2	51.4	58.2
11	3 hour	26.6	29.0	37.3	43.6	50.4	60.3	68.8
12	6 hour	34.0	37.0	47.9	56.4	65.6	79.5	91.5
13	12 hour	42.9	47.0	61.1	72.2	84.2	102.0	118.0
14	24 hour	53.5	58.6	76.4	89.8	104.0	125.0	143.0
15	48 hour	65.9	72.3	93.2	108.0	123.0	144.0	161.0
16	72 hour	74.7	82.0	105.0	120.0	134.0	155.0	171.0
17	96 hour	82.5	90.3	114.0	130.0	145.0	165.0	181.0
18	120 hour	89.7	98.1	123.0	140.0	155.0	177.0	193.0
19	144 hour	96.9	106.0	133.0	150.0	167.0	190.0	207.0
20	168 hour	104.0	114.0	143.0	161.0	179.0	205.0	224.0

Estimated Runoff Rates
Annual Exceedence Probability / ARI

	63.2% 1.00	50% 1.44	20% 4.48	10% 10	5% 20	2% 50	1% 100
Maximum of All Events							
Residential Lots : R20	2%	3%	8%	11%	14%	16%	18%
Group Housing	5%	9%	19%	25%	30%	35%	38%
Medium Density	5%	9%	20%	26%	30%	35%	39%
Commercial	0%	0%	0%	0%	0%	0%	0%
POS/Conservation/Landscape Interface	1%	1%	4%	6%	8%	10%	11%
Road Reserve	69%	69%	71%	76%	79%	82%	85%
External Catchment : Lots	2%	3%	8%	11%	14%	16%	18%
External Catchment : Road Reserve	69%	69%	71%	76%	79%	82%	85%
External Catchment : POS	1%	1%	4%	6%	8%	10%	11%
0	0%	0%	0%	0%	0%	0%	0%
combined total	**9%**	**10%**	**15%**	**18%**	**21%**	**23%**	**25%**

Event Selector	9	1 hour					
Residential Lots : R20	0%	1%	5%	9%	11%	14%	16%
Group Housing	0%	2%	13%	20%	25%	30%	33%
Medium Density	0%	2%	14%	20%	25%	30%	34%
Commercial	0%	0%	0%	0%	0%	0%	0%
POS/Conservation/Landscape Interface	1%	1%	2%	4%	6%	8%	10%
Road Reserve	63%	65%	67%	72%	75%	79%	81%
External Catchment : Lots	0%	1%	5%	9%	11%	14%	16%
External Catchment : Road Reserve	63%	65%	67%	72%	75%	79%	81%
External Catchment : POS	1%	1%	2%	4%	6%	8%	10%
0	0%	0%	0%	0%	0%	0%	0%
combined total	**7%**	**8%**	**12%**	**15%**	**18%**	**21%**	**23%**

APPENDIX M
Post Development Stormwater Modelling

Post Development Stormwater Modelling Detailed Results : Individual Catchments

							15mm Event : Water Quality Treatment						20% AEP Event							1% AEP Event					
	Contributing Catchments	Storage Type	Storage Invert (mAHD)	AAMGL (mAHD)	MGL (mAHD)	Inv above AAMGL (m)	EIA (ha)	K (m/d)	Flood Rise (m)	Top Water Level (mAHD)	TWL Area (m2)	Reqd Volume (m3)	20%/1% AEP EIA (ha)	Modelled Effective K (m/d)	Flood Rise (m)	Top Water Level (mAHD)	TWL Area (m2)	Reqd Volume (m3)	Critical Duration (hr)	Modelled Effective K (m/d)	Flood Rise (m)	Top Water Level (mAHD)	TWL Area (m2)	Reqd Volume (m3)	Critical Duration (hr)
S1	A1	Swale	35.8	22.2	22.9	13.6	0.67	2.5	0.29	36.09	317	72	1.32	5.2	0.68	36.48	540	252	6	6.9	1.04	36.84	785	502	12
S2	A2	Swale	36.7	19.9	20.6	16.8	0.18	2.5	0.29	36.99	105	18	0.31	4.9	0.51	37.21	186	49	1	5.5	0.71	37.41	272	95	12
S3	AExt1 & A4	Underground	34.0	19.9	20.6	14.1	0.69	-	-	-	-	-	1.48	6.9	0.46	34.46	495	228	1	6.9	1.45	35.45	495	718	12
S4	AExt2	Underground	33.5	22.4	23.1	11.1	0.77	-	-	-	-	-	1.64	10.0	0.44	33.94	465	202	12	10.0	1.45	34.95	465	676	12
S5	AExt3 & A3	Basin	36.7	22.2	22.9	14.5	0.45	2.5	0.30	37.00	244	48	0.93	9.0	0.54	37.24	394	124	1	11.0	0.80	37.50	575	250	12
S6	B1	Basin	35.8	22.3	23.0	13.5	0.46	2.5	0.30	36.10	216	50	0.94	5.2	0.66	36.46	365	177	6	7.0	1.02	36.82	551	354	12
S7	B2	Swale	26.8	22.1	22.8	4.7	0.17	2.5	0.29	27.09	117	16	0.32	8.0	0.43	27.23	181	37	1	9.4	0.62	27.42	279	81	12
S8	B3 & BExt1	Basin	26.8	22.3	23.0	4.5	0.98	2.5	0.29	27.09	462	106	2.03	5.3	0.71	27.51	805	391	6	6.9	1.09	27.89	1159	785	12
S9	C1	Basin	25.9	22.4	23.1	3.5	0.17	2.5	0.30	26.20	121	18	0.31	8.9	0.41	26.31	172	34	1	10.5	0.60	26.50	268	75	12
S10	D1	Swale	27.0	22.7	23.4	4.3	0.00	-	-	-	-	-	0.24	6.2	0.49	27.49	49	25	12	8.7	0.86	27.86	132	75	12
S11	D2	Basin	27.0	22.9	23.6	4.1	0.16	2.5	0.29	27.29	92	17	0.31	4.7	0.47	27.47	147	51	1	6.5	0.68	27.68	224	101	12
S12	D3	Swale	26.5	23.1	23.8	3.4	0.58	2.5	0.30	26.80	429	86	1.22	4.8	0.53	27.03	663	227	12	6.5	0.79	27.29	947	453	12
S13	D4	Basin	26.5	23.0	23.7	3.5	0.07	2.5	0.27	26.77	44	7	0.13	3.3	0.38	26.88	64	23	12	5.3	0.49	26.99	88	36	1
S14	DExt1	Basin	25.5	22.8	23.5	2.7	1.91	-	-	-	-	-	3.65	14.0	0.93	26.43	687	541	12	14.0	1.98	27.48	955	1400	12
S15	E1	Swale	24.7	22.5	23.2	2.2	0.34	2.5	0.30	25.00	229	34	0.75	6.1	0.54	25.24	431	113	1	8.1	0.73	25.43	602	211	12
S16	E2 & EExt1	Basin	24.5	22.3	23.0	2.2	0.95	2.5	0.29	24.79	424	102	1.82	8.8	0.62	25.12	618	273	1	11.4	1.00	25.50	880	556	12
S17	EExt2	Underground	23.0	22.5	23.2	0.5	0.70	-	-	-	-	-	1.38	11.0	0.53	23.53	360	191	1	11.0	1.50	24.50	360	540	12
S18	F1	Swale	26.0	22.5	23.2	3.5	0.11	2.5	0.28	26.28	79	11	0.20	9.6	0.34	26.34	119	19	1	12.0	0.46	26.46	169	36	12
S19	F2 & FExt1	Basin	25.7	22.5	23.2	3.2	0.17	2.5	0.28	25.98	91	17	0.42	10.7	0.55	26.25	165	51	1	13.4	0.77	26.47	242	96	12
S20	G1 & GExt1 & GExt2	Basin	25.0	22.8	23.5	2.2	1.34	2.5	0.25	25.25	641	140	2.61	4.8	0.72	25.72	963	547	6	6.6	1.18	26.18	1340	1087	12
S21	G2 & GExt3	Swale	25.0	22.9	23.6	2.1	0.86	2.5	0.30	25.30	390	93	1.69	4.5	0.76	25.76	670	363	6	6.9	1.12	26.12	931	667	12
S22	G3	Swale	26.0	23.0	23.7	3.0	0.12	2.5	0.29	26.29	68	13	0.27	5.0	0.48	26.48	115	44	1	6.6	0.66	26.66	168	77	1
S23	H1	Basin	26.2	23.2	23.9	3.0	0.37	2.5	0.30	26.50	199	39	0.62	4.5	0.51	26.71	310	107	6	6.5	0.75	26.95	451	211	12
S24	I1 & IExt1 & IExt2	Swale	26.2	23.3	24.0	2.9	1.41	2.5	0.30	26.50	650	153	2.31	5.5	0.60	26.80	966	411	12	6.4	0.99	27.19	1416	893	12
S25	J1 & JExt1	Basin	26.0	23.3	24.0	2.7	1.35	2.5	0.28	26.28	655	144	2.37	4.8	0.63	26.63	1037	462	6	6.2	0.92	26.92	1380	831	6
S26	K1	Swale	27.5	23.3	24.0	4.2	0.14	2.5	0.30	27.80	80	15	0.39	5.9	0.56	28.06	154	63	1	7.3	0.77	28.27	228	113	1
S27	K2	Basin	27.4	23.3	24.0	4.1	0.15	2.5	0.28	27.68	89	16	0.31	4.8	0.47	27.87	147	51	1	6.3	0.64	28.04	208	89	1
S28	K3	Basin	26.6	23.3	24.0	3.3	0.32	2.5	0.30	26.90	160	35	0.64	9.7	0.55	27.15	251	86	1	12.2	0.83	27.43	373	172	12
S29	K4	Basin	26.6	23.1	23.8	3.5	0.26	2.5	0.30	26.90	187	40	0.75	9.6	0.59	27.19	311	112	1	13.1	0.85	27.45	443	209	12
S30	KExt1	Underground	24.5	23.1	23.8	1.4	0.29	-	-	-	-	-	0.53	10.0	0.54	25.04	140	76	1	10.0	1.47	25.97	140	205	12
S31	L1 & LExt1	Undergound	23.6	23.2	23.9	0.4	0.48	-	-	-	-	-	1.10	10.0	1.06	24.66	185	197	1	10.0	1.50	25.10	185	278	12
S32	L2	Swale	27.4	23.2	23.9	4.2	0.12	2.5	0.27	27.67	77	13	0.36	5.5	0.53	27.93	152	58	12	7.0	0.72	28.12	219	104	1
S33	L3	Swale	25.8	23.2	23.9	2.6	0.09	2.5	0.29	26.09	52	9	0.21	10.2	0.50	26.30	96	24	1	13.7	0.64	26.44	132	40	12
S34	L4	Basin	25.0	23.3	24.0	1.7	0.47	2.5	0.30	25.30	246	50	0.97	5.1	0.61	25.61	398	177	6	6.5	0.88	25.88	553	319	6
S35	LExt2	Underground	23.5	23.3	24.0	0.2	0.21	-	-	-	-	-	0.41	10.0	0.68	24.18	44	30	1	10.0	1.49	24.99	44	66	12
S36	M1	Swale	24.8	23.4	24.1	1.4	0.30	2.5	0.28	25.08	213	29	0.61	7.3	0.46	25.26	362	81	1	9.4	0.62	25.42	502	150	12
S37	M2	Basin	24.5	23.6	24.3	0.9	0.34	2.5	0.30	24.80	168	37	0.72	5.2	0.67	25.17	314	125	6	6.0	1.00	25.50	476	254	12
S38	M3	Basin	25.2	23.4	24.1	1.8	0.14	2.5	0.28	25.48	89	16	0.32	5.0	0.48	25.68	151	54	1	6.4	0.65	25.85	212	92	1
										Total	**6934**	**1444**				Total	**13672**	**6076**					Total	**18849**	**12897**
																Total (ex UG)	**11983**	**5152**					Total (ex UG)	**17160**	**10414**

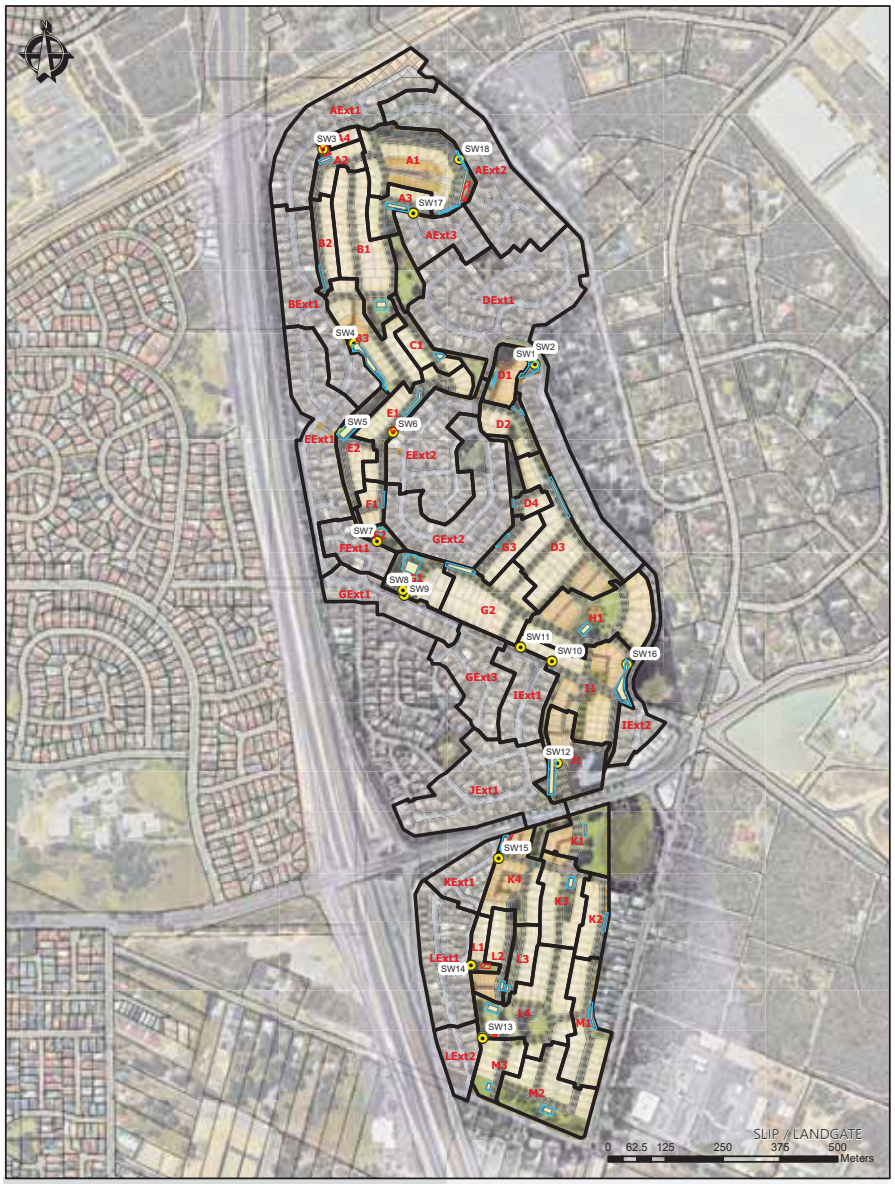
Underground storage inverts dictated by surveyed inverts of existing pipework

Effective K shown in table above represents a combination of K for the biofilter area and adopted K for the larger flood area , considering the relative areas of inundation and permeability testing

APPENDIX N

Indicative Storage Cross Sections **& Landscape Overlay**

Date: 27/08/2023 Job No. H22046



Site
Catchments
External Catchments
Biofiltration Area
Basin/Swale Flood Storage
Underground Flood Storage
Existing Pipework/ Outlet

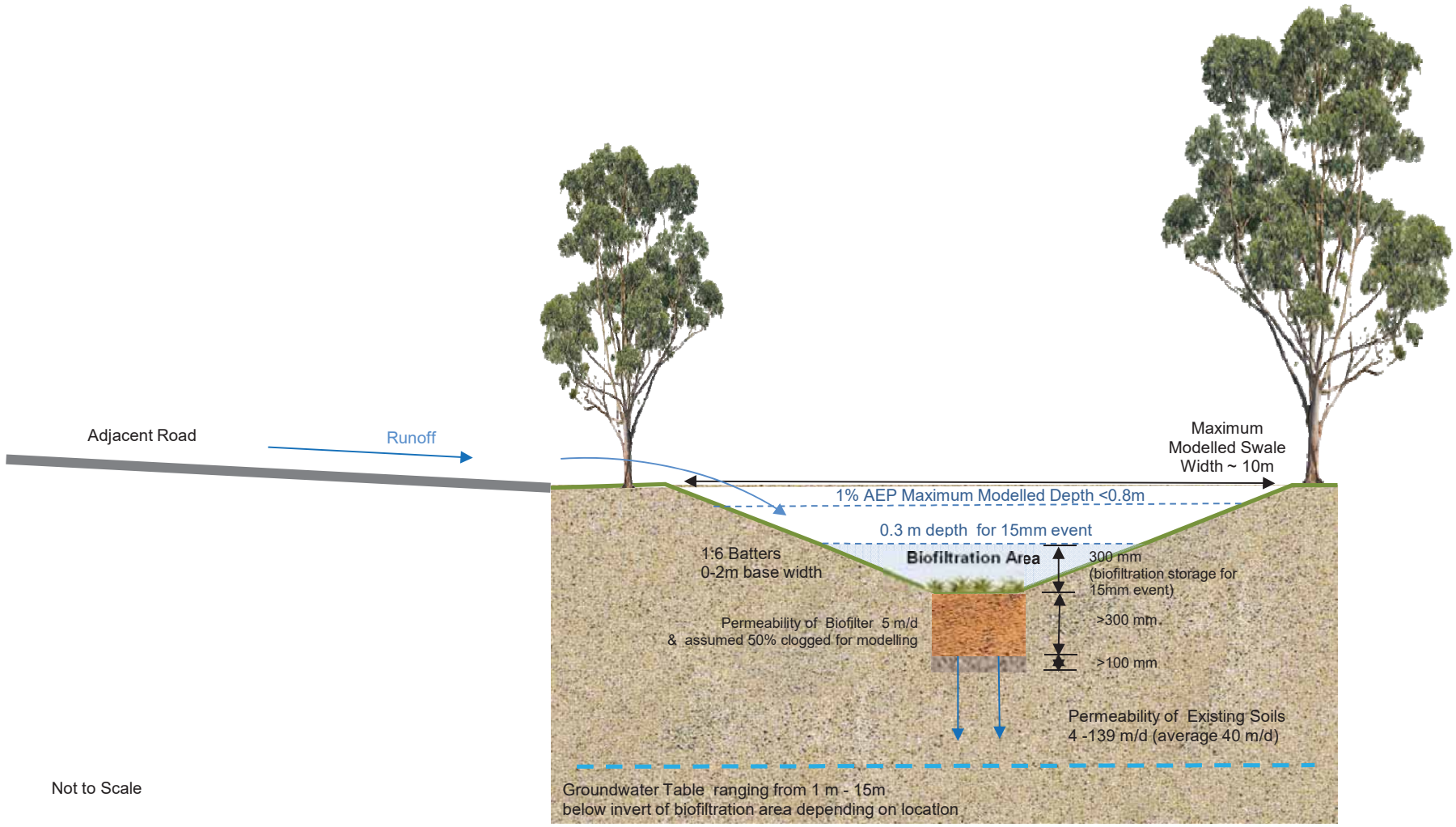
hyd2o

Glen Iris Jandakot Local Water Management Strategy

Stormwater Management Landscape Overlay

Appendix N

Date: 25/5/2021 Job No H20002



Swale cross section shown indicative for modelling purposes
Actual depth and width to vary based on individual detailed design requirements at each location at UWMP stage

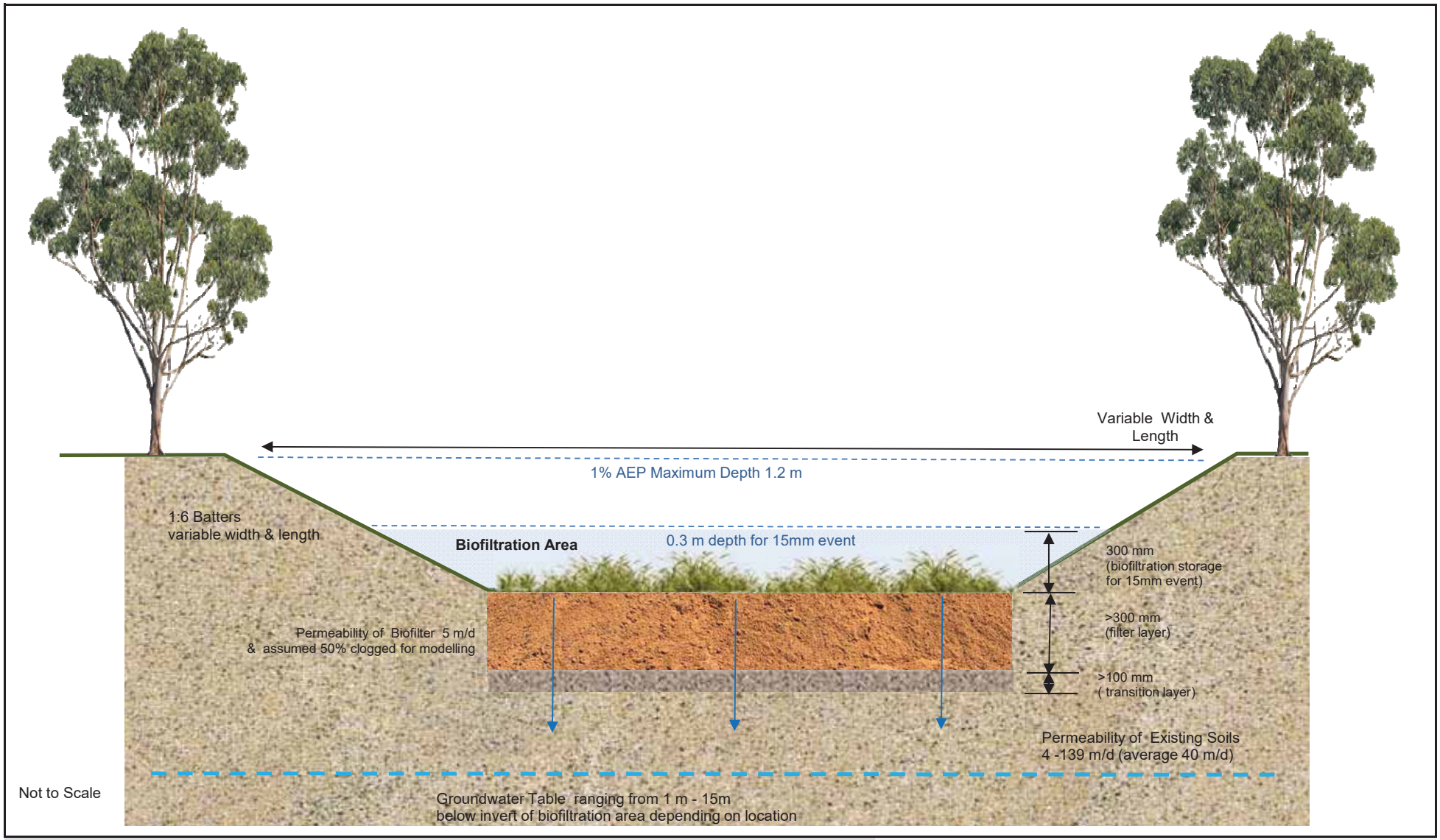
hyd$_2$o

Glen Iris Jandakot Local Water Management Strategy

Typical Modelled Swale Cross Section

Appendix N1

Date: 25/5/2021 Job No H20002



Basin cross section shown indicative for modelling purposes
Actual depth and width to vary based on individual detailed design requirements at each location at UWMP stage

hyd$_2$o

Glen Iris Jandakot Local Water Management Strategy

Typical Modelled Basin Cross Section

Appendix N2

APPENDIX O
Engineering Drawings

PLAN
SCALE 1:1000

0 10 20 40 60m
SCALE 1:1000 @ ORIGINAL SHEET SIZE A1

NOTES

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE CONTRACT DRAWINGS AND SPECIFICATION
2. ALL DIMENSIONS SHOWN ARE IN METRES UNLESS OTHERWISE SHOWN.
3. SURVEY DATA PROVIDED BY MNG.
4. ALL LEVELS SHALL BE DETERMINED FROM BENCH MARKS ESTABLISHED BY THE PROJECT SURVEYOR.
5. ALL SETBACKS TO BE 6m FROM FRONT BOUNDARY UNLESS NOTED OTHERWISE.
6. GEOTECHNICAL INSPECTIONS AND ASSESSMENTS TO BE CARRIED OUT AS PER SPECIFICATION AND AT RECOMMENDATION FROM THE PRINCIPAL NOMINATED GEOTECHNICAL CONSULTANT.
7. EXISTING SERVICES ARE SHOWN FOR INFORMATION ONLY. ALL SERVICES ARE TO BE LOCATED PRIOR TO THE COMMENCEMENT OF WORKS. THE CONTRACTOR SHALL REPORT ANY DISCREPANCY OR CLASH WITH SERVICES TO THE SUPERINTENDENT.
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9. CONTRACTOR SHALL REMOVE ALL RUBBISH, MISCELLANEOUS REMNANTS AND THE LIKE FROM WITHIN THE SITE.
10. SITE TO REMAIN SECURE AT ALL TIMES. CONTRACTOR TO ALLOW FOR TEMPORARY FENCE TO BE INSTALLED/RELOCATED SO THE WORKS CAN BE CONSTRUCTED IN ITS ENTIRETY.
11. UPON DISCOVERY OF ANY "UNEXPECTED FIND" THE CONTRACTOR SHALL CEASE WORK IN THE VICINITY OF THIS DISCOVERY, MAKE THE AREA SAFE AND NOTIFY THE SUPERINTENDENT OF THE OCCURRENCE.
12. ALL WORKS IN THE VICINITY OF "TREES TO BE PROTECTED" SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE PROJECT ARBORIST. CONTRACTOR TO INSTALL AND MAINTAIN TPZ FENCING THROUGHOUT WORKS.
13. INTERNAL BATTER SLOPES TO BE NO STEEPER THAN 1:3 (V:H). UNLESS NOTED OTHERWISE. ADJACENT POS AREAS, BATTERS ARE TO BE WHOLLY WITHIN THE LOT TO MINIMISE CLEARING.

LEGEND

- LIMIT OF WORKS
- 2 — LOT NUMBER
- 43.15 — PROPOSED BULK EARTHWORKS PAD LEVEL
- 43.15 — FUTURE BULK EARTHWORKS PAD LEVEL
- PROPOSED BULK EARTHWORKS CONTOURS (0.25m INTERVAL)
- EXISTING SURFACE CONTOURS (0.5m INTERVAL)
- GROUNDWATER LEVEL CONTOURS (0.50m INTERVAL)
- FUTURE RETAINING WALL
- EXISTING ROAD/KERB
- PROPOSED ROAD/KERB
- PROPOSED BATTER
- EXISTING EMBANKMENT
- FUTURE BATTER
- EXISTING SEWER
- EXISTING WATER
- EXISTING DRAINAGE
- EXISTING NBN
- EXISTING TELSTRA
- EXISTING GAS
- EXISTING UNDERGROUND POWER
- EXISTING OVERHEAD POWER
- EXISTING IRRIGATION
- EXISTING TREE TO REMAIN AND BE PROTECTED
- EXISTING TREE TO BE REMOVED
- BLACK COCKATOO HABITAT TREE (SURVEYED)
- BLACK COCKATOO HABITAT TREE (UN-SURVEYED)

WARNING
BEWARE OF UNDERGROUND SERVICES
The location of underground cables are approximate only and their exact position should be checked on site. No guarantee is given that all existing cables and services are shown. Locate all underground cables and services before commencement of work. Refer to Worksafe Regulation 3.21.
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REV	DATE	DRAWN	CHECKED	APPROVED	
C	25.07.23	JJ	BG	BT	ISSUED FOR COUNCIL APPROVAL
B	07.07.23	JJ			REVISED PRECALCULATION PLAN
A	01.06.23	JJ			ISSUED FOR TENDER

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ECP ACQUISITIONS 6 PTY LTD
ACUMEN DEVELOPMENT SOLUTIONS

PROJECT:
GLEN IRIS ESTATE JANDAKOT
CENTRAL BULK EARTHWORKS

DRAWING TITLE:
BULK EARTHWORKS PLAN
SHEET 1

DRAWN H.VU		WAPC No. 163728	
DESIGNED J.JONES		SCALE @ A1 1:1000	
PROJECT MANAGER B.TREW		DATUM AHD	CO-ORDS PCG94
JDSI PROJECT No. JDS201817.BE01	DRAWING No. C100		REVISION C

Plotted By: jjones Plot Date: 27/07/23 - 13:56 Cad File: C:\12dS\data\JDSI-12DSYN\JDS201817.BE01_148\CIVIL\Drawings\JDS201817.BE01_C100-C101.dwg

NOTES

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE CONTRACT DRAWINGS AND SPECIFICATIONS.
2. FOR STANDARD NOTES AND LEGEND REFER TO C100 OF THIS SET

0 10 20 40 60m
SCALE 1:1000 @ ORIGINAL SHEET SIZE A1

PLAN
SCALE 1:1000

WARNING
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C	25.07.23	JJ	BG	BT	ISSUED FOR COUNCIL APPROVAL
B	07.07.23	JJ			REVISED PRECALCULATION PLAN
A	01.06.23	JJ			ISSUED FOR TENDER

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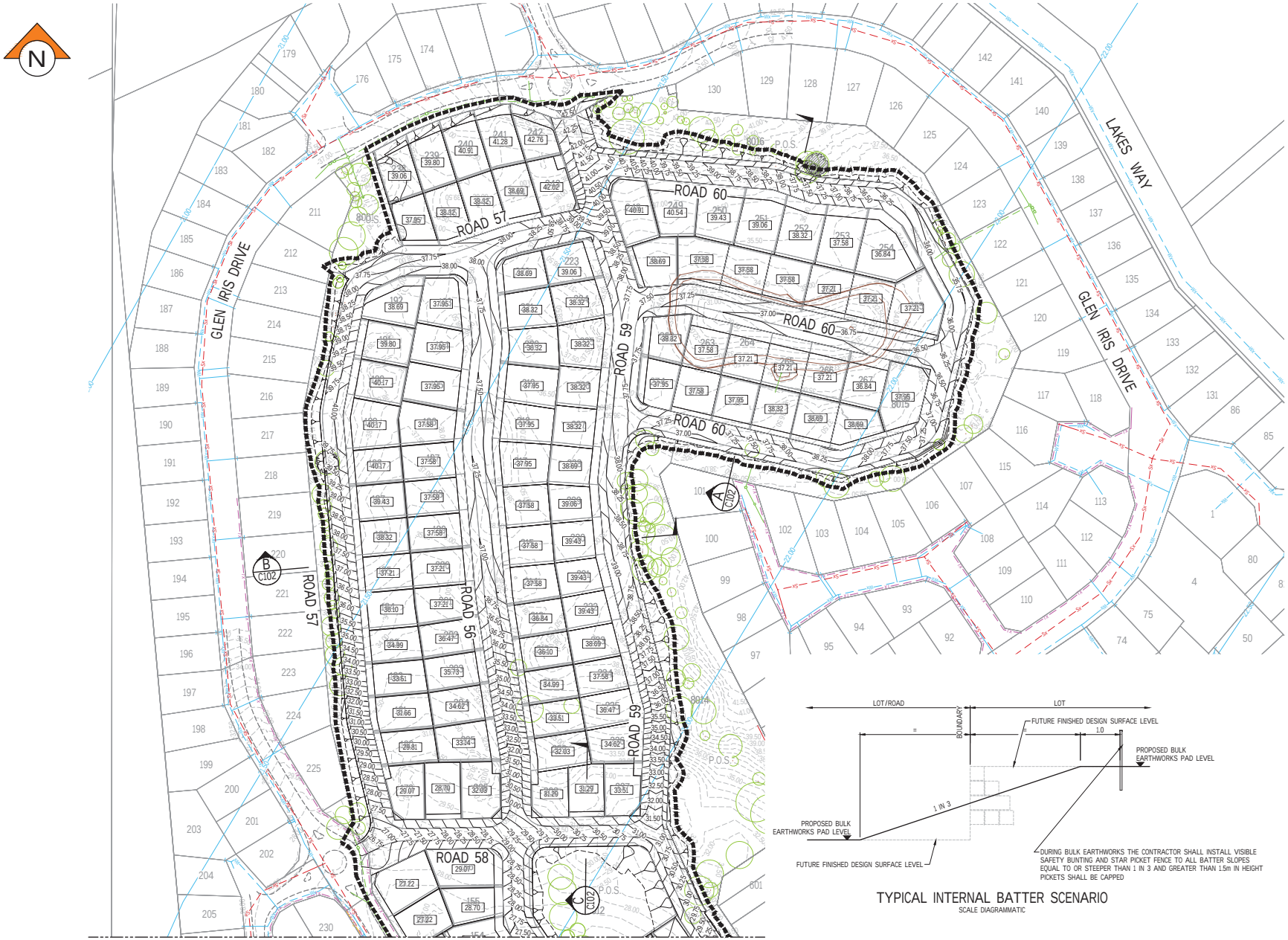
PROJECT: GLEN IRIS ESTATE JANDAKOT CENTRAL BULK EARTHWORKS

DRAWING TITLE: BULK EARTHWORKS PLAN SHEET 2

DRAWN: H.VU	WAPC No.: 163728
DESIGNED: J.JONES	SCALE @ A1: 1:1000
PROJECT MANAGER: B.TREW	DATUM: AHD; CO-ORDS: PCG94
JDSI PROJECT No.: JDS201817.BE01	DRAWING No.: C101; REVISION: C

Plotted By: jjones Plot Date: 27/07/23 - 13:55 Cad File: C:\12dS\data\JDSI-12DSYN\JDS201817.BE01_148\CIVIL\Drawings\JDS201817.BE01_C100-C101.dwg



PLAN
SCALE 1:1000

0 10 20 40 60m
SCALE 1:1000 @ ORIGINAL SHEET SIZE A1

TYPICAL INTERNAL BATTER SCENARIO
SCALE DIAGRAMMATIC

NOTES

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3. SURVEY DATA PROVIDED BY LAND SURVEYS, SAVAGE SURVEYING AND MNG.
4. ALL LEVELS SHALL BE DETERMINED FROM BENCH MARKS ESTABLISHED BY THE PROJECT SURVEYOR.
5. ALL SETBACKS TO BE 4m FROM FRONT BOUNDARY UNLESS NOTED OTHERWISE.
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8. NO WORKS ARE TO BE UNDERTAKEN WITHIN THE TREE PROTECTION ZONE WITHOUT PRIOR APPROVAL FROM THE PROJECT ARBORIST.
9. FOR TREE PROTECTION ZONE FENCING REQUIREMENTS REFER TO EMERGE ASSOCIATES TREE PROTECTION PLAN FB-SK-01.
10. ALL INFRASTRUCTURE IDENTIFIED TO BE REMOVED IS TO BE DISPOSED OF OFF SITE UNLESS NOTED OTHERWISE.
11. CONTRACTOR SHALL REMOVE ALL RUBBISH, MISCELLANEOUS REMNANTS AND THE LIKE FROM WITHIN THE SITE.
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14. CONTRACTOR TO MAKE ALLOWANCE FOR ALL ITEMS OF DEMOLITION WORKS CONTAINED OR IMPLIED WITHIN THE DRAWING SET AS NECESSARY FOR THE SATISFACTORY COMPLETION AND PERFORMANCE OF THE WORKS.
15. ALL WORKS IN THE VICINITY OF "TREES TO BE PROTECTED" SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE PROJECT ARBORIST.
16. INTERNAL BATTER SLOPES TO BE NO STEEPER THAN 1:3 (V:H). UNLESS NOTED OTHERWISE.

LEGEND

- LIMIT OF WORKS
- 2 — LOT NUMBER
- 43.15 — PROPOSED BULK EARTHWORKS PAD LEVEL
- 43.15 — EXISTING LOT LEVEL
- 43.15 — FUTURE BULK EARTHWORKS PAD LEVEL
- 15.00 — PROPOSED BULK EARTHWORKS CONTOURS (025m INTERVAL)
- 15.00 — EXISTING SURFACE CONTOURS (0.50m INTERVAL)
- 15.00 — GROUNDWATER LEVEL CONTOURS (0.50m INTERVAL)
- FUTURE RETAINING WALL
- EXISTING RETAINING WALL
- EXISTING ROAD/KERB
- PROPOSED ROAD/KERB
- PROPOSED BATTER
- EXISTING EMBANKMENT
- FUTURE BATTER
- Sx — EXISTING SEWER
- Wx — EXISTING WATER
- Dx — EXISTING DRAINAGE
- NBNx — EXISTING NBN
- Tx — EXISTING TELSTRA
- Gx — EXISTING GAS
- Ex — EXISTING UNDERGROUND POWER
- OHx — EXISTING OVERHEAD POWER
- Ix — EXISTING IRRIGATION
- EXISTING TREE TO REMAIN AND BE PROTECTED
- EXISTING TREE POSSIBLE RETENTION
- BLACK COCKATOO HABITAT TREE (SURVEYED)
- BLACK COCKATOO HABITAT TREE (UN-SURVEYED)

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CLIENT: EASTCOURT

PROJECT: GLEN IRIS ESTATE JANDAKOT NORTHERN BULK EARTHWORKS

DRAWING TITLE: BULK EARTHWORKS PLAN SHEET 1 OF 2

DRAWN N.TRAN	WAPC No.	
DESIGNED J.JONES	SCALE @ A1 1:1000	
PROJECT MANAGER S.FOLEY	DATUM AHD	CO-ORDS PCG94
JDSI PROJECT No. JDS201817.BE02	DRAWING No. C100	REVISION A

Plotted By: Bsamuel Plot Date: 24/08/23 - 16:04 Cad File: C:\12dS\data\JDSI-12DSYN\JDS201817.BE02_171\CIVIL\Drawings\JDS201817.BE02_C100-C101.dwg

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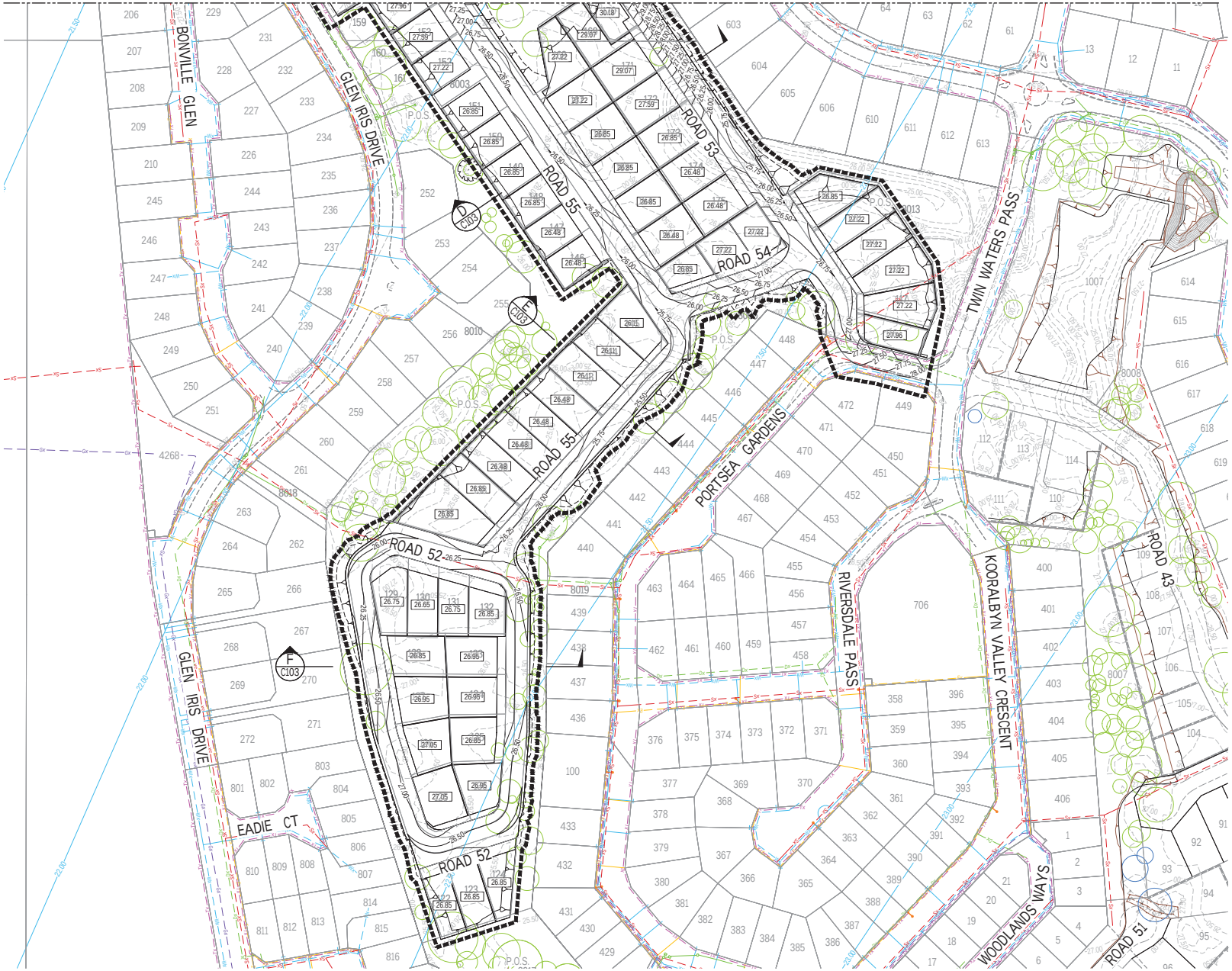

PLAN
SCALE 1:1000

0 10 20 40 60m
SCALE 1:1000 @ ORIGINAL SHEET SIZE A1

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PROJECT: GLEN IRIS ESTATE JANDAKOT NORTHERN BULK EARTHWORKS

DRAWING TITLE: BULK EARTHWORKS PLAN SHEET 2 OF 2

DRAWN: N.TRAN	WAPC No.
DESIGNED: J.JONES	SCALE @ A1: 1:1000
PROJECT MANAGER: S.FOLEY	DATUM: AHD; CO-ORDS: PCG94
JDSI PROJECT No.: JDS201817.BE02	DRAWING No.: C101; REVISION: A

Plotted By: Bsamuel Plot Date: 24/08/23 - 16:03 Cad File: C:\12dS\data\JDSI-12DSYN\JDS201817.BE02_171\CIVIL\Drawings\JDS201817.BE02_C100-C101.dwg

GLEN IRIS ESTATE

APPENDIX 11
ACTIVE SUSTAINABILITY REPORT

GLEN IRIS ESTATE

Sustainability Initiatives

Following provides a summary list of all the sustainability initiatives that have been committed to at Glen Iris estate.

All the listed sustainability initiatives were referred to in the Local Structure Plan Report.

Some were stated as clear commitments and design responses, others were proposed as a broad statement of intent.

Those listed under Community and Ecosystems are as written within the local structure plan report.

Initiatives listed under Energy, Water, Waste and Materials have now been defined.

All will be implemented, but some do require further investigation to determine actual deliverables. These initiatives 'to be investigated' are shown in amber.

Project Vision addressing Sustainable Urban Development

(Extracted from Local Structure Plan Report Section 5.3 Sustainability Commitments)

The Glen Iris development is planned designed and developed to address and incorporate key principles and practices that define sustainable urban development.

The development constitutes an urban infill addressing the State Planning Policy 'Perth Peel @ 3.5 Million' to consolidate urban growth, as well as City of Cockburn's planning strategies addressing environmental integrity and social community benefit such as housing choice, liveability, connection to shops and services, transport options, access to public spaces and employment.

Integral to this commitment, the proponent is committed to implement key sustainability initiatives aligned with the UDIA EnviroDevelopment standards.

Community

Consultation

- Detailed consultation with existing community to ensure new areas are strongly integrated with the existing community

Connected / Integrated

- Urban design to support the integration of the new with the existing residential area
- Layout, open space, roads and pathways designed to encourage a safe environment and encourage positive interaction between residents and people using the area.
    - Direct lot interface with open space; and cul-de-sacs connected with public access ways
    - All dwellings will be within 150m of local neighbourhood parks and green spaces

14 September 2021
Acumen – Glen Iris development
Sustainably Initiatives

    - Meandering road layout and interconnected linear POS 'green corridors'
- Interconnected pedestrian network – including throughout public open space
    - Pathways for both walking and cycling that are safe, attractive and well-lit connecting residential areas with public spaces and local facilities
- Public spaces designed to allow multiple uses with safety, comfort and security for community members, including children, the elderly and disabled people, providing shade, seating and quality amenities.
    - Public open space located and designed for both active and passive recreation opportunities

Housing

- Development provides 'infill' housing – responding to WAPC Infill targets and urban consolation
- Centrally located to the existing local centres, employment areas, essential services, social activities and public transport networks
- Inclusion of 10 medium density (R30) group housing sites
    - Located to be dispersed throughout the development area, with 5 site close to central Local Centre area
    - Accommodates smaller houses, thus providing opportunities for existing residents to downsize for aging in-place, with lower living/running costs
- Design Guidelines to support environmental design and construction:
    - Address energy efficiency and renewable energy
    - Water conservation and reuse
    - Waste Management Recycled and Materials selection
    - Universal Access / Accessible Housing
- Appropriate noise mitigation measures to reduce impacts from nearby Jandakot Airport - to be implemented

Local Commercial Centre

- Integration of commercial development with the existing Local Centre.
    - Helps create a community hub as a connection point for interaction of future and existing residents
- Expansion of the Local Centre for improved community facilities and convenience
    - Allows for a range of uses such as supermarket, café/retail outlets, community services such as additional medical facilities

Community Facilities

- The development will create a range of new publicly accessible facilities.
- The extensive community consultation process identified a number of desirable public facilities including:
    - Informal larger play areas, personal training areas, playgrounds
    - Street furniture, Shelter structures with picnic settings and BBQ facilities
    - Walking and cycle path
    - Dog walking trails and facilities
    - Public art

Environmental / Ecosystems:

Public Open Space / Green Space / Tree Retention

- The landscape plan will create a continuous tree canopy coverage to limit urban heat island effect and maximise green canopy coverage
    - Addresses the objectives and provisions of the Urban Forest Plan
- Public Open Space
    - 18.75% - and a total green space of 22.9% - well in excess of the minimum 10% requirement - in park and bushland corridors, designed to manage fire risk
- Retaining over 500 existing mature trees, and
- Planting over 1000 additional new trees – mainly endemic native species - in new parks and buffers adjoining existing residences
    - Design has intentionally located POS/Green Space to maximise the retention of existing trees
    - Two areas of existing Banksia bushland are to be retained within the site
- Tree retention assists in managing the interface with the existing residential development, and maintaining the existing character of the area
- Consideration of incorporating food bearing – bush tucker plant species

Fauna Protection

- Protection and/or relocation of native fauna during construction; and creation of possible fauna habitat opportunities within open space and retention of trees suitable for avian fauna
- It is anticipated up to 8 of the 11 Black Cockatoo breeding habitat trees be retained on site in public open space and road reserves.
- Preliminary subdivision layout designed to mitigate impacts during construction
    - Where trees are to be retained, these will be detailed within the Construction and Environment Management Plan

Water Sensitive Design

- Water Sensitive Design to manage surface water quality to support ecological health
- A major reduction in the existing long-term groundwater draw
- Stormwater management initiatives, techniques and inclusions to provide at source recharge, including possible subsurface storage tanks
- Planted detention basins inclusive of nutrient stripping capability in place of sumps
- Maintenance initiatives to reduce fertilizers, pesticides, herbicides and chemical use generally

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Sustainably Initiatives

WATER CONSERVATION and REUSE

- A variety of water wise initiatives applied to the public and private realm inclusive of more efficient irrigation systems.
    - Planting of local native species have low water needs and only require irrigation during establishment
    - Existing bores are expected to be reworked to maximise water extraction efficiency and to meet new efficiency standards.
    - The irrigation system will have a range of inbuilt sustainable measures including, but not limited to, rain gauges, water use monitoring, partial drip systems and hydro-zoning to respond to periods of excessive rain or lengthy dry periods.
- Landscape guidelines provided to residents to assist them in making informed choices around design, aesthetics, plants species selection and productive gardens.
- Key initiatives include:
    - Water efficient fixtures – Shower, Toilet, Basins
    - Provide a water efficient landscaping package to front gardens - Waterwise native indigenous plants and irrigation
    - Installation of a rainwater tank, plumbed for toilet flushing and cold-water connection to washing machine – proposed as 3,000l tank for large <R25 lots and 1,500l tank for smaller >R30 Cottage lots (Dwellings shall be plumbed with appropriate pipework to be rainwater reuse ready, and rainwater tank, pumps and pipework to be installed as per Department of Health requirements; OR
    - Installation of a Grey water diverter system for garden irrigation, plumbed to washing machine and showers. (Dwellings are to be plumbed with appropriate pipework to be grey water reuse ready, and grey water diversion, filtration and pump system, and sub-surface irrigation pipework to be installed as per Department of Health requirements.)

ENERGY

Glen Iris estate is aiming to be a net carbon-zero development for operational energy use. To achieve this the development will be all-electric with a focus on energy efficiency in housing design and fit-out, and include installed renewable energy PV systems. This is in recognition that to achieve net-zero emissions it is necessary to not have any fossil derived energy sources within the development area. Accordingly, no reticulated gas would be brought into the development.

- Street and lots planned to provide best practice solar access opportunities, as well as ensure that buildings and outdoor spaces have solar amenity.
- Building design guidelines informing purchasers about energy efficiency and comfort; addressing:
    - All houses to achieve minimum 7 star NatHERS Energy Efficiency rating
    - Climate responsive – solar -passive - design for homes
        - Note: these design requirements will also address Quite House Design requirements – such as glazing (6.38mm laminated glass), enclosed eaves with 6mm fibre-cement), and doors - solid core external and sliding doors with acoustic seals)

- Efficient fixtures and appliances: Water Heating Systems; Airconditioning, Lighting, Cooking
- Renewable energy systems: for R20 lots: min 3.5kW / dwelling; R30 Grouped sites: average 1.5kW/dwelling; and
- Investigations into a Community micro-grid battery storage system for all lots, and potentially including existing adjoining lots

- LED / dimmable solar lighting for street lighting and public spaces

WASTE MANAGEMENT AND RECYCLING

- All development works to be guided by a Waste Management plan during civil works and building construction, targeting > 80% recycling
- Building design guidelines informing purchasers about the waste hierarchy of reduce, reuse and recycle.
- The key initiatives proposed include:
  - Civil works contract specifications to develop and manage a construction waste management and recycling program
  - Recycle or reuse a minimum of 80% (by volume) of demolition, land clearing and civil works materials/products
  - All building construction to engage a reputable Waste Management Recycling Company who can capture, recycle and/or reuse a minimum of 80% (by volume) of construction waste materials generated during construction of the dwelling, and monitor and verify recycling rates

MATERIALS

- All civil works and landscape design to incorporate materials with recycled content, reused, and replacement materials; such as for construction of roads and pathways, landscape features, reuse of timber as both nature play elements and in mulch and possible selected public art elements.
- Preference for use of low embodied energy materials where possible and suitable.
  - Recycled structural fill for lots
  - Recycled sub-base materials for roads
  - Recycled asphalt
  - Reuse of topsoil (approx. 100mm thick) in public open space or non-structural areas of the site
  - Reuse of timber removed from the site as both nature play elements and in mulch and possible selected public art elements
  - Recycled mulch (from cleared vegetation) may be used for stabilisation of batters
  - Soft and permeable paving and paths in POS areas

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Sustainably Initiatives

APPENDIX 1: Sustainability Initiatives - as included in LSP Report

Section 5.3 Sustainability Commitments:

The Glen Iris development is planned designed and developed to address and incorporate key principles and practices that define sustainable urban development.

The development constitutes an urban infill addressing the State Planning Policy 'Perth Peel @ 3.5 Million' to consolidate urban growth, as well as City of Cockburn's planning strategies addressing environmental integrity and social community benefit such as housing choice, liveability, connection to shops and services, transport options, access to public spaces and employment.

Integral to this commitment, the proponent is committed to implement key sustainability initiatives aligned with the UDIA EnviroDevelopment standards.

A detailed analysis of Glen Iris against the EnviroDevelopment standards has been undertaken to inform project planning and to determine project initiatives.

The results of the analysis found that the project is well placed to address the EnviroDevelopment certification requirements in all six categories: Ecosystems, Community, Waste, Materials, Energy and Water. Further investigation will continue to allow a more accurate determination to be made.

ED Element	Key Project Sustainability Initiatives
ECOSYSTEMS	- Water Sensitive Design to manage surface water quality to support ecological health, including a major reduction in the existing long-term groundwater draw, and significant reduction in the use of fertilizers, herbicides and pesticides - Retention of over 500 of existing mature trees, relocation of some, and planting of local native species in new parks and buffers adjoining existing residences. - Protection and/or relocation of native fauna during construction; and creation of possible fauna habitat opportunities within open space and retention of trees suitable for avian fauna. - Significant public open spaces – 18.75% - and a total green space of 22.9% - in park and bushland corridors - designed to manage fire risk
COMMUNITY	- Detailed consultation with existing community to ensure new areas are strongly integrated with the existing community. - A range of housing types and densities, including R30 Group Housing sites to allow greater diversity of residents, including down-sizing for retirees, singles, couples and families; and creating a community hub as a connection point for interaction of future and existing residents - The development is designed to encourage a safe environment and encourage positive interaction between residents and other local people using the area. - All dwellings will be within 200m of local neighbourhood parks and green spaces - Public spaces designed to allow multiple uses with safety, comfort and security for community members, including children, the elderly and disabled people, providing shade, seating and quality amenities. - Pathways for both walking and cycling that are safe, attractive and well-lit connecting residential areas with public spaces and local facilities.

ED Element	Key Project Sustainability Initiatives
	- Reduction in water use though waterwise landscape and gardens, water efficient fixtures and appliances. - Rainwater harvesting and reuse OR Greywater reuse on larger lots - Landscape guidelines provided to residents to assist them in making informed choices around design, aesthetics, plants species selection and productive gardens.
	- Street and lots planned to provide best practice solar access opportunities, as well as ensure that buildings and outdoor spaces have solar amenity. - Building design guidelines informing purchasers about energy efficiency and comfort; addressing - Climate responsive – solar -passive - design for homes - Renewable energy systems and investigations into a community micro-grid battery storage system for all lots, and potentially including existing adjoining lots - Efficient fixtures and appliances - Use of efficient LED /and solar lighting for street lighting and public spaces.
	- All development works to be guided by a Waste Management plan during civil works and building construction, targeting > 80% recycling - Building design guidelines informing purchasers about the waste hierarchy of reduce, reuse and recycle
	- All civil works and landscape design to incorporate materials with recycled content, reused, and replacement materials; such as for construction of roads and pathways, landscape features, reuse of timber as both nature play elements and in mulch and possible selected public art elements.

GLEN IRIS ESTATE

APPENDIX 12
DEPARTMENT OF EDUCATION CORRESPONDENCE

Rebecca Thompson

From: AHMAD Ikmal [Asset Planning and Services] <Ikmal.Ahmad@education.wa.edu.au>
Sent: Thursday, 3 June 2021 11:23 AM
To: George Hajigabriel
Cc: TURNBULL Matt [Asset Planning and Services]
Subject: Glen Iris Golf Course Redevelopment - School Requirements (JobRef: 9166)

Follow Up Flag: Follow up
Flag Status: Flagged

Good morning George
I apologise for the delay in responding.

The Department has reviewed the current student enrolment number for South Lake Primary School and projected dwelling number within the subject school's large enrolment intake area. Based on the available information, it is anticipated that South Lake Primary School would have sufficient capacity to accommodate the student yield generated from the proposed 600 dwellings within the Glen Iris Golf Course redevelopment area. Accordingly, a new public primary school site is not required in this instance.

Notwithstanding this, the Department will continue to closely monitor the student enrolment demand on South Lake Primary School and if required, identify the suitable number and location of future public school site/s having regard to the potential residential growth in the broader locality such as the Planning Investigation Areas to the east of Glen Iris Golf Course.

Whilst a new school is not required to be set aside in the Glen Iris Golf Course, introducing new residential development will create public school enrolment demand and therefore, a developer contribution to a future public primary school site is still applicable as part of future subdivision of the redevelopment area in line with the WAPC Operational Policy 2.4 – Planning for School Sites.

Regards
Ikmal

Ikmal Ahmad

Principal Consultant – Land Planning
Asset Planning and Services

Department of Education
151 Royal Street, East Perth WA 6004
T 9264 4435 **E** ikmal.ahmad@education.wa.edu.au
education.wa.edu.au

For land planning referrals and queries, please email to landplanning@education.wa.edu.au

Shaping the future

I respectfully acknowledge the Whadjuk Noongar people and their elders past, present and future. They are the traditional custodians of Mandalup (East Perth) where we work.

From: George Hajigabriel <George.Hajigabriel@rowegroup.com.au>
Sent: Wednesday, 2 June 2021 9:51 AM
To: AHMAD Ikmal [Asset Planning and Services] <Ikmal.Ahmad@education.wa.edu.au>; TURNBULL Matt [Asset Planning and Services] <matt.turnbull@education.wa.edu.au>
Cc: 'Jarrod Rendell' <jarrod@acumends.com.au>
Subject: RE: Glen Iris Golf Course Redevelopment - School Requirements (JobRef: 9166)

Thanks Ahmad – much appreciated.

Regards,

George Hajigabriel
General Manager

P: 08 9221 1991
M: 0412 498 503
W: rowegroup.com.au

>> click here for more contact information

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Sent: Wednesday, 2 June 2021 9:20 AM
To: George Hajigabriel <George.Hajigabriel@rowegroup.com.au>; TURNBULL Matt [Asset Planning and Services] <matt.turnbull@education.wa.edu.au>
Cc: 'Jarrod Rendell' <jarrod@acumends.com.au>
Subject: RE: Glen Iris Golf Course Redevelopment - School Requirements (JobRef: 9166)

Hi George

We are currently reviewing some data and will respond to you as soon as possible.

Regards
Ikmal

Ikmal Ahmad

Principal Consultant – Land Planning
Asset Planning and Services

Department of Education
151 Royal Street, East Perth WA 6004
T 9264 4435 **E** ikmal.ahmad@education.wa.edu.au
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From: George Hajigabriel <George.Hajigabriel@rowegroup.com.au>
Sent: Wednesday, 2 June 2021 9:07 AM
To: TURNBULL Matt [Asset Planning and Services] <matt.turnbull@education.wa.edu.au>
Cc: AHMAD Ikmal [Asset Planning and Services] <Ikmal.Ahmad@education.wa.edu.au>; 'Jarrod Rendell' <jarrod@acumends.com.au>
Subject: RE: Glen Iris Golf Course Redevelopment - School Requirements (JobRef: 9166)

Hi Matt,

Just following up to see if you have had an opportunity to further review the Glen Iris proposal?

Thanks.

Regards,

George Hajigabriel
General Manager

P: 08 9221 1991
M: 0412 498 503
W: rowegroup.com.au

>> click here for more contact information

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From: TURNBULL Matt [Asset Planning and Services] <matt.turnbull@education.wa.edu.au>
Sent: Wednesday, 19 May 2021 11:14 AM
To: George Hajigabriel <George.Hajigabriel@rowegroup.com.au>
Cc: AHMAD Ikmal [Asset Planning and Services] <Ikmal.Ahmad@education.wa.edu.au>; 'Jarrod Rendell' <jarrod@acumends.com.au>
Subject: RE: Glen Iris Golf Course Redevelopment - School Requirements (JobRef: 9166)

Hi George

Many thanks for the consultation on this. We will undertake a further review and respond accordingly.

Kind regards

Matt Turnbull

Manager Land and Property
Asset Planning and Services

Department of Education
151 Royal Street, East Perth WA 6004
T 9264 5178 **E** matt.turnbull@education.wa.edu.au
education.wa.edu.au

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From: George Hajigabriel <George.Hajigabriel@rowegroup.com.au>
Sent: Monday, 17 May 2021 5:31 PM
To: TURNBULL Matt [Asset Planning and Services] <matt.turnbull@education.wa.edu.au>
Cc: AHMAD Ikmal [Asset Planning and Services] <Ikmal.Ahmad@education.wa.edu.au>; 'Jarrod Rendell' <jarrod@acumends.com.au>
Subject: RE: Glen Iris Golf Course Redevelopment - School Requirements (JobRef: 9166)

Hi Matt,

I hope that you have been keeping well.

Further to our meeting a little while ago in relation to the Glen Iris Golf Course redevelopment we are nearing the point of lodging a Scheme Amendment and Structure Plan with the City. In our communications with the City we have advised them that at this stage the DoE does not have a firm position on the need or otherwise for a primary school within the development however the initial indications suggest that it is unlikely one will be required. This is based on consideration of the existing demand and the anticipated demographic profile of the potential purchasers of lots in the new estate. The outcome of the Planning Investigation areas may have an influence on demand in the broader catchment. Hopefully the status of the Planning Investigation areas will be public by the time the proposal is being formally considered and hence a more informed consideration can be undertaken.

I trust that the above is an accurate reflection of the status.

For your information our proposal will be for just under 600 dwellings comprising an average lot size of between 550-600m2 for single residential lots and 300m2 for grouped housing/strata sites (copy of indicative masterplan is attached).

The City has requested that we seek a written position from the DoE. Are you able to provide a preliminary DoE position – noting that there will be an advertising/consultation process in the future for a formal DoE position to be provided?

Please feel free to give me a call if you would like to discuss.

Thanks.

Regards,

George Hajigabriel
General Manager

P: 08 9221 1991
M: 0412 498 503
W: rowegroup.com.au

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GLEN IRIS ESTATE

APPENDIX 13
RETAIL NEEDS ASSESSMENT

Taktics4
Glen Iris Local Centre

Retail Needs Assessment

Acumen
July 2023
PN 2017

Contact

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Version Control

Document Name	Date	Description	Prepared
2017-Glen Iris-RNA-Final-05	July 2023	Final – incorporating technical note	GRD

Distribution Control

Document Name	Date	Distribution	Format	Delivery
2017-Glen Iris-RNA-Final-05	July 2023	GH – Rowe Group	PDF	electronic

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EXECUTIVE SUMMARY

The analysis of the retail and consumer markets influencing the potential development of a retail centre at Glen Iris indicate that a small supermarket based local centre is the most suitable development opportunity. A small supermarket based local centre in Glen Iris would be likely to comprise:

SMALL SUPERMARKET BASED CENTRE – Development Characteristics	
Supermarket	***1,500sqm***
Shops	*5 - 10*
Shop Floorspace (sqm)	*1,000sqm*
Total	***2,500sqm***

A proposed local centre in Glen Iris:

- could expect to be trading prior to 2031.
- may be contained within an allocated commercially zoned parcel of land totalling 0.70Ha.
- will rely on capturing 32% of all supermarket spending from its immediate Jandakot/Glen Iris catchment and 5% of the total catchment supermarket spending.
- Would result in minor sales impacts on the surrounding existing supermarket-based centre network.
- will complement the existing commercial activity in Berrigan Drive rather than compete with it.

1 INTRODUCTION

1.1 Purpose

This paper provides a commercial and economic assessment on the potential for sustainable retail development opportunities resulting from the residential redevelopment of the former Glen Iris Golf Course.

1.2 Proposed Development

The residential redevelopment of the former Glen Iris Golf Course is estimated to create an additional 550 dwellings. The findings in this paper assess whether this redevelopment subsequently creates a sustainable development opportunity for a retail centre to serve the new (and existing) residents in the vicinity of the planned residential redevelopment.

1.3 Approach

The findings in this paper are derived from a robust consideration of market influences on the potential for the sustainable delivery of retail activity in Glen Iris, including:

1. Competitive Commercial Environment - The proximity, extent, accessibility, and role of the surrounding commercial activity centres network.

2. Consumer Markets – the delineation and definition of intended catchments, and the extent, growth, retail needs, and spending profiles of the intended resident market within those catchments. The extent, growth, and nature of retail spending profiles for any other non-residential markets.

3. Market Capacity – the overall retail spending capacity available to a potential retail centre. The potential for a retail centre to capture sales from existing centres/tenants, and subsequently the amount of floor space that potential retail sales could commercially sustain.

4. Development Opportunities – the implications of these commercial and market influences on the potential for delivery and sustainability of retail activity, and the commercial and policy implications associated with its delivery.

2 COMPETITIVE COMMERCIAL ENVIRONMENT

The existing and planned commercial activity centres network around Glen Iris will influence the potential for delivery of additional retail activity in the area. The proximity of existing and planned centres, their intended role/function, tenancy mix, and accessibility to resident catchments, will ultimately determine the potential to attract sufficient sales to attract businesses to a new centre.

The role of any activity centre is determined largely by the type and brand of its major or anchor tenant. A Discount Department Store (Kmart, Target, BigW) and/or Supermarket (Coles, Woolworths, IGA, Aldi, Farmer Jacks) network will ultimately determine the extent of a resident catchment for a centre but also the level of interest an operator may have in being attracted to a new centre/location.

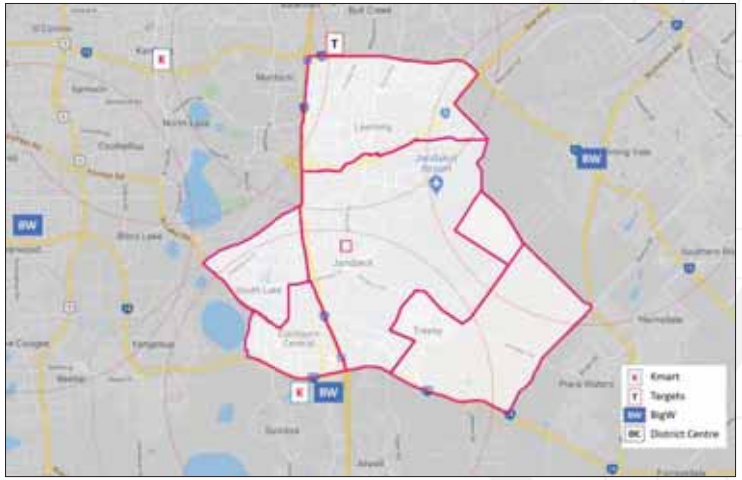
2.1 DDS Based Centres

DDS are typically located in Strategic Metropolitan, Secondary, and District Centres, and typically capture most of its sales/trade from a catchment of around 3.5km. The Glen Iris resident community already has access to all major Department Store operators, including:

- Big W and Kmart at Cockburn Central, 3.5 km to the south.
- Target at Bull Creek, 3.5 km to the north.
- BigW stores at Spearwood (Phoenix Park) to the west and Canningvale (Livingstone) to the East
- Kmart at Kardinya.

No other District Centres are planned in the area which would influence the delivery or performance of a local centre at Glen Iris.

DDS DISTRIBUTION MAP



2.2 Supermarket Based Centres

Neighbourhood Centres are typically anchored by full line supermarket(s), whereas Local Centres are typically anchored by a small supermarket or no supermarket at all.

Supermarket operators generate most of the customer traffic and sales for Neighbourhood Centres. Smaller convenience-based specialty retailers in these centres subsequently rely on their proximity to these major supermarkets for exposure to that customer traffic.

Subsequently, it is unlikely that a Neighbourhood Centre would be developed without a major supermarket operator, or a smaller Local Centre would be developed without a small supermarket operator. The smaller tenants in these centres would not be sustainable without the presence of a major supermarket tenant.

It is therefore reasonable to consider that the sustainability of a Neighbourhood Centre is dependent on the sustainability of a supermarket in that centre. If the supermarket can achieve sustainable retail sales, then it is subsequently expected that it will generate the customer traffic necessary for the smaller retailers to also be sustainable.

Analysis of supermarket-based Neighbourhood Centres reveals that they mostly follow a fixed development formula, based predominantly around the size of the supermarket that may be sustained in the catchment it is intended to serve. The sustainability of major supermarket chains is therefore critical to the successful analysis of activity centres and networks.

This paper focuses predominantly on the sustainability of potential supermarket activity to assess the sustainability of all potential retail activity in Glen Iris.

Two main supermarket operators dominate the supermarket and grocery market in Australia. Analysis of their distribution network shows a typical distance of 3 km between stores which means that Coles and Woolworths (which typically trade from 3,500 sqm stores) typically capture most of their sales from a 1.5km catchment.

IGA and independent grocers who operate under the IGA banner typically capture most of their sales from a smaller catchment of up to 1 km. IGA based stores range from IGA (750sqm-1,500sqm) and IGA express 250sqm-500sqm.

Aldi is a relative new introduction to the supermarket network. They typically comprise 1,500sqm stores and initially traded to a far wider catchment of up to 5km due to their smaller market share. However, as they continue to expand, the average distance between stores will become smaller, indicating that they may ultimately trade to a smaller catchment.

Spudshed is another recent introduction to the supermarket network. Spudshed currently has 17 stores operating in the Greater Perth Region. They typically trade from 2,000 sqm stores and draw trade from a much wider catchment. Up to 40% of all Spudshed sales are estimated to be driven by business spending and is therefore not derived from resident spending. In addition the Spudshed catchment is significantly more extensive than the proposed Glen Iris catchment with analysis of the Spudshed customer traffic indicating that only 15% of all Spudshed sales are being derived from the catchment designated for Glen Iris.

Ultimately, the viability of a centre is almost entirely based on its ability to sustain a major supermarket operator. Supermarkets currently capture 80% of all food and grocery spending by residents across Australia. The additional retailers such as butchers and bakers and newsagents ultimately rely on the foot traffic generated by a supermarket to capture the retail sales they need to remain viable.

In short, if the supermarket can be delivered and sustained in an area, a supermarket-based centre is likely to be viable.

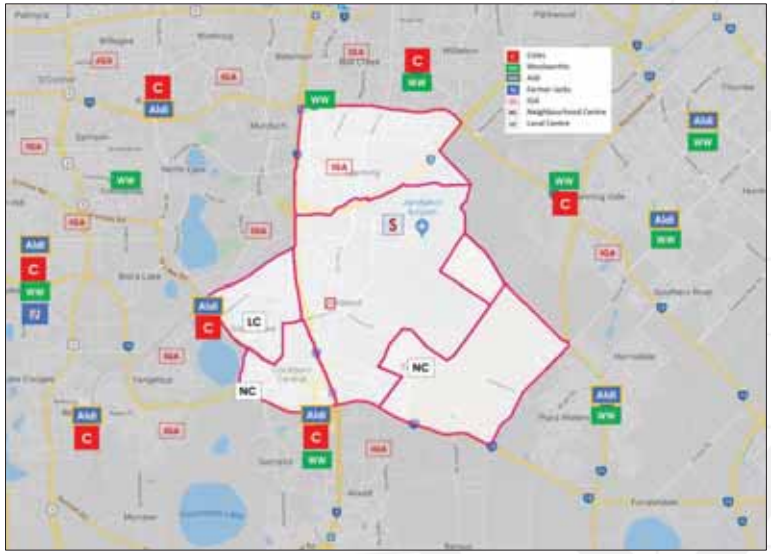
2.3 Supermarket Network

There is currently an estimated 36,500 sqm of supermarket floor space available to residents in Glen Iris. The closest supermarkets include:

- Spudshed in Jandakot – 3 km east of Glen Iris
- IGA in Leeming – 3 km north of Glen Iris
- Coles and Aldi at South Lake – 4.4 km west of Glen Iris
- Coles, Woolworths and Aldi at Cockburn Central – 4.4 km south of Glen Iris
- Ales supermarket at Yangebup – 4.5 km south of Glen Iris

No full line supermarket is currently operating within 4 km of Glen Iris. No existing supermarket-based centres currently operate within 4 km of Glen Iris. The nearest small supermarket-based centre is located 3km from the centre of the planned residential redevelopment of Glen Iris. Spudshed is located within the study area but is a standalone operator (not part of a larger centre).

SUPERMARKET DISTRIBUTION MAP



It is therefore reasonable to expect that Glen Iris residents will access these supermarket-based centres for most of their day-to-day food/grocery and convenience goods.

Proposed Centres

Treeby

An additional 3,500 sqm of supermarket floor space is also planned for Treeby, 3.8 km south of Glen Iris.

Berrigan Quarter

Berrigan Quarter is a Local Centre located 2.5 km west of Glen Iris. It has previously accommodated an IGA supermarket, but this store has recently closed. The closure of this store is thought to be influenced primarily on the introduction of an Aldi store at South Lake less than 2 km west of Berrigan Quarter. The loss of the Berrigan Quarter supermarket has meant that Glen Iris residents must travel even further for their supermarket trips.

It is unlikely that Berrigan Quarter will accommodate a supermarket operator in the future. However, modelling has considered the potential for part of this former supermarket space to be used as supermarket/grocer in the future.

The addition of these proposed centres means that Glen Iris residents will have access to a forecast supermarket floor space of 42,750 sqm.

SUPERMARKET DISTRIBUTION TABLE

		Supermarkets (Floor space (sqm)						
Centre Name	Centre Type	Coles	WW	Aldi	IGA	Other	Proposed	Total Supermarket Floor space
Cockburn Central	SMC	3,500	3,500	1,500				8,500
Ale	NC					2,500		2,500
South Lake	NC	3,500		1,500				5,000
Bull Creek	NC		3,500					3,500
Willeton	NC	3,500	3,500					7,000
Livingstone	DC	3,500	3,500					7,000
Spudshed (Jandakot)	LC					2,000		2,000
Atwell	LC				1,000			1,000
Bibra Lake	LC				1,000			1,000
Leeming	LC				1,000			1,000
Proposed Berrigan Quarter	*LC*						*750*	750
Proposed Treeby	*NC*						*3,500*	3,500
All Centres		14,000	14,000	3,000	3,000	4,500	4,250	42,750

Taktics4

2.4 Glen Iris Centre/Berrigan Drive

Commercial activity is currently located on either side of Berrigan Drive adjacent to the Dean Road and Jandakot Road intersection. The retail activity in these centres is contained within 3,900sqm of building floor space.

Glen Iris Centre / Berrigan Quarter	Approximate Floor space (sqm)
North side	2,400 sqm
South side	1,500 sqm
Total	3,900 sqm

Taktics4

Activity type	Indicative Floor space (sqm)	Contribution of Total Floor space
Medical	2,600 sqm	67%
Retail and Hospitality	300 sqm	8%
Retail Services	500 sqm	13%
Non-Retail	200 sqm	5%
Vacant	300 sqm	8%
Total	3,900 sqm	100%

Taktics4

Only 300sqm (8%) of the 3,900sqm of existing commercial activity along Berrigan Drive currently accommodate retail businesses which trade to a local catchment. The remaining activity (92%) predominantly trades as a showroom centre with a business mix which trades to lower frequency trips and higher volumes of traffic.

This centre does not perform the role of a convenience-based local centre serving the immediate local population. It is positioned on a high-volume road intersection to cater for passing trade and its business mix caters/trades predominantly to low frequency customer traffic more like a showroom retail centre. Whilst the floor space allocated to these centres may seem to be capable of supporting a small supermarket, their configuration and layout is not conducive to the provision of a small compact local convenience-based centre.
The current retail activity along Berrigan Drive does not perform the role of a local centre.

With only 300sqm of retail floor space allocated to this centre and not anchored by a supermarket, the Glen Iris / Berrigan Drive Centre is subsequently not considered to form part of this analysis.

2.5 Accessibility

Accessibility between Glen Iris and surrounding communities and centres initially appears to be constrained by a range of substantially developed infrastructure, including:

- Roe Highway and Railway to the north - isolating Glen Iris from Leeming
- Kwinana Freeway to the west - isolating Glen Iris from South Lake and Cockburn Central

However, residents in Glen Iris still enjoy relatively easy access to centres in these locations due to:

- Direct grade separated access over the Kwinana Freeway via Berrigan Drive to South Lake
- Direct grade separated access over Roe Highway and railway via Berrigan Drive/Karel Ave

SUPERMARKET/CENTRE DISTANCES BY CATCHMENT

Centre Name	Distance (km)					
	Jandakot/ Glen Iris	Glen Iris GC	South Lake	Cockburn Central	Leeming	Treeby
Cockburn Central	4.4	4.4	4.7	0.5	7.8	3.4
Ale	4.3	4.3	3.2	2.5	7.4	6.6
South Lake	4.4	4.4	1.4	3.6	7.8	6.8
Bull Creek	5.2	5.2	7.6	8.9	2.1	9.1
Willeton	5.5	5.5	10.6	11.3	2.6	9.5
Livingstone	10.3	10.3	10.4	10.4	6.2	8.5
Spudshed (Jandakot)	3.0	3.0	4.7	6.4	2.7	5.6
Atwell	5.1	5.1	5.6	2.8	8.4	2.9
Bibra Lake	8.3	8.3	4.6	6.8	4.8	10.0
Leeming	3.0	3.0	6.4	8.1	1.2	7.2
Proposed Berrigan Quart	1.8	1.8	0.9	3.5	6.7	5.0
Proposed Treeby	3.8	3.8	5.4	3.7	6.6	0.3

Taktics4

2.6 Opportunities/Catchments

This section considers the potential for attracting a supermarket operator to Glen Iris given the current and future supermarket operators influencing the catchment. Based on the location and distribution of supermarket-based centres in and around Glen iris, there may be a potential for a supermarket-based centre in Glen Iris given the lack of a major supermarket operator in Glen Iris, and Leeming.

- Woolworths has a strong presence to the north (Bull Creek and Willetton) although they are still over 5km from the Glen Iris redevelopment.
- Coles has a strong presence to the south (Cockburn and South Lake) although they are still over 4km away from the Glen Iris redevelopment.
- IGA has a small presence in locations that are not readily accessible to Glen Iris residents (except for IGA Leeming which is the closest supermarket to the Glen Iris Redevelopment) 3km away from the Glen Iris redevelopment.

The existing supermarket network provides sufficient evidence to consider the following development opportunities.

1. Opportunity 1 - Full line supermarket-based neighbourhood centre.
2. Opportunity 2 - Small supermarket based local centre.

Subsequent sections of this paper will assess the implications associated with each of these potential development opportunities.

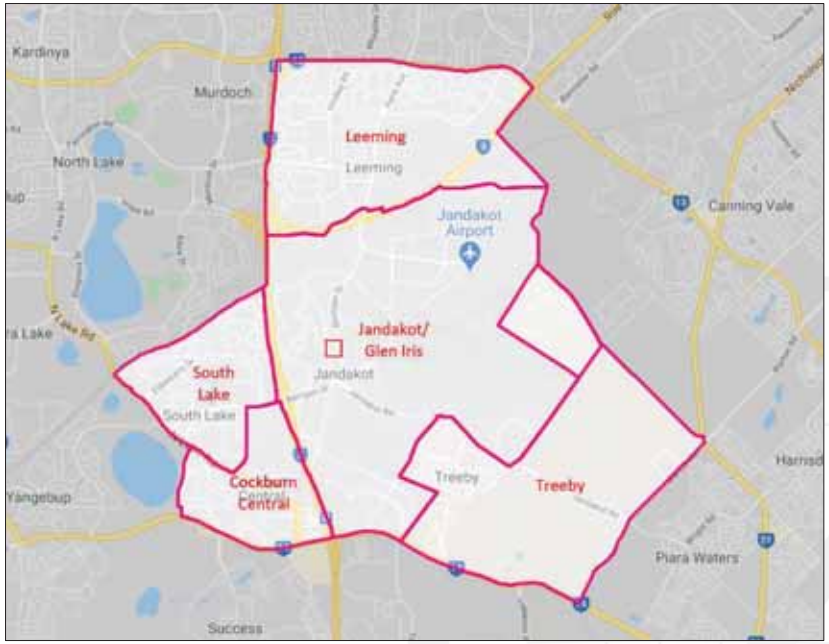
Catchments

It is reasonable to expect that any supermarket-based centre proposed for Glen Iris would realistically expect to capture most of its sales from Glen Iris, Jandakot, Leeming, South Lake, Cockburn Central and Treeby.

The economic viability of a potential centre in Glen Iris will therefore be dependent on the extent, nature, needs and profiles of the residents in these locations.

The Jandakot and Glen Iris redevelopment area effectively represent the same area. However, for the purposes of this analysis they will be reported separately to show the reliance and influence the new development may have on the sustainability of any future centre.

CATCHMENT MAP



Remplan/ Mapbuilder

3 CONSUMER MARKETS

This section assesses the extent, nature, and needs of the communities within the intended resident catchment for a potential neighbourhood or local centre in Glen Iris. It also assesses the potential to draw sales from other non-residential markets.

3.1 Resident Population/Dwellings

The localities forming the main resident catchment area for Glen Iris was reported to contain nearly 22,000 usual residents in 2016. The usual resident population of the catchment is estimated to have increased by nearly 3,000 residents (average of nearly 600 residents p.a.) to reach almost 24,900 residents by 2021.

The usual resident population in the main resident catchment is forecast to increase to nearly 41,100 usual residents by 2041, based on forecasts for continued growth of over 1,000 new residents p.a. over the next 10 years. Thereafter, growth is forecast to slow to under 740 residents p.a. to 2036, and to 375 residents p.a. to 2041. These figures include the planned Glen Iris redevelopment which is expected to introduce 1,485 new residents in 550 new dwellings by 2036.

This forecast population base reflects an average household size of 2.7 persons. The 2016 Census recorded a current average household size of 2.9 persons for the Jandakot suburb. The smaller household size used for Glen Iris redevelopment reflects a continual and gradual Australia wide trend to a decline in household sizes in established urban areas. A trend which is also expected to occur in Jandakot over the next 10 -15 years as the Glen Iris redevelopment occurs.

CURRENT and FORECAST POPULATION by CATCHMENT

Year	Jandakot/ Glen Iris	Glen Iris GC	South Lake	Cockburn Central	Leeming	Treeby	All Catchments	Average Growth per census	Average Growth p.a.
2016	2,766	-	5,862	1,569	10,722	1,003	21,922	-	-
2021	2,824	-	6,009	2,005	10,776	3,272	24,886	2,964	593
2026	2,973	400	6,159	3,698	10,829	5,849	29,908	5,023	1,005
2031	3,181	950	6,313	5,085	10,884	8,979	35,392	5,483	1,097
2036	3,383	1,485	6,471	6,218	10,938	10,605	39,100	3,708	742
2041	3,491	1,485	6,632	7,194	10,993	11,182	40,977	1,877	375
2021-2041	667	1,485	624	5,188	217	7,910	16,091	4,023	805

Id forecast (2020)

The catchment current equates to 20% of the total City of Cockburn resident population. Over the next 20 years, resident population growth in the main resident catchment will represent 35% of the total planned growth in the City of Cockburn. Ultimately the population in the main resident catchment will equate to nearly a quarter of all residents in the City of Cockburn.

CURRENT and FORECAST POPULATION

Year	***City of Cockburn***	***All Catchments***	***Catchment as % Cockburn Population***
2016	*108,770*	*21,922*	*20%*
2021	*123,203*	*24,886*	*20%*
2026	*137,709*	*29,908*	*22%*
2031	*151,176*	*35,392*	*23%*
2036	*161,479*	*39,100*	*24%*
2041	*169,689*	*40,977*	*24%*
2021-2041	46,486	16,091	***35%***

Id forecast (2020)

3.2 Resident Demographics

Analysis of the socio-economic characteristics for these catchments will influence the retail spending profile and retail spending capacity available in the main resident catchment.

- The suburbs of Jandakot and Leeming share similar demographics characteristics and are reported as a single entity.
- The suburbs of South lake and Cockburn Central share similar demographic characteristics and are reported as single entity.

Analysis of these socio-economic profiles/characteristics for each of the communities in the main resident catchment reveals:

Migration Profiles

<u>Jandakot/Leeming</u>
- More established catchment.
- More residents living at the same address as 1 year ago.
- More residents living at same address as 5 years ago.

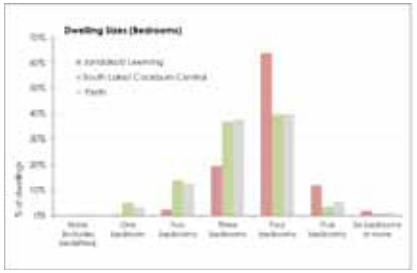
<u>South Lake/Cockburn Central</u>
- Developing catchment.
- Resident migration consistent with Perth averages.

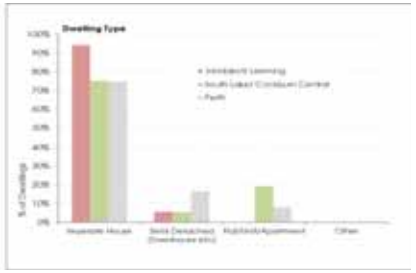
Dwelling Profiles

<u>Jandakot/Leeming</u>
- More separate dwellings.
- Less semidetached dwellings.
- Less 2- and 3-bedroom dwellings.
- More 4-, 5- and 6-bedroom dwellings.

<u>South Lake/Cockburn Central</u>
- More apartments.
- More 1- and 2-bedroom dwellings.
- Less 4- and 5-bedroom dwellings.

DWELLING PROFILES





Personal Profiles

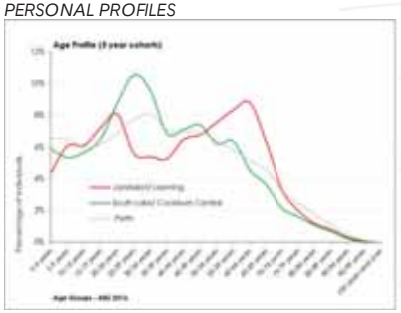
Jandakot/Leeming

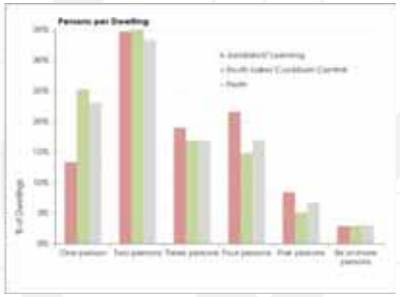
- Average age of 39.6 years – 5% older than Perth averages.
- Less children aged 0-9 years and fewer adults aged 25 years-44 years.
- More young adults aged 14-25 years and 50-69 years.
- More families with children and couples with no children.
- Average household size of 2.9 persons - 9% larger than Perth averages.
- More 3, 4 and 5 person households.

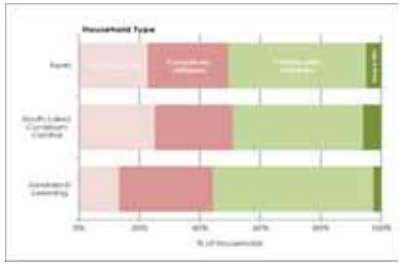
South Lake/Cockburn Central

- Average age of 35.6 years – 5% younger than Perth.
- Less children aged 0-14 years.
- More adults aged 20-24 years.
- Family sizes consistent with Perth averages.
- Average household size of 2.5 persons - 5% smaller than Perth averages.
- more 1 and 2 person households.

PERSONAL PROFILES







Economic Profiles

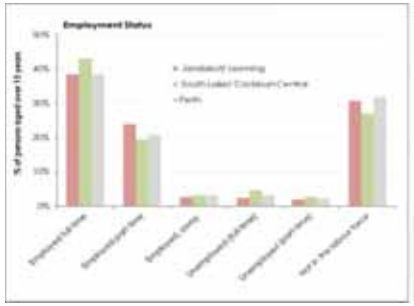
Jandakot/Leeming

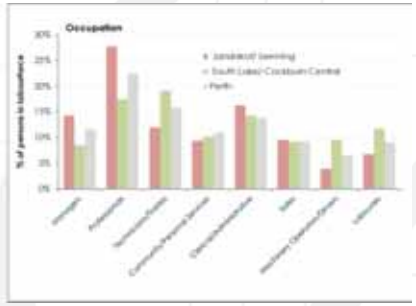
- Less residents employed full time and fewer residents in the labourforce.
- More residents employed part time.
- Average personal incomes 7% above Perth averages.
- Average of 2.3 incomes per household - 12% above Perth averages.
- Average household incomes 21% above Perth averages.

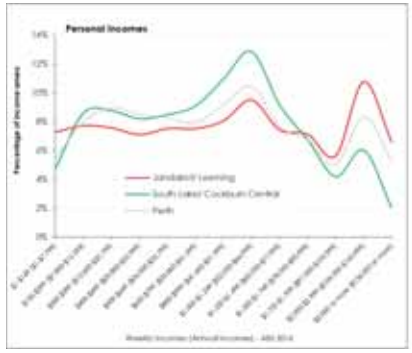
South Lake/Cockburn Central

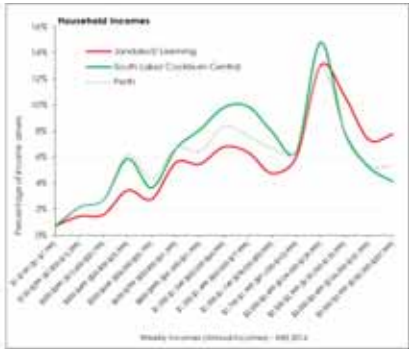
- More residents employed full time.
- Fewer residents employed part time and fewer residents in the labourforce.
- Average personal incomes 10% lower than Perth averages.
- Average of 2.1 incomes per household - 2% below Perth averages.
- Average household incomes 14% below Perth averages.

ECONOMIC PROFILES









Financial Commitment Profiles

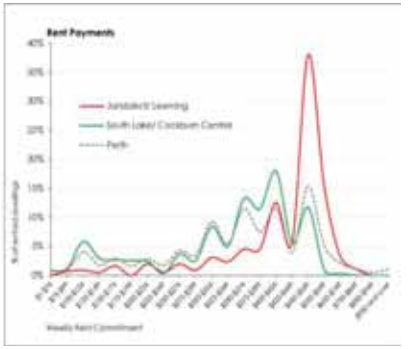
Jandakot/Leeming

- Significantly more dwellings owned outright without mortgage.
- Significantly less rented dwellings.
- Average mortgage repayments 4% above Perth averages.
- Average rent 21% above Perth averages.

South Lake/Cockburn Central

- Less dwellings owned outright.
- More dwellings with mortgage.
- More rented dwellings.
- Average mortgage repayments 14% below Perth averages.
- Average rent 10% below Perth averages.

FINANCIAL COMMITMENT PROFILES



3.3 Resident Retail Spending Profile

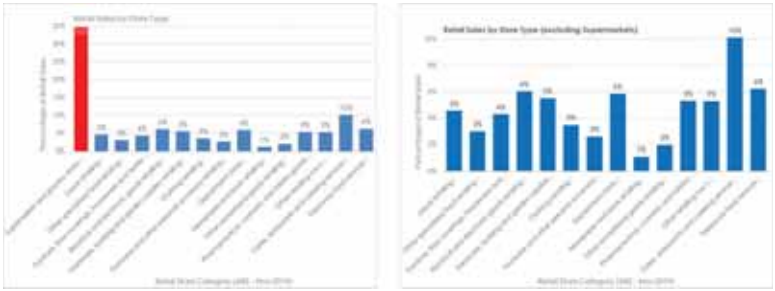
The estimated retail spending profiles for small areas across Australia can be extrapolated from a range of relevant data sources including:

- Retail Trade, Australia - 8501.0 (ABS monthly)
- Household Expenditure Survey, Australia – 65300.0 (ABS 2015/16)
- Consumer Price Index, Australia – 6401.0 (ABS monthly)
- Estimated Resident Population – 3101.0 (ABS Quarterly)
- Population and Household Census (ABS 2016)

The analysis of these data sources highlights several key spending patterns throughout Australia, including:

- Food/grocery retailers capture 41% of all resident retail spending.
    - 82% of this spending is captured by supermarkets.
    - 18% of this spending is captured by non-supermarket food/grocery retailers.
- Department Stores and DDS capture 6% of all resident retail spending (or 13% of all non-food/grocery retail spending),
- Cafes and restaurants capture 10% of all resident retail spending.
- Takeaway outlets capture 6% of all resident retail spending.

AVERAGE RETAIL SALES BY STORE TYPE



Retail Sales (ABS 2020)

AVERAGE RETAIL SALES BY STORE TYPE BY RETAIL CATEGORY

Retail Sales (ABS 2020)

These figures highlight the extent to which supermarkets dominate the capture of the food and grocery spending market in Australia. To further compound the limited spending available for non-supermarket food and grocery stores, the limited non supermarket food and grocery spending is mostly captured during the same trip to the supermarket which means that food and grocery retailers in supermarket-based centres capture most of this non supermarket-based food and grocery spending. It therefore follows that only a small percentage of this non supermarket food and grocery spending is available for local centres/stores which are not anchored by a supermarket.

Overall, the demographic profiles for the main resident catchment indicates an average supermarket spending of:

- $5,263 per capita in Jandakot - 16% above Perth average spending
- $5,209 per capita in Leeming - 15% above Perth average spending
- $4,058 per capita in South Lake - 10% below Perth average spending
- $4,016 per capita in Cockburn Central – 11% below Perth average spending

AVERAGE RETAIL SPENDING PER CAPITA PROFILE BY CATCHMENT BY RETAIL CATEGORY

Retail Store Category	Jandakot/ Glen Iris	South Lake	Cockburn Central	Leeming	Perth Average
Supermarket and Grocery sto	$5,263	$4,058	$4,016	$5,209	$4,526
Liquor	$691	$532	$527	$681	$585
Other Food	$407	$329	$327	$401	$361
Food and Grocery	$6,362	$4,920	$4,871	$6,291	$5,472
Household Goods	$3,016	$2,255	$2,229	$2,975	$2,538
Clothing & Fashion	$1,021	$700	$691	$991	$800
Department Stores	$1,113	$748	$738	$1,077	$866
Other	$1,735	$1,409	$1,399	$1,714	$1,528
Café, Restaurant, Takeaway	$2,472	$1,596	$1,566	$2,428	$1,915
Total Retail	$15,720	$11,628	$11,494	$15,476	$13,119

Household Expenditure Survey (ABS 2019)/Population and Household Census (ABS 2016) Retail Sales (ABS 2020)

VARIATION IN RETAIL SPENDING PROFILES to PERTH AVERAGES

Retail Store Category	Jandakot/ Glen Iris	Glen Iris GC	South Lake	Cockburn Central	Leeming
Supermarket and Grocery sto	16.3%	16.3%	-10.3%	-11.3%	15.1%
Liquor	18.1%	18.1%	-9.1%	-9.9%	16.2%
Other Food	12.8%	12.8%	-8.7%	-9.3%	11.2%
Food and Grocery	16.3%	16.3%	-10.1%	-11.0%	***15.0%***
Household Goods	18.8%	18.8%	-11.2%	-12.2%	*17.2%*
Clothing & Fashion	27.7%	27.7%	-12.5%	-13.6%	*23.9%*
Department Stores	28.6%	28.6%	-13.6%	-14.8%	*24.5%*
Other	13.6%	13.6%	-7.7%	-8.4%	*12.2%*
Café, Restaurant, Takeaway	29.1%	29.1%	-16.7%	-18.2%	***26.8%***
Total Retail	19.8%	19.8%	-11.4%	-12.4%	***18.0%***

Household Expenditure Survey (ABS 2019)/Population and Household Census (ABS 2016) Retail Sales (ABS 2020)

3.4 Resident Retail Spending Capacity

Based on these resident retail spending profiles for the catchment localities the aggregate resident supermarket spending capacity generated by residents within the main resident catchment is estimated to be $120M p.a. in 2021, including $15M in Jandakot, $56M p.a. in Leeming and $24M p.a. in South Lake.

Supermarket spending in the main resident catchment is forecast to grow by nearly $25M p.a. by 2026 and by an additional $78M p.a. by 2041.

New residents in the Glen Iris GC redevelopment are estimated to generate $2.1M p.a. in supermarket spending by 2026 and $7.8M p.a. when all resident dwellings are developed and occupied.

AGGREGATE SUPERMARKET SPENDING CAPACITY BY CATCHMENT BY YEAR

Year	Jandakot/ Glen Iris	Glen Iris GC	South Lake	Cockburn Central	Leeming	Treeby	Total
2016	$14.6	$0.0	$23.8	$6.3	$55.9	$5.3	$105.8
2021	$14.9	$0.0	$24.4	$8.1	$56.1	$17.2	$120.7
2026	$15.6	$2.1	$25.0	$14.9	$56.4	$30.8	$144.8
2031	$16.7	$5.0	$25.6	$20.4	$56.7	$47.3	$171.7
2036	$17.8	$7.8	$26.3	$25.0	$57.0	$55.8	$189.6
2041	$18.4	$7.8	$26.9	$28.9	$57.3	$58.9	$198.1

Household Expenditure Survey (ABS 2019)/Population and Household Census (ABS 2016) Retail Sales (ABS 2020)

A full line supermarket on average can capture $35M p.a. meaning that the forecast additional growth in catchment spending alone over the next 20 years is likely to generate sufficient supermarket sales to support up to the equivalent of two extra full line supermarkets in the catchment.

3.5 Other Retail Spending Markets

The limited employment generation, passing trade and visitor accommodation and attractions in and around Glen Iris, limits the likelihood of a retail centre generating significant sales from these other non-resident consumer markets.

4 RETAIL MARKET CAPACITY

This section assesses the influences of the current and planned centres network, resident needs and spending capacity within the resident catchment to determine the ability of a potential Neighbourhood Centre or Local Centre to be developed sustainability within the Glen Iris development.

It does this by determining the likely market capture of annual supermarket spending that a supermarket of a particular size is likely to capture from each catchment and comparing it to the average volume of retail sales thought to be needed to remain viable in the market.

This paper considers the development potential for:

- Opportunity 1 - a full line (3,500 sqm) supermarket-based Neighbourhood Centre.
- Opportunity 2 – a small supermarket (1,500 sqm) based Local Centre.

4.1 Full line Supermarket Opportunity

The modelling of the full line supermarket opportunity shows that a 3,500 sqm supermarket at Glen Iris could expect to capture 14% of the total resident catchment supermarket spending including:

- 70% of supermarket spending generated by Jandakot/Glen Iris/Glen Iris GC residents.
- 9% of supermarket spending generated by South Lake residents.
- 6% of supermarket spending generated by Leeming residents.
- 5% of supermarket spending generated by Treeby residents.
- 2% of supermarket spending generated by Cockburn Central residents.

In 2026, this market capture would produce supermarket sales of $19.6M p.a. at an average sales productivity of $5,600/sqm p.a. Up to 63% of all supermarket sales would expect to be captured from Jandakot/Glen Iris (56%) and the early residents in the redevelopment (7%) as well as 17% of sales from Leeming residents and 11% from South Lake residents.

	Catchment						
2026	Jandakot/ Glen Iris	Glen Iris GC	South Lake	Cockburn Central	Leeming	Treeby	Total
Spending Capacity ($M p.a.)	$15.6	$2.1	$25.0	$14.9	$56.4	$30.8	$144.8
Market Capture by Glen Iris (%)	70%	70%	9%	2%	6%	4%	14%
Sales Captured ($M p.a.)	$10.9	$1.5	$2.2	$0.3	$3.3	$1.4	$19.6
Contribution to Sales (%)	56%	7%	11%	2%	17%	7%	100%

Supermarket Size	3,500
Sales Productivity ($/sqm p.a.)	$5,607

Running the model without Treeby Neighbourhood Centre by 2026 shows that the sales at a potential centre in Glen Iris increase by $1.8M p.a. an increase of total sales to $21.4M p.a.

By 2031, the market capture would be responsible for generating $23.3 M p.a. at an average sales productivity of $6,700/sqm p.a. These sales would rely mainly on the immediate Jandakot/Glen Iris catchment (65%) including new residents forming the redevelopment (contributing 15%). The continued redevelopment of Glen Iris correlates to a decrease in reliance on Leeming (15%) and South Lake (10%) and Treeby (9%) for sales.

Running the model without Treeby Neighbourhood Centre by 2031 shows that the sales at a potential centre in Glen Iris increase by $2.5M p.a. an increase of total sales to $25.8M p.a.

2031	Jandakot/ Glen Iris	Glen Iris GC	South Lake	Cockburn Central	Leeming	Treeby	Total
Spending Capacity ($M p.a.)	$16.7	$5.0	$25.6	$20.4	$56.7	$47.3	$171.7
Market Capture by Glen Iris (%)	70%	70%	9%	2%	6%	4%	14%
Sales Captured ($M p.a.)	$11.7	$3.5	$2.3	$0.4	$3.4	$2.1	$23.3
Contribution to Sales (%)	50%	15%	10%	2%	14%	9%	100%

Supermarket Size	3,500
Sales Productivity ($/sqm p.a.)	$6,667

By 2036, the market capture could produce $26.6 M p.a. at an average sales productivity of nearly $7,600/sqm p.a. Residents forming Jandakot/Glen Iris (47%) and the redevelopment of Glen Iris (20%) are responsible for contributing over two thirds of all supermarket sales.

It may be reasonably expected that Treeby will be developed by 2036.

2036	Jandakot/ Glen Iris	Glen Iris GC	South Lake	Cockburn Central	Leeming	Treeby	Total
Spending Capacity ($M p.a.)	$17.8	$7.8	$26.3	$25.0	$57.0	$55.8	$189.6
Market Capture by Glen Iris (%)	70%	70%	9%	2%	6%	4%	14%
Sales Captured ($M p.a.)	$12.4	$5.5	$2.3	$0.5	$3.4	$2.5	$26.6
Contribution to Sales (%)	47%	21%	9%	2%	13%	9%	100%

Supermarket Size	3,500
Sales Productivity ($/sqm p.a.)	$7,597

By 2041, the sales potential does not increase dramatically suggesting that the ultimate sales potential for the full line supermarket is about $27.3M p.a. at an average sales productivity of over $7,800sqm/p.a. Sales contribution by catchment remains steady as two thirds of all supermarket sales are captured by the immediate catchment.

	Catchment						
2041	Jandakot/ Glen Iris	Glen Iris GC	South Lake	Cockburn Central	Leeming	Treeby	Total
Spending Capacity ($M p.a.)	$18.4	$7.8	$26.9	$28.9	$57.3	$58.9	$198.1
Market Capture by Glen Iris (%)	70%	70%	9%	2%	6%	4%	14%
Sales Captured ($M p.a.)	$12.8	$5.5	$2.4	$0.6	$3.4	$2.6	$27.3
Contribution to Sales (%)	47%	20%	9%	2%	12%	10%	100%

Supermarket Size	3,500
Sales Productivity ($/sqm p.a.)	$7,793

These annual sales figures are below the average thought to be attractive to a major supermarket operator. However, the opportunity to capture sales from competitors or create a saturation distribution strategy, or even a desire to keep a competitor out of a particular market may result in these lower-than-average sales figures being sufficient to warrant consideration.

4.2 Small Supermarket Opportunity

The modelling of the small supermarket opportunity over time reveals that a small supermarket has the potential to capture 5% of the total resident catchment supermarket spending including 32% of Jandakot/Glen Iris and Glen Iris GC redevelopment residents. The smaller supermarket option has less draw power and trade to a more localised catchment. It is subsequently estimated to generate between 1%-2% of the market capture from the other communities in the main resident catchment.

Based on these capture rates, in 2026, a small supermarket has the potential to generate $7.2M p.a. at an average sales productivity of $4,700/sqm p.a.

Running the model without Treeby Neighbourhood Centre shows that the sales at a potential centre in Glen Iris increase by $600,000 p.a. an increase of total sales to $7.7M p.a.

2026	Jandakot/ Glen Iris	Glen Iris GC	South Lake	Cockburn Central	Leeming	Treeby	Total
Spending Capacity ($M p.a.)	$15.6	$2.1	$25.0	$14.9	$56.4	$30.8	$144.8
Market Capture by Glen Iris (%)	32%	32%	2%	0%	1%	1%	5%
Sales Captured ($M p.a.)	$5.0	$0.7	$0.4	$0.1	$0.6	$0.3	$7.1
Contribution to Sales (%)	71%	10%	6%	1%	9%	4%	100%

Supermarket Size	1,500
Sales Productivity ($/sqm p.a.)	$4,721

By 2031, the increase in supermarket spending within the main resident catchment can generate $8.5M p.a. in retail sales at an average sales productivity of $5,700/sqm p.a. As expected, a smaller supermarket would rely mainly on the immediate Jandakot/Glen Iris community generating (82%) of all sales Including 19% of all sales contributed from new residents in the redevelopment area.

Running the model without Treeby Neighbourhood Centre shows that the sales at a potential centre in Glen Iris increase by $700,000 p.a. an increase of total sales to $9.2M p.a.

2031	Jandakot/ Glen Iris	Glen Iris GC	South Lake	Cockburn Central	Leeming	Treeby	Total
Spending Capacity ($M p.a.)	$16.7	$5.0	$25.6	$20.4	$56.7	$47.3	$171.7
Market Capture by Glen Iris (%)	32%	32%	2%	0%	1%	1%	5%
Sales Captured ($M p.a.)	$5.4	$1.6	$0.4	$0.1	$0.7	$0.4	$8.5
Contribution to Sales (%)	63%	19%	5%	1%	8%	5%	100%

Supermarket Size	1,500
Sales Productivity ($/sqm p.a.)	$5,688

By 2036, the increased in supermarket spending should be capable of producing sales of $9.9M p.a. at an average sales productivity of $6,600/sqm p.a. These sales are still predicated on capturing 82% of all sales from Jandakot/Glen Iris (58% of all sales) and Glen Iris GC (25%).

It may be reasonably expected that Treeby will be developed by 2036.

2036	Jandakot/ Glen Iris	Glen Iris GC	South Lake	Cockburn Central	Leeming	Treeby	Total
Spending Capacity ($M p.a.)	$17.8	$7.8	$26.3	$25.0	$57.0	$55.8	$189.6
Market Capture by Glen Iris (%)	32%	32%	2%	0%	1%	1%	5%
Sales Captured ($M p.a.)	$5.7	$2.5	$0.5	$0.1	$0.7	$0.5	$9.9
Contribution to Sales (%)	58%	25%	5%	1%	7%	5%	100%

Supermarket Size	1,500
Sales Productivity ($/sqm p.a.)	$6,585

Finally, by 2041 a 1,500sqm supermarket is forecast to ultimately be capable of generating $10.1M p.a. at an average sales productivity of $6,750/sqm p.a. maintaining the same reliance on the immediate resident catchment.

2041	Jandakot/ Glen Iris	Glen Iris GC	South Lake	Cockburn Central	Leeming	Treeby	Total
Spending Capacity ($M p.a.)	$18.4	$7.8	$26.9	$28.9	$57.3	$58.9	$198.1
Market Capture by Glen Iris (%)	32%	32%	2%	0%	1%	1%	5%
Sales Captured ($M p.a.)	$5.9	$2.5	$0.5	$0.1	$0.7	$0.5	$10.1
Contribution to Sales (%)	58%	25%	5%	1%	7%	5%	100%

Supermarket Size	1,500
Sales Productivity ($/sqm p.a.)	$6,743

4.3 Implications

Analysis suggests that both the full line supermarket-based neighbourhood centre opportunity or the small supermarket based local centre opportunities may ultimately be viable as part of the Glen Iris redevelopment. However, it is more likely that a smaller supermarket-based centre presents the best commercial opportunity for the development.

The forecast sales potential for the small supermarket are expected to reach industry averages by 2036. However, it is not unusual for a smaller centre to be developed slightly ahead of sales expectations to establish trading patterns and shopper loyalty as the immediate catchment develops, meaning that the small supermarket option could be developed between 2026-2031.

The figures also indicate that Treeby is expected to generate sufficient dwellings, population, and supermarket spending to ultimately support two supermarkets. Whilst the planning for Treeby includes the potential for a single supermarket-based centre, the introduction of a second supermarket at Treeby would have the potential to impact sales forecast for Glen Iris.

5 DEVELOPMENT OPPORTUNITIES

This section considers the implications for the supermarket development on the overall centre type sustainable within the Glen Iris development.

Large supermarkets (3,500sqm) are typically able to sustain a centre which contains between 10 and 20 shops (totalling between 1,000sqm and 2,000sqm) creating a neighbourhood centre of between 4,500sqm and 5,500sqm). There are larger and smaller centres of this nature – but on average most neighbourhood centres fall within this size range.

Smaller supermarkets between 750sqm and 1,500sqm are typically able to sustain between 5 and 10 shops (totalling between 750sqm and 1,000sqm) creating a small neighbourhood centre of between 1,500sqm and 2,500sqm. Despite the policy demand for the allocation of local centres of between 500sqm and 1,000sqm, it is increasingly rare to see a local centre with 5 to 10 shops developed without a small supermarket to anchor it. A local centre without a supermarket operator is often more likely to comprise a single café/deli of up to 250sqm.

	Large Supermarket based Centre	Small Supermarket based Centre
Supermarket	3,500sqm	750sqm – 1,500sqm
Shops	10 - 20	5 - 10
Shop Floorspace (sqm)	1,000 sqm – 2,000sqm	750sqm – 1,000sqm
Total	4,500sqm – 5,500sqm	1,500sqm – 2,500sqm

These development typologies are important when considering the size and nature and sustainability of a centre planned to be introduced into the activity centres network. Planning for activity centres in a network without consideration for the likely commercial and development demand as well as the market demand may lead to unrealistic expectations in relation to future delivery of retail activity in the node. Not all retail centres follow these typologies, however, the further they depart from these models the greater the commercial risk to the sustainability of the centre.

5.1 Economic Impacts

Another important consideration in planning for the delivery of a Neighbourhood Centre is the impact that it may have on the performance of other centres. This section considers the economic impacts and implications for each development opportunity.

State Planning Policy 4.2 – Activity Centre – Perth and Peel require an economic test to be applied for:

- Existing centres - increase in size by more than 6,000sqm on their original allocated floor space assess the extent to which a new development may impact on the existing infrastructure and network.
- Proposed Centres – that have not or do not form part of the District, Local planning framework or Retail Needs Planning completed for the area.

A general rule of thumb (expected to be further endorsed by draft changes to the policy) is that 10% impact on the sales of a centre is considered a high impact while 5% impact is moderate and 2.5% is considered low impact.

The following assessments show the difference in sales at supermarkets in centres as if the planned centre were developed and not developed and consider the sales variation in the context of overall decrease in sales for the entire centre.

To compare the direct impacts of a centre on the network, the entire centre network is modelled for each year with and without the planned centre included in the network. This way the sales figures for the centre network can be assessed for sales growth from resident population growth.

5.2 Full Line Supermarket Impacts

In 2031 a full line supermarket (3,500sqm) opportunity capable of capturing $23.2M p.a. in sales at Glen Iris would effectively need to capture these sales from other surrounding centres, including:

- Cockburn Central $7.7M p.a. (6.8%) impact on annual sales
- Willetton $4.6M p.a. (5.1%) impact on annual sales
- South Lake $3.0M p.a. (5.2%) impact on annual sales

It should be noted that by 2031 all these supermarkets will be trading better than they are currently due to the forecast growth in resident population and subsequently resident retail spending capacity in the resident catchment.

It should also be noted that because a full line supermarket is expected to capture 70% of all new resident spending from the Glen Iris redevelopment – that 30% of all supermarket spending by new residents will therefore be expected to be captured by existing supermarkets in the centres network.

POTENTIAL SALES IMPACT by CENTRE – Full Line Supermarket Impacts

2031

	without centre		*with centre*		*Impact*	
Centre Name	Estimated Annual Supermarket Sales (all sources including outside the catchments)	Estimated Required Sustainble Sales Productivity ($/sqm p.a.)	Estimated Annual Supermarket Sales (all sources)	Estimated Change in Required Sustainble Supermarket Sales Productivity ($/sqm p.a.)	Potential Supermarket Sales Impact ($M p.a.)	Potential Supermarket Sales Impact (%)
Cockburn Central	$113.1	$13,303	$105.4	$12,396	-$7.7	-6.8%
Ale	$30.1	$12,054	$29.5	$11,789	-$0.7	-2.2%
South Lake	$58.5	$11,701	$55.5	$11,096	-$3.0	-5.2%
Bull Creek	$38.6	$11,035	$37.3	$10,668	-$1.3	-3.3%
Willeton	$89.9	$12,836	$85.3	$12,181	-$4.6	-5.1%
Livingstone	$83.8	$11,978	$81.4	$11,622	-$2.5	-3.0%
Spudshed (Jandakot)	$21.6	$10,814	$21.0	$10,512	-$0.6	-2.8%
Atwell	$19.1	$19,085	$19.0	$18,994	-$0.1	-0.5%
Bibra Lake	$8.0	$7,957	$7.9	$7,890	-$0.1	-0.8%
Leeming	$6.5	$6,452	$6.3	$6,275	-$0.2	-2.8%
Proposed Berrigan Quarter	$5.1	$6,810	$5.0	$6,621	-$0.1	-2.8%
Proposed Treeby	$32.3	$9,228	$29.9	$8,547	-$2.4	-7.4%
Competing Centres	$506.6	$11,849	$483.3	$11,306	-$23.2	-4.6%
Glen Iris (Subject Centre)	*$0.0*	*$0*	*$23.2*	*$6,633*	*$23.2*	*n/a*
All Centres	$506.6		$506.6		$0.0	

Taktics4 Retail Sales Model (2021)

5.3 Small Supermarket Impacts

In 2031 a smaller supermarket (1,500sqm) opportunity capable of capturing $8.7Mp.a. in sales at Glen Iris would effectively need to capture these sales from other surrounding centres, including:

- Cockburn Central $2.9M p.a. (2.6%) impact on annual sales
- Willetton $1.7M p.a. (1.9%) impact on annual sales
- South Lake $1.1M p.a. (1.9%) impact on annual sales

It should be noted that by 2031 all these supermarkets will be trading better than they are currently due to the forecast growth in resident population and subsequently resident retail spending capacity in the resident catchment.

It should also be noted that because a smaller supermarket is expected to capture 32% of all new resident spending from the Glen Iris redevelopment – that 68% of all supermarket spending by new residents will therefore be expected to be captured by existing supermarkets in the centres network.

POTENTIAL SALES IMPACT by CENTRE – Small Supermarket Impacts

2031

	without centre		*with centre*		*Impact*	
Centre Name	Estimated Annual Supermarket Sales (all sources including outside the catchments)	Estimated Required Sustainble Sales Productivity ($/sqm p.a.)	Estimated Annual Supermarket Sales (all sources)	Estimated Change in Required Sustainble Supermarket Sales Productivity ($/sqm p.a.)	Potential Supermarket Sales Impact ($M p.a.)	Potential Supermarket Sales Impact (%)
Cockburn Central	$113.1	$13,303	$110.1	$12,958	-$2.9	-2.6%
Ale	$30.1	$12,054	$29.9	$11,951	-$0.3	-0.8%
South Lake	$58.5	$11,701	$57.4	$11,483	-$1.1	-1.9%
Bull Creek	$38.6	$11,035	$38.2	$10,905	-$0.5	-1.2%
Willeton	$89.9	$12,836	$88.2	$12,597	-$1.7	-1.9%
Livingstone	$83.8	$11,978	$82.9	$11,849	-$0.9	-1.1%
Spudshed (Jandakot)	$21.6	$10,814	$21.4	$10,697	-$0.2	-1.1%
Atwell	$19.1	$19,085	$19.1	$19,050	$0.0	-0.2%
Bibra Lake	$8.0	$7,957	$7.9	$7,933	$0.0	-0.3%
Leeming	$6.5	$6,452	$6.4	$6,388	-$0.1	-1.0%
Proposed Berrigan Quarter	$5.1	$6,810	$5.1	$6,737	-$0.1	-1.1%
Proposed Treeby	$32.3	$9,228	$31.6	$9,016	-$0.7	-2.3%
Competing Centres	$506.6	$11,849	$498.1	$11,651	-$8.5	-1.7%
Glen Iris (Subject Centre)	*$0.0*	*$0*	*$8.5*	*$5,640*	*$8.5*	*n/a*
All Centres	$506.6		$506.6		$0.0	

Taktics4 Retail Sales Model (2021)

These results suggest that a small supermarket based local centre is less likely to cause an economic impact on surrounding centres network.

5.4 Commercial Implications

Given the current network framework and store distribution patterns in the area:

- It may be difficult to attract a full line supermarket operator (Coles or Woolworths) to Glen Iris. Coles and Woolworths both have a strong presence in the surrounding catchments.
- The forecast lower sales and sales productivity expectations would be likely to reduce the attractiveness together with the fact that some of these sales would be captured from existing stores in the network.
- Aldi is already located to the west and south of the catchment and is unlikely to be interested in a store in Glen Iris based on their current spatial planning and store rollout plans.
- This leaves the opportunity for an independent operator under the IGA banner to locate in the local centre.

Current Australian shopping centre development economics demand that the development of a 2,500sqm supermarket-based centre is only economically viable if it is developed as a single development entity. This approach ensures that the local centre can be designed and developed in a manner which generates the tenant mix, foot traffic and subsequent rental income necessary to be viable in the short term and sustainable in the long term.

The proposed supermarket based local centre in Glen Iris will not undermine the existing 300sqm of retail floor space in Berrigan Drive. On the contrary, the proposed small supermarket anchored local centre will be expected to assist the economic opportunities for existing retailers in Berrigan Drive by facilitating more retail trips by locals to the proposed local centre, subsequently increasing exposure, awareness, and potential sales for existing retailers by residents who are currently travelling elsewhere for most of their shopping trips. Reciprocity and shared access to car parking between the existing retail in Berrigan Drive and the proposed local centre may further facilitate these opportunities for existing retailers.

5.5 Policy Implications

SPP 4.2 establishes clear parameters in relation to the introduction of new centres.

It acknowledges that its responsibility predominantly lies with the allocation and spatial distribution of District centres and above. Neighbourhood Centres and Local Centres are more likely to be spatially allocated by the relevant Local Government Authority.

Neighbourhood Centres are more likely to be allocated during the District Structure Planning process, while Local Centres are more likely to be spatially allocated and assessed during the Local Structure Planning process.

Subsequently, it is likely that a Neighbourhood Centre allocated during the Local Structure Planning process would be less likely to be accepted as good and proper planning by the relevant planning authorities.

The potential impacts associated with a full line supermarket-based centre at Glen Iris would also make it less favourable at an authority level and be more likely to attract opposition and intervention at a competitor level as well as a LGA and State Planning Authority.

A Local Centre with a small supermarket-based centre is subsequently more likely to be acceptable by relevant authorities, especially given the low impact results associated with the smaller centre size.

5.6 Summary/Recommendations

The analysis of the retail and consumer markets influencing the potential development of a centre at Glen Iris indicate that a small supermarket based local centre is the most suitable development opportunity. A small supermarket based local centre would be likely to comprise:

SMALL SUPERMARKET BASED CENTRE – Development Characteristics

Supermarket	***1,500sqm***
Shops	*5 - 10*
Shop Floorspace (sqm)	*1,000sqm*
Total	***2,500sqm***

A proposed local centre in Glen Iris:

- could expect to be trading prior to 2031.
- may be contained within an allocated commercially zoned parcel of land totalling 0.70Ha.
- will rely on capturing 32% of all supermarket spending from its immediate Jandakot/Glen Iris catchment and 5% of the total catchment supermarket spending.
- Would result in minor sales impacts on the surrounding existing supermarket-based centre network.
- will complement the existing commercial activity in the vicinity rather than compete with it.
- is in addition to the 300sqm of retail floor space currently provided within the vicinity of the proposed shopping centre location.

GLEN IRIS ESTATE

APPENDIX 14
LOCAL CENTRE CONCEPT PLAN

LOCAL CENTRE SITE - INDICATIVE CONCEPT ONLY

GLEN IRIS ESTATE

JANDAKOT

N

0 20m

SCALE @ A3: 1:500

9166-FIG-38-B

DRAWN: JS
DATE CREATED: 2023.08.30
PROJECTION: MGA50 GDA94
CADASTRE: LANDGATE

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ROWE GROUP DESIGN

GLEN IRIS ESTATE

APPENDIX 15
ENGINEERING SERVICES REPORT

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Engineering Servicing Report

GLEN IRIS ESTATE

Acumen Development Solutions

On behalf of Eastcourt Property Group

JDS201817_Rev E

August 2023

INTEGRITY

We are open, honest, and consistent in our principles and conduct, so we're able to build trusted relationships with our clients and partners.

RESPECT

We treat everyone with respect and dignity and develop relationships founded on understanding and trust.

ACCOUNTABILITY

We always assume responsibility for our actions and make decisions in line with our economic, social, and ethical obligations.

EXCELLENCE

We pursue excellence in everything we do, challenging ourselves to look beyond the obvious and ensure ongoing improvement.

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DOCUMENT REVIEW					
Revision	Date Issued	Issue Type	Written By	Reviewed By	Approved By
Rev A	02/06/2021	For Information	BT	SF	BT
Rev B	17/06/2021	For Information	KM	DAH	DAH
Rev C	06/09/2021	For Information	BT	SF	BT
Rev D	16/03/2022	For Information	BT	SF	BT
Rev E	03/08/2023	For Information	BT	SF	BT

1 Introduction and Key Objectives

JDSi Consulting Engineers (JDSi) have been commissioned by Acumen Development Solutions (Acumen). to prepare the Engineering Servicing Report to support a Scheme Amendment and Local Structure Plan application for the proposed residential subdivision across the land holding. JDSi understand the proposed development consists of the following:

- 550 dwellings.
- Small local retail lot abutting Berrigan Drive.
- Public Open Space (POS) and new road and pedestrian networks.

Refer ***Appendix A*** Structure Plan.

The investigations undertaken and preparation of the report have been largely based on desktop studies and some preliminary advice from the service authorities. The information is current as of May 2021 and may be subject to change as development progresses in the area.

The report summarises the results of a review of the civil and electrical engineering related elements of the development:

The key objectives of this report are to:

- Provide commentary on the proposed development and background to the existing site location and conditions.
- Provide commentary on any earthworks and remediation required within the development area.
- Provide commentary on the existing roads, drainage and utility services infrastructure within the vicinity of the development.
- Provide commentary on the proposed road network and any upgrades required to facilitate the proposed development.
- Provide commentary on the overall stormwater drainage strategy for the proposed development.
- Document the Water Corporation's servicing requirements for sewer and water reticulation.
- Document Western Power's servicing requirements for electrical reticulation.
- Document servicing requirement for telecommunication and gas reticulation.

2 Study Area

The proposed Development site is 53.74 ha in size and is located on the former Glen Iris Golf Course in Jandakot. It is located approximately 17km south of Perth on the east side of the Kwinana Freeway, within the City of Cockburn.

The site is generally bounded by existing residential properties, with Glen Iris Drive to the north and west; Dean Road and Prinsep Road to the east; Turnbury Drive and The Lakes Boulevard to the west; and Imlah Court to the south. Berrigan Drive dissects the lower third of the site in an east-west direction, whilst a pedestrian underpass under Berrigan Drive connects the northern and southern portions of the site. Twin Water Pass dissects the northern third of the site via an overpass, from Dean Road to the east, to provide road access to a section of residential properties located centrally in the site.

A portion of former road reserve, being an extension off Hartwell Parade, dissects the site north of Berrigan Drive however this portion does not contain any constructed roadway. A number of existing services are located in this portion of unconstructed road reserve. In addition, there are a number of existing services and corresponding easements located within the site, including sewer, drainage, gas and power.

The site is predominantly cleared due to its former golf course use with some existing low vegetation, native and larger trees along the external boundaries and along edges of former fairways. Some existing, man-made lakes are present on the site however it understood these have recently been drained due to safety concerns and to conserve groundwater that was used for replenishment.

The site is generally contained by 1.8m high chain mesh fencing where abutting public roads and existing limestone retaining walls and residential style fencing where abutting the existing residential private properties.

Figure 1: Site Location

2.1 Topography

A topographical survey for the site has been undertaken by MNG and indicates that the existing surface levels vary from approximately 43.0mAHD in the north, 26.0mAHD in the centre of the site and 24.0mAHD in the south of the site. Some lower elevations of about 24.0mAHD exist in the vicinity of the man-made lakes. The site is generally undulating with some steeper slopes present along the extremities of the land holding in the northern section of the site.

Refer ***Appendix B*** Feature Survey.

2.2 Groundwater

The site is included in the Department of Water and Environmental Regulation's online Perth Groundwater Atlas. Based on post 1990 groundwater levels the Average Annual Maximum Groundwater Level (AAMGL) varies across the site, from approximately 24mAD in the south-east corner to 21mAHD in the north-west corner. Groundwater flow is generally in a north-westerly direction.

JDSi understand that Hyd2o have been commissioned to undertake further hydrological studies on the site, including detailed assessment of groundwater levels to inform the development.

Figure 2: AAMGL – Hyd2o

The subject area falls within the Jandakot Underground Water Pollution Control Area UWPCA). Developers within a UWPCA need to fulfill their legal responsibilities including those covering 'land use' planning, environmental, health and building permit matters. The Department of Water and Environmental Regulation is responsible for managing and protecting Western Australia's water resources. The subject area is also affected by several 300m Wellhead Protection Buffers. These buffers are declared to protect the quality of groundwater being extracted for drinking water. In these zones' groundwater moves rapidly towards wells and any surface contamination moving through the soil could find its way into scheme water supplies. Activities and land uses in these areas are restricted and subject to the Department of Water and Environmental Regulation approval processes in accordance with the Western Australian Planning Commissions current State Planning Policy 2.7.

2.3 Geological Conditions

Published geological maps (Ref. Perth Metropolitan Region 1:50,000 Environmental Geology Series: Fremantle) for the area depict the land as being underlain by Bassendean Sand overlying clayey and silty material of the Guildford Formation at depth.

A detailed Geotechnical Site Investigation, in accordance with AS1726, was completed by CMW Geosciences Pty Ltd between 30 November and 2 December 2020. The scope of fieldwork completed was as follows:

- A walkover survey of the site to assess the general landform, site conditions and adjacent structures;
- 55 test pits, denoted TP01 to TP55, were excavated to depths of up to 2.2m using a JCB 8.5 tonne backhoe fitted with a 450mm wide toothed bucket to investigate the underlying soil conditions, facilitate sampling for laboratory testing and to assess excavatability and earthworks recommendations.
- Perth Sand Penetrometer (PSP) tests were carried out adjacent to each test pit, in general accordance with AS1289.6.3.3, to depths of up to 2.1m to provide soil density/consistency profiles and to provide a subgrade CBR value for pavement design purposes.
- 8 hand auger boreholes were drilled with a 100mm diameter auger to a depth of up to 1.42m to facilitate infiltration testing.

Refer ***Appendix C*** for a copy of the full Geotechnical Site Investigation Report.

The ground conditions encountered and inferred from the investigation were considered to be generally consistent with the published geology for the area and can be generalised according to the following subsurface sequence:

- **TOPSOIL:** dark grey, brown, fine to medium grained, subangular to subrounded sand with trace fines (>12% in TP48); trace organics; trace roots and rootlets; trace branches; trace vegetation, overlying;
- **FILL: SAND (UNCONTROLLED)** loose to very dense, fine to medium grained, subangular to subrounded; grey/pale yellow and orange-brown; trace fine grained limestone gravel (TP04, TP20); trace fines; trace organics; trace roots and rootlets; trace branches. Uncontrolled fill in the form of old reticulation pipe and bricks were found in TP04, TP18, TP28 and TP34. The reticulation pipe uncovered in TP28 and TP34 contained potential asbestos between depth of 0.5 and 1.6 mbgl, overlying;
- **SAND (SP)**: loose to very dense, fine to medium grained, subangular to subrounded; grey/orange/yellow and white; trace fines; trace roots and rootlets, overlying;
- **COFFEE ROCK**: very dense, fine to medium grained, subangular to subrounded, dark brown/black; weakly cemented. (Only found in TP03 TP06, TP12 and TP52). The coffee rock was typically found in or around low energy zones (lakes) located across the site where groundwater may be present.

2.4 Acid Sulphate Soils

Acid Sulphate Soil mapping compiled by Department of Water and Environmental Regulation indicates the site is generally located within an area of "*moderate to low risk of acid sulphate soils occurring within 3 m of natural soil surface*". All excavation works and dewatering in ASS must be carefully managed to avoid any potential damage to surrounding land and water ways.

Figure 3: WAPC ASS Mapping

3 Construction Management

As part of the construction management process the Contractor will need to undertake a number of pre-construction processes, including but not limited to:

3.1 Dilapidation Report

All property owners deemed to be in close proximity to the staged works will be offered an opportunity for a dilapidation report, also known as a property condition report, to be undertaken on their property. This will record the state of the property prior to commencement of works and identify any pre-existing damage and can therefore be used as a baseline against any claims of damage by the property owner. In addition to the Dilapidation Report the Contractor will be required to take out applicable Contract Works insurance and Public Liability Insurance.

3.2 Dust, Noise and Vibration Management Plan

The Contractor will be required to submit for approval a Dust, Noise and Vibration Management Plan to the Local Authority. This will detail the works, construction methodologies and mitigation measures to be implemented in order to comply with relevant legislation and industry codes of practice relating to Dust, Noise and Vibration on construction sites.

3.3 Health, Safety and Environmental Management Plan

The Contractor will be required to submit for approval a Health, Safety and Environmental Management Plan to the Local Authority. This will detail the works, construction methodologies and mitigation measures to be implemented in order to comply with relevant legislation and industry codes of practice relating to Health, Safety and Environment on construction sites.

3.4 Traffic Management Plan

The Contractor will be required to submit for approval a Traffic Management Plan to the Local Authority and/or Main Roads WA where works are being undertaken within public road reserves. This will detail the works areas, working times, road closures and traffic management controls to be implemented whilst working in public road reserves. This plan will consider both vehicle traffic and pedestrian traffic in the vicinity of the works areas.

4 Demolition and Earthworks

4.1 Demolition & Clearing

The existing, large mature trees will form an important asset to the proposed Development. To ensure the protection and integration of existing vegetation a tree retention plan will be implemented which will require the identification and flagging of all trees and vegetation to be retained prior to any earthworks occurring on site. Tree Protection Zones, as prescribed by AS4970, will be established and maintained throughout the works via the use of bunting and fencing where applicable. Any works undertaken within the nominated Tree Protection Zones will be undertaken in consultation with the project Arborist to preserve the health and viability of the retained trees. Clearing areas and any trees to be removed will be marked prior to earthworks commencing and all nominated trees and vegetation will be removed carefully so as to not disturb foliage and roots of any adjoining trees.

Any redundant infrastructure, fencing, scrap material or rubbish located on the site will need to be removed and disposed of to an approved tipping location prior to works on site. It is understood that the existing Clubhouse building will be demolished as part of the works. A specific demolition methodology should be implemented for this process.

Any Presumed Asbestos Containing Material (PACM) encountered during the works will trigger a notification by the Contractor in accordance with a site specific “Unexpected Finds Protocol”. Works in the area will cease immediately and the area will be cordoned off and made safe. The projects Environmental Consultant will then provide a methodology to remove and dispose of the material safely to an approved waste handling facility and provide a validation report upon completion of any remediation. All works relating to PACM will be undertaken in accordance with:

- National code of practice for the safe removal of asbestos 2nd edition [NOHSC:2002(2005)], and
- Department of Health’s Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (2009)

4.2 Earthworks

To complete bulk earthworks required for the Development the following construction methodology is recommended:

- Identification and protection of all trees to be retained, prior to removal of nominated trees and grubbing of roots.
- Vegetation and turf removal including grubbing of roots within clearing areas.
- Stripping of topsoil (approx. 100mm thick) for reuse in POS or non-structural areas of the site.
- Tyne the top 400mm of the surface to expose any uncontrolled fill or waste materials for removal.
- Moisture condition and recompact the tyned surface.
- Cut to fill operations across the site, including moisture conditioning and compaction to achieve the target density.

All bulk earthwork operations should be witnessed by a suitably qualified Geotechnical Engineer and control testing undertaken in accordance with AS3798.

Further information related to bulk earthworks can be found in the CMW Geosciences Pty Ltd Geotechnical Investigation Report (Refer ***Appendix C***).

Engineering Servicing Report
Glen Iris Estate
JDS201817

5 Wastewater Reticulation

The Water Corporation owns and maintains the wastewater reticulation network in the area.

Planning advice received from the Water Corporation confirms that the Development is currently within both the Bibra Lake and Jandakot Sewer District (SD). Based on the existing contours, a small area of the site north of Berrigan Drive (highlighted in yellow on Figure 4) is currently included in the Bibra Lake SD, however this will be changed to the Jandakot SD catchment, and would be served by Glenbawn Drive Sewer Pump Station instead of the Virgilia Terrace Sewer Pump Station.

Water Corporation have advised that there are numerous upgrades required to downstream headworks infrastructure including collection sewers, pump stations and pressure mains however these works will be undertaken by Water Corporation as the Development progresses and new flows come online. Standard Water Corporation per lot headworks charges will be paid by the Developer to fund infrastructure upgrade works.

As a result of the proposed Development there is a reticulation sewer that is downstream of the Development that may need to be upgraded as development progresses. Approximately 825m of existing DN225 reticulation sewer from manhole number T9948 to S0697 may need to be upgraded to DN300 (refer Figure 5 for location). The Developer will need to liaise with the Water Corporation for any upgrade works to external infrastructure.

All new wastewater works installed for the Development will need to be designed and constructed in accordance with Water Corporations guidelines, including the Developers Manual and Design and Construction Requirements for Gravity Sewer DN150 to SN600 (DS50). It is noted that there are numerous live wastewater lines located within the Development site and these are covered by existing easements in favour of the Water Corporation. The Development layout and construction methodologies will need to consider the location of these services throughout the Development process in order to maintain services to all existing properties.

Figure 4: Water Corporation Sewer Catchments

6 Water Reticulation

The Water Corporation owns and maintains the potable water reticulation network in the area.

Based on planning advice received from the Water Corporation, to accommodate the new subdivision, upgrades will be required to headworks infrastructure including existing distribution mains however these works will be undertaken by Water Corporation as the Development progresses. Standard Water Corporation per lot headworks charges will be paid by the Developer to fund infrastructure upgrade works.

To service the new subdivision a typical water reticulation network will be installed within the new road reserves and it is expected that both the northern and southern sections of the site will be connected to the existing DN500 distribution main located in Berrigan Drive. Water Corporation has indicated both mains will need to be DN150. Water Corporation provided the below sketch indicatively showing the DN150 for the southern portion of the site – Figure 5. A sketch for the northern portion was not provided by the Water Corporation and will be resolved during detailed design.

All water main extensions required for the development site will be laid within the existing and proposed road reserves, on the correct alignment and in accordance with the Utility Providers Code of Practice and Water Corporations Water Reticulation Pipelines DN250 and Smaller (DS63).

Figure 5: Water Corporation DN150 Water Reticulation route

7 Roadworks

The surrounding road network is under the control of the City of Cockburn and as such all works on and abutting the public roads will be subject to their approval. The roads abutting the development are generally considered to be Access Roads, with the exception of Berrigan Drive, which is a Distributor A, and Prinsep Road, which is a Local Distributor. The existing road network typically consists of formed pavements with kerbing and an asphalt wearing course.

Based on the current plans, access to the Development site will be via the existing road network, with multiple points of connection. It is proposed to install a new 4 way signalised intersection onto Berrigan Drive however this is subject to ongoing review and approval by City of Cockburn and Main Roads WA. JDSi understand that a Transport Impact Assessment is being completed by GTA Consultants to inform the Scheme Amendment and Local Structure Plan, including recommendations on any intersection upgrades required to accommodate the increased traffic loading.

The new road network will be consistent with standard residential developments including kerbed and asphalted pavements and road cross-sections will be designed to align with the existing landform. In all cases the road cross sections will be designed to cater for utility services on standard verge alignments and appropriate stormwater management strategies.

In several instances, the road reservations will be substantially wider than standard access roads to accommodate the retention of mature trees in interface buffers adjoining the existing homes around the site.

Any new public roads, parking areas and footpaths will need to be designed in accordance with City of Cockburn standards and guidelines, Local Government Guidelines for Subdivisional Development (IPWEA) and Main Roads WA requirements.

8 Stormwater Drainage

Urban Water Management (UWM) is now a key part of any development process incorporating principles of integrating water and land use planning, considering all water sources in water planning, integrating water use and natural water processes and a total catchment integration of natural resource use and management (Ref. Stormwater Management Manual for Western Australia, DOW, April 2004 the State Water Strategy 2003 and the State Water Plan 2007).

Stormwater drainage management is a major component of an overall UWM strategy for which achievement of the principals of the plan may be facilitated through the application of Water Sensitive Urban Design (WSUD) techniques during planning, design and construction of urban development projects. Objectives of WSUD include but are not limited to the following:

- Detention of stormwater rather than rapid conveyance to maintain pre development flows for quantity management;
- Use of vegetation for filtering purposes and nutrient stripping for quality management;
- Use of stormwater to conserve potable water; and
- Water efficient landscaping.

A UWMP is currently being prepared for the development site with its purpose being to provide the framework for the application of total water cycle management to the proposed design consistent with Better Urban Water Management (WAPC, 2008) and Department of Water and Environmental Regulation (DWER) principles of Water Sensitive Urban Design (WSUD) as described in the Stormwater Management Manual (DoW, 2007).

In general, the stormwater management strategy for the site will:

- Maintain pre-development peak flow rates into and out of the site.
- Retain up to 1% AEP critical event on-site unless there is a downstream basin or water body which has got the capacity to accommodate runoff from the development.
- Retain 10% AEP rainfall within Lots.
- Set habitable floor levels at least 0.3 m above the 1% AEP flood level of the urban drainage system.
- Utilise a pit and pipe network, or roadside swales where possible, to cater for flows up to 10% AEP rainfall events, while greater than 10% AEP flow will be conveyed via overland flow through the road network.
- Retain and infiltrate rainfall on site using basins and/or underground storage.
- Demonstrate that the land is capable of managing stormwater for all events up to the 1% AEP event.
- Ensure all basins and underground chambers within the estate are designed to cater for the 1% AEP critical event on-site.
- Controls used to improve stormwater quality will be included within roadside swales, open channels and stormwater retention systems such as planting of specific vegetation and possible utilisation of an amended soil profile to assist in nutrient retention and breakdown.
- The use of native vegetation where practicable, minimal fertiliser application and soil amendment in major drainage areas will assist with the management of groundwater and surface water quality.

Of particular importance for this site is that a large area of the external developed areas all discharge into the former Golf Course site. These external catchments will need to be managed and incorporated into the proposed drainage design for the subdivision. Various options include:

- Maintain the existing open basins on the site in their existing location, noting that some of these are currently fenced, with steep side slopes.

- Revise the external drainage network and outlet locations and consolidate these into new storage and infiltration areas within the development area.
- Install new inline storage and infiltration structures higher up in the catchments to reduce the inflow volumes to the new subdivision.

The specific option to be utilised at each location will depend on the catchment size, availability of POS and road reserve areas and depth of outlet pipework compared to the design surface.

Based on the permeability tests undertaken on the insitu sand material the infiltration rate is very high for this site. This means that drainage areas won't need to be large in area and the site will lend itself to the various underground storage options.

As the City of Cockburn will ultimately own and maintain all stormwater infrastructure the design and construction work will need to be undertaken in accordance with their guidelines and standards, as well as the Local Government Guidelines for Subdivisional Development (IPWEA).

9 Power Supply

9.1 Existing Power Network

The following advice is based on a JDSi desktop study and support information obtained from the Western Power NCMT (Network Capacity Mapping Tool) online database.

Murdoch Zone Substation is the closest bulk electricity supply point to the new residential development site. Based on Western Power forecasts for remaining capacity through to 2026 there is between 10-15MVA capacity available within the area as shown in Figure 6.

An existing Transmission line (330kV) exists at the southern side of the development along Imlah Court. A clearance assessment will need to be undertaken by Western Power to consider any restrictions. This will have an impact on constructability of above ground infrastructure and buildings within the powerline easement. It is noted that the tenure of the Western Power Transmission Line corridor will need to be resolved as the City of Cockburn do not accept management responsibility or POS crediting for powerline easements.

Existing High Voltage (HV) overhead lines exist on the east side of development along Prinsep Road with various sections of Underground HV located within the vicinity of the project servicing the existing residential lots. These are not 'backbone feeders' that can be utilised for extension of the HV network.

Existing Low Voltage (LV) underground power exists within the surroundings of the development. Further investigation via a Western Power DIP or Feasibility Study will be required to determine any network capacity available to supply the required load for the proposed subdivision.

Figure 6: Western Power Forecast Capacity for 2026

9.2 Proposed Power Network

The proposed residential development of Glen Iris Estate requires an anticipated power supply of approximately 3500kVA. The following table shows the breakdown of the anticipated load.

Load Type	Number of lots	kVA Allocated
Residential	550	2750 (@ 5kVA/lot)
Public Open Space	20	600 (@ 30kVA/lot)
Commercial	1	150 (@ 200kVA/ha)
Total	**571**	**3500**

Table 1: Power Load Breakdown for Glen Iris Estate.

Western Power owns and operates all electrical supply network assets within the development area and therefore all new electrical supply equipment and cables will need to be installed in accordance with Western Power, WAER (West Australian Electrical Requirements), AS3000 specifications and Standards.

Based on JDSi's initial assessment, it is anticipated that 6 substation sites (combination of transformer and switchgear) will be required to service the entirety of the proposed development.

It is unlikely that overhead powerlines will be required to be undergrounded as part of the WAPC Conditions. The existing underground Western Power assets supplying the surrounding lots will be required to be interconnected and/or reinforced as part of the new underground HV network.

Western Power cannot reserve network capacity therefore we recommend the Developer lodge a formal application with the Utility as soon as practicable. The Development's electricity load requirements will be required to be approved by Western Power, along with the design and installation of nay new assets.

10 Gas

ATCO Gas own and maintain the existing underground gas network in the vicinity of the Development.

Reticulated gas is not considered to be an essential service and as such is not required as a condition of subdivision. However, it is usual practice to install a gas reticulation network for a residential subdivision within a common civil services trench. If there is an extension required to connect to the nearest main or to bore under major roads the Developer will be required to pay for this as a headworks cost. All new gas installations will be designed by ATCO Gas and installed as part of the civil works.

Advice from ATCO Gas is that the existing MAOP 70kPa network surrounding the Glen Iris Estate will be able to supply the proposed development. Figure 7 below shows the likely connection points to the existing network and provides options in terms of staging.

There is also an existing DN150 PVC medium pressure gas main that runs through the northern part of the site through the existing Dean Road reserve. The Thornlie Cockburn Link project team are also proposing to install a DN200 steel high pressure gas main through the site along the same alignment as the existing main. This is replacing existing gas mains which currently run through the proposed rail reserves. These mains will also provide opportunity for connection and have been designed to ensure there are no limitations for development in the future.

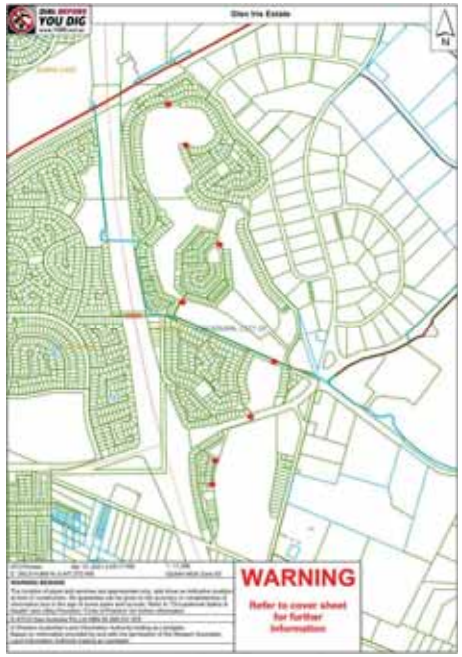


Figure 7: Western Power Forecast Capacity for 2026

11 Telecommunications

Based on Dial Before You Dig reports there is existing Telstra and NBN owned pit and pipe network within the vicinity of the Development. The NBN Rollout Map indicates that the wider Glen Iris area is covered by the NBN network and is “service ready”. Existing properties surrounding the development site are covered by a fixed line, Fibre To The Node (FFTN) service.

Advice from NBN is that the site is within their existing fixed footprint, and as such there will be no additional costs for backhaul to service the Development.

General communication services for the development will consist of the installation of a standard pit and pipe network in accordance with NBN Co guidelines and standards. The current design practice for road reserves, pavement and verge provisions will make adequate allowance for services in accordance with the agreed Utilities Service Providers handbook. There will be some local land requirements for equipment sites which will be accommodated at detailed subdivision stage.

To progress the design and installation of a new communications network a New Development Application will need to be submitted to NBN and this agreement would confirm any Developer requirements. Developers will be required to cover the costs of trenching and ducting for the infrastructure, however NBN Co will cover the other costs of installing fibre infrastructure, including backhaul.

Figure 8: NBN Map

In relation to City of Cockburn's "*Local Planning Policy 5.19 – Structure Plans & Telecommunications Infrastructure*", the following summarises the mobile telecommunication infrastructure and coverage in the local area.

The below figure shows mobile phone towers in the vicinity of the site. This information was sourced from the Radio Frequency National Site Archive (RFNSA) which is managed by the Australian Mobile Telecommunications Association (AMTA).

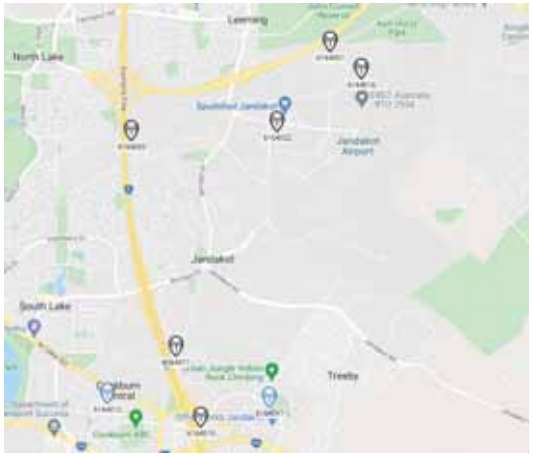


Figure 9: Location of Mobile Phone Towers

Mobile phone coverage in the vicinity of site is provided by Telstra, Optus and Vodaphone. Based on the coverage maps from these providers there is does not appear to be any issues with coverage or capacity in the development area.

Figure 10: Telstra 5G Coverage

Figure 11: Optus Mobile Coverage

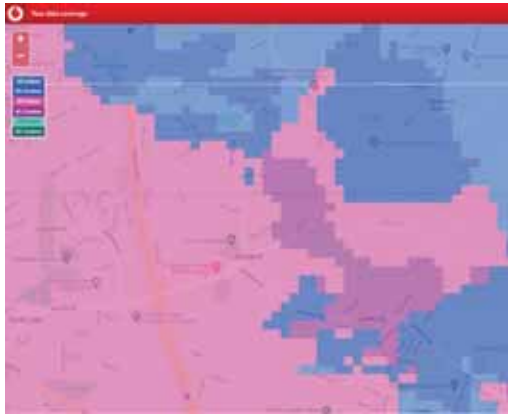


Figure 12:Vodaphone Mobile Coverage

In February 2022 JDSi contacted the Mobile Black Spot Program Team, which is being managed by the Department of Infrastructure, Transport, Regional Development and Communications, to inform them of the proposed development. As at the date of this report no specific feedback has been received, however a generic response was received, and a copy is included in ***Appendix E***.

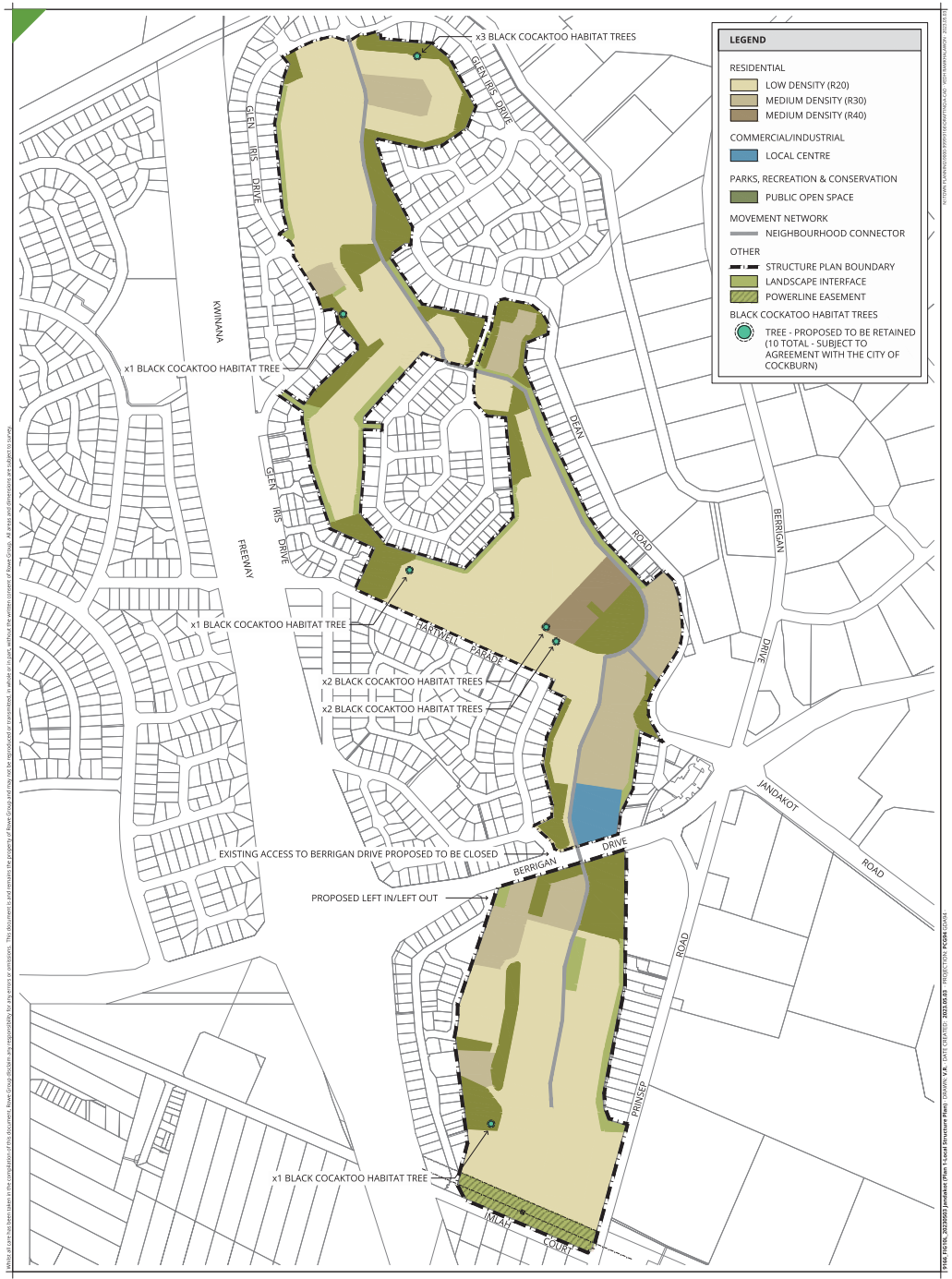
12 Disclaimer

JDSi have undertaken this assessment based on a desktop study and preliminary discussions with service authorities and subsequently assumptions have been made which, if incorrect, have the potential to change the assessment and/or recommendations. Major cost implications exist through factors which cannot be assured at this time including, but not limited to, upgrading and provision of utility services, conditions of development, Local Authority Scheme Requirements, ground conditions and timing of adjacent developments.

While JDSi has taken all care in the preparation of the likely development requirements and has noted key assumptions, JDSi accepts no responsibility for the accuracy of this report and provides it only as an indicative summary of engineering requirements.

If any further information is required or should you wish to clarify any issue, please contact our office.

APPENDIX A
PROPOSED STRUCTURE PLAN



PLAN 1 - LOCAL STRUCTURE PLAN

GLEN IRIS DRIVE
JANDAKOT

NORTH

0 150 m
SCALE @ A3: 1:6000

9166-FIG-10-L

ROWE GROUP DESIGN

APPENDIX B
FEATURE SURVEY

MNG.
Mining Near Group (Pty) Ltd
Tel: +27 (0)11 7 2000
Fax: +27 (0)11 7 2000
Cell: +27 (0)11 7 2000
Email: info@mng.mng.co.za
Web: www.mng.mng.co.za
Reg. No. 2004/007 (Pty)
Office in Brooks Bakery, Kenmore Mountain Estate, Port Harcourt

THIS DRAWING SHOWS THE ACCURACY OF DATA SHOWN. WHEN IT WAS PREPARED AND THE DATA SHOWN ARE TO BE USED AS A GUIDE ONLY. THE DATA SHOWN ARE SUBJECT TO THE SCALE OF THE DRAWING. ALL DRAWING SHOWN ARE TO BE USED AS A GUIDE ONLY. THE DATA SHOWN ARE SUBJECT TO THE SCALE OF THE DRAWING. ALL DRAWING SHOWN ARE TO BE USED AS A GUIDE ONLY. THE DATA SHOWN ARE SUBJECT TO THE SCALE OF THE DRAWING.

PROJECT: 2004/007 (Pty) Ltd

GLEN IRIS GOLF COURSE

JANDAKOT

SCALE 1 : 2000 @ A0

0 0 50

ALL DISTANCES ARE IN METRES

SOURCE DATA	SOURCE	DATE	SCALE	DEVOTED ACCURACY
AERIAL PHOTOGRAPHY	GEOLOGICAL PRINC	MAR 2015	1:500	+/- 0.3m
CADASTRAL DATA	LANDGATE	MARCH 2015	N/A	+/- 0.2m
TOPOGRAPHY	MNG	SEP 2015	N/A	+/- 0.1m
FIELD DETAIL ROOM	ZONE N/A			CONTOUR INTERVAL 0.25m
DATA DESIGN BY	PROJECT MANAGER CHARLES SCHNAK		DRAWN BY	CHECK CAD

FILE PATH: 102160-OPM-007-A

Job Number	Page	Date Number	Revision

APPENDIX C
GEOTECHNICAL REPORT

23 December 2020

PROPOSED RESIDENTIAL SUBDIVISON GLEN IRIS GOLF COURSE, JANDAKOT, WA GEOTECHNICAL INVESTIGATION REPORT

Eastcourt Property Group

Ref. PER2020-0452AB Rev 0

PER2020-0452AB		
Date	Revision	Comments
23 December 2020	0	FINAL GEOTECHNICAL REPORT

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Figure 01 – Site Investigation Plan

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Appendix A – Test Pit Logs, PSP Plots & Photos

Appendix B – Permeability Test Results

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GLEN IRIS ESTATE SUBDIVISON, JANDAKOT, WA – GEOTECHNICAL INVESTIGATION 23 DECEMBER 2020

1 INTRODUCTION

CMW Geosciences Pty Ltd (CMW) was authorised by Mitch Dodson of Acumends Development Solutions on behalf of Eastcourt Property Group to carry out a geotechnical investigation of a proposed residential subdivision development site located at the Glen Iris Public Golf Course on Dean Road, Jandakot WA by way of email authorisation dated 16 November 2020. The scope of work and associated terms and conditions of our engagement were detailed in our services proposal referenced *PER2020-0452AA, Rev 0*, dated 28 October 2020.

The purpose of this report is to describe the investigation completed, the ground conditions encountered and to provide recommendations with respect to geotechnical aspects of the proposed development including site preparation and earthworks, site classification, suitable foundation parameters, drainage, and the identification of geohazards and risks to the proposed development.

2 SITE DESCRIPTION

The proposed development site is approximately 53ha and will be located at the previous location of the Glen Iris Public Golf Course along Dean Road, Jandakot WA which has since been closed (refer to attached Site Investigation Plan – Figure No. 01).

For better understanding, the site has been split into three distinctive areas as seen in Figure 01. The first area, the most northern precinct is bound to the north, east and west by existing residential developments along Glen Iris Drive, and to the south by residential developments along Portsea Gardens and Twin Waterers Pass. Surface levels obtained from an imagery survey conducted by MNG (Ref. *102160-OPM-007-A*) on 09 April 2019 indicates this area is relatively steeply sloping from RL 43m AHD along the northern most boundary to RL 27m AHD along the southern boundary. The southeastern area also slopes gradually towards the centre of the northernmost lake (RL 34m AHD).

The central precinct is bound to the east by existing residential developments along Dean Road and Par Cresent which is further south, to the south by Berrigan Drive and to the west by residential developments along Hartwell Parade, Glacier Way, Eadie Cresent and Glen Iris Drive. In the centre of the precinct there are a large number of further residential developments linked by an array of roads and accessways connected to Twins Waters Pass. Near the southwestern corner of the area an existing single storey clubhouse development is located with associated carparking. Surface levels obtained from an imagery survey conducted by MNG indicates this area is relatively consistent, gently sloping from RL 27m along the northern boundary to RL 28m AHD along the southern boundary.

The southernmost precinct is bound to the north by Berrigan Drive, to the east by Prinsep Park and Prinsep Road, to the south by Imlah Cresent and to the west by residential dwellings along The Lakes Boulevard and The Fairway. In the southwestern most corner, there is two single story maintenance workshops with associated paved accessways. Surface levels obtained from an imagery survey conducted by MNG indicates this area is gently sloping from RL 26m AHD along the southern boundary to RL 29m along the northern boundary.

Surface levels are only indicative as there are numerous undulations, swales and isolated elevated areas, bunkers and fairways that mould the topographical profile of the entire site.

The site was previously used as a public golf course therefore the site contains relatively cleared areas. Vegetation cover comprises grass with some small to large sized trees lining the outsides of the fairways. There are also six manmade lakes located across the site.

It is believed the existing developments on the golf course will be demolished prior to the bulk earthworks for the proposed subdivision.

Aerial imagery from Landgate show that prior to the development of the golf course in 1965 the site was previously in use as agricultural lands. The surrounding areas have undergone significant land development and subdivision that appears to have affected the current golf course. In addition, the golf course layout has largely been man-made by earthworking. Because of this, there may be uncontrolled fill, very loose sands, buried topsoil or other unsuitable material present in areas of the site. In addition, there could be unsuitable material in the lake beds.

3 PROPOSED DEVELOPMENT

The plans supplied depict the area of approximately 53ha will be divided into approximately 600 to 800 residential lots with Public Open Space (POS), drainage basins plus associated accessways and roadways. At present, however, no specific engineering details of the proposed land development have been provided.

We anticipate that significant cut to fill earthworks will be required in order to form finished ground levels. The magnitude of the cut to fills assume the lots will be stepped from east to west. It is also understood that retaining walls will be constructed to assist with the development of the lots.

4 FIELD INVESTIGATION

The field investigation was carried out from 30 November 2020 to 02 December 2020, following a dial before you dig search. All fieldwork was carried out under the direction of CMW Geosciences Pty Ltd in general accordance with AS1726 (2017), Geotechnical Site Investigations. The scope of fieldwork completed was as follows:

- A walkover survey of the site to assess the general landform, site conditions and adjacent structures;
- 55 test pits, denoted TP01 to TP55, were excavated to depths of up to 2.2m using a JCB 8.5 tonne backhoe fitted with a 450mm wide toothed bucket to investigate the underlying soil conditions, facilitate sampling for laboratory testing and to assess excavatability and earthworks recommendations. Engineering logs of the test pits and photographs are presented in Appendix A;
- Perth Sand Penetrometer (PSP) tests were carried out adjacent to each test pit, in general accordance with AS1289.6.3.3, to depths of up to 2.1m to provide soil density/consistency profiles and to provide a subgrade CBR value for pavement design purposes. Graphical results of the PSP plots are presented on the test pit logs in Appendix A;
- 8 hand auger boreholes were drilled with a 100mm diameter auger to a depth of up to 1.42m to facilitate infiltration testing. Results of the permeability test are presented in Appendix B.

The approximate locations of the respective investigation sites referred to above are shown on the attached Site Investigation Plan (Figure No. 01). Test locations were selected by CMW with input from Steve Foley (JDSi) on specific areas to target/stay clear of during the investigation. Test locations were measured using a hand-held GPS to an accuracy of ±5m. Elevations were inferred from the imagery survey conducted by MNG (Ref. *102160-OPM-007-A*) on 09 April 2019.

5 LABORATORY TESTING

A small program of soil laboratory testing was carried out on representative soil samples generally in accordance with the requirements of the latest edition of AS1289 (where applicable).

Testing was carried out on samples selected by CMW and carried out by Western Geotechnical & Laboratory Services Pty Ltd (WGL), a NATA registered laboratory.

The following laboratory tests were carried out:

- 8 Organic Content Test (Loss on Ignition).

The laboratory test results, and associated certificates are provided in Appendix C.

6 GROUND MODEL

6.1 Geology

Published geological maps (Ref. Perth Metropolitan Region 1:50,000 Environmental Geology Series: Fremantle) and the CMW investigation database for the area depict the land as being underlain by Bassendean Sand overlying clayey and silty material of the Guildford Formation at depth.

Based on the known history of the site and surrounding land levels, some superficial depths of fill were also anticipated because of the previous agricultural use of the land.

6.2 Subsurface Conditions

The ground conditions encountered and inferred from the investigation were considered to be generally consistent with the published geology for the area and can be generalised according to the following subsurface sequence:

TOPSOIL: SAND / CLAYEY SAND	dark grey, brown, fine to medium grained, subangular to subrounded sand with trace fines (>12% in TP48); trace organics; trace roots and rootlets; trace branches; trace vegetation, overlying;
FILL: SAND (UNCONTROLLED)	loose to very dense, fine to medium grained, subangular to subrounded; grey/pale yellow and orange-brown; trace fine grained limestone gravel (TP04, TP20); trace fines; trace organics; trace roots and rootlets; trace branches. Uncontrolled fill in the form of old reticulation pipe and bricks were found in TP04, TP18, TP28 and TP34. The reticulation pipe uncovered in TP28 and TP34 contained potential asbestos between depth of 0.5 and 1.6 mbgl, overlying;
SAND (SP)	loose to very dense, fine to medium grained, subangular to subrounded; grey/orange/yellow and white; trace fines; trace roots and rootlets, overlying;
COFFEE ROCK	very dense, fine to medium grained, subangular to subrounded, dark brown/black; weakly cemented. (Only found in TP03 TP06, TP12 and TP52). The coffee rock was typically found in or around low energy zones (lakes) located across the site where groundwater may be present.

Of the six manmade lakes located across the site, only TP48 was able to excavate the base of the lake due to the lake being empty. A green plastic liner was found approximately 0.5m below the base of the lake overlying the natural sand. It is assumed this liner is present at the base of all the other lakes at a similar depth. The liner was also found to be extending to the banks of the lakes evident in test pits TP34, TP44 and TP52 where the same plastic liner was uncovered just below the surface.

The distribution of the above units is summarised in Table 1 below:

Table 1: Summary of Soil Stratigraphy			
Description	**Depth to top of layer (m)**		
	Minimum	**Maximum**	**Average**
TOPSOIL: SAND / CLAYEY SAND	0.00		
FILL: SAND (UNCONTROLLED)	0.02	0.20	0.11
SAND (SP)	0.10	1.90	1.00
COFFEE ROCK	>2.05		

6.3 Groundwater

A review of the Perth Groundwater Atlas indicates that groundwater levels are likely to be between RL 21m AHD and 26m AHD below existing ground levels. These levels equate to depths of approximately <1m below the lowest existing ground contours along the southern boundary of site.

During the investigation, which was completed in early-summer conditions (Nov/Dec 2020), groundwater was not encountered within any of the investigation locations.

6.4 Permeability

Tabulated results of the 8 in-situ falling head permeability tests carried out was used to estimate the soil coefficient of permeability in accordance with the methods described in Horslev (1951) (falling head test) and CIRIA Report No. 113 (falling head test).

Table summarises the results obtained. Complete results of the in-situ falling head tests are presented in Appendix B.

Table 2: Summary of Falling Head Permeability Tests					
Standpipe ID	**Bottom of Test Hole (mbgl)**	**Approximate Permeability**			
		CIRIA (m/sec)	**CIRIA (m/day)**	**Horslev (m/sec)**	**Horslev (m/day)**
Perm 1	1.36	$3.15x10^{-04}$	27.22	$6.50x10^{-05}$	5.61
Perm 2	1.42	$1.22x10^{-03}$	105.00	$2.99x10^{-04}$	25.84
Perm 3	1.35	$6.73x10^{-04}$	58.18	$1.85x10^{-04}$	16.00
Perm 4	1.38	$4.25x10^{-04}$	36.75	$1.01x10^{-04}$	8.69
Perm 5	1.40	$8.26x10^{-04}$	71.39	$1.99x10^{-04}$	17.16
Perm 6	1.40	$5.05x10^{-04}$	43.61	$1.69x10^{-04}$	14.46
Perm 7	1.41	$3.54x10^{-04}$	30.55	$7.82x10^{-05}$	6.75
Perm 8	1.41	$8.32x10^{-04}$	71.89	$1.87x10^{-04}$	16.13

7 LABORATORY TEST RESULTS

The soil organic content laboratory test results are summarised in Table 3 below.

Table 3: Soil Organic Content Laboratory Results			
Sample ID	**Depth To and From (mbgl)**	**Ash Content (%)**	**Organic Content (%)**
TP04	0.0 – 0.1	95.8	4.2
TP14	0.0 – 0.1	94.7	5.3
TP29	0.0 – 0.1	96.0	4.0
TP41	0.0 – 0.1	91.4	8.6
TP46	0.0 – 0.1	95.6	4.4
TP48	0.0 – 0.1	74.5	25.5
TP23	0.0 – 0.1	94.6	5.4
TP15	0.0 – 0.1	96.7	3.3
Note: TP48 was located at the base of a previous lake which may explain the abnormally high organic content.			

8 GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS

8.1 General

Following our understanding of the preliminary development plans and our interpreted ground model, we consider that the site is suitable for supporting the proposed residential development, subject to the requirements of AS 2870-2011 and our specific earthworks recommendations detailed in Section 8.2 below.

8.2 Earthworks

Natural and uncontrolled fill sand is expected to be encountered throughout the full depth range of excavations (<1m depth) We anticipate that major cut to fill bulk earthworks will be required to form finished ground levels. This activity is considered appropriate for the site subject to the earthworks construction recommendations described below.

We note earthworks must be carried out in accordance with the recommendations provided in this report and AS3798-2007 *Guidelines on Earthworks for Commercial and Residential Developments*.

8.2.1 Topsoil Strip and Subgrade Preparation

- All vegetation must be stripped and removed from site;
- A 100mm topsoil strip should be considered appropriate for most of the site, however where thick root mats or otherwise unsuitable material is present to a greater depth then this should be removed and cut to waste or reused as fill within the POS areas;
- Existing trees must be removed and their root systems must be completely grubbed out. The soil beneath the root system must be proof rolled and backfilled to the specifications described below;

- Following the topsoil strip, the top 400mm of the soil profile should be tyned to bring any waste / uncontrolled fill to the surface. In some instances, the Earthworks Contractor may be required to excavate deeper to remove all waste / uncontrolled fill. Any organic (tree roots / stumps) or manmade waste observed should be removed from site. Alternatively, the fill material should be stockpiled for reuse as sand fill material following an inspection by a suitably qualified geotechnical engineer; and
- The upper 300mm of the exposed subgrade must be moisture conditioned with a water cart and compacted with a suitable roller to achieve at least 7 blows per 300mm penetration with a Perth Sand Penetrometer (PSP) excluding the top 150mm, which is equivalent to a dry density ratio of at least 95% based on Modified Compaction (AS1289 5.1.1). Any loose, soft, organic or manmade waste materials observed during this proof roll shall be removed and replaced with compacted clean sand fill.

8.2.2 Bulk Earthworks

We recommend the following during bulk earthworks:

- Material must be moisture conditioned with a water cart and compacted in layers not exceeding 300mm with a suitable roller to achieve at least 7 blows per 300mm penetration with a PSP excluding the top 150mm, which is approximately equivalent to a dry density ratio of 95% based on Modified Compaction (AS1289 5.2.1);
- Site won material from proposed cut earthworks is considered suitable for use in bulk earthworks from a geotechnical perspective, subject to adequate placement and providing that similar and consistent fill materials are used for specific applications (i.e. entire fill pads are constructed of similar fill materials); and
- Imported sand bulk fill materials will need to be free of organic or deleterious inclusions with a fines content of less than 5% of the fill volume and a maximum particle size of 100mm. It must be moisture conditioned with a water cart and compacted in layers not exceeding 300mm to achieve at least 7 blows per 300mm penetration with a PSP, which is equivalent to a dry density ratio of 95% based on Modified Compaction (AS1289 5.2.1).

8.2.3 Retaining Wall Backfill

We recommend the following during retaining wall backfilling:

- Backfill layers should be placed in maximum 300mm thick loose layers, moisture conditioned to within ±3% of the optimum moisture content and compacted with a suitable vibrating plate compactor to achieve a dry density ratio of at least 95% based on Modified Compaction (AS1289 5.2.1).

The technical and control requirements for Engineered Fill, including site observation and compaction testing, are outlined in AS3798-2007. We recommend that this work is completed under the direction and control of a suitably experienced Geotechnical Engineer familiar with the contents of this report.

8.2.4 Excavatability

The loose to very dense natural sands and uncontrolled fill sand encountered across the site may be excavated using standard mechanical plant.

8.2.5 Earthworks Monitoring

Variations in ground conditions may occur between test locations. If conditions other than those described above are encountered, then further advice should be sought without delay. During earthworks, site visits should be made by a Geotechnical Engineer or Engineering Geologist who is familiar with the contents of this report to ensure that topsoil stripping is carried out adequately, proof

compaction and cut to fill earthworks are conducted in accordance with AS3798-2007, and to audit the compaction of earthworks. Earthworks control testing should be undertaken in accordance with the guidelines set out in AS3798-2007. CMW would be pleased to perform this function if required.

8.2.6 Lake Remediation and Backfilling

We recommend the following during lake remediation and backfilling:;

- Drain lakes to remove water. Note: Some lakes may require dewatering as the base of the lake is below groundwater;
- Remove all organics and fill material above the liner;
- Remove liner from base of lakes and along embankments; and
- Once the liner has been removed the lakes should be backfilled with clean sand fill or site won material as mentioned in 8.2.2 and compacted in layers not exceeding 300mm to achieve at least 7 blows per 300mm penetration with a PSP, which is equivalent to a dry density ratio of 95% based on Modified Compaction (AS1289 5.2.1). Each layer of fill that is placed should be keyed (fill over cut) into the lake embankments to ensure each layer extends into intact foundation materials.

8.3 Strip and Pad Foundations

The design of available foundation bearing pressures for isolated strip and pad footings with 0.5m or 1.0m embedment depth has been carried out using the Terzaghi bearing capacity equation. Subject to completing the earthworks and foundation preparation recommendations provided in section 8.2 above, shallow strip or pad footings founded within medium dense near surface soils (<1m) or compacted fill material may be designed on the basis of the maximum allowable bearing pressures provided in Table 4.

Table 4: Summary of Shallow Footing Design Bearing Pressure

Embedment Depth (m)	Footing Width (m)	Footing Length (m)	Allowable Bearing Pressure (kPa)	Estimated Settlement (mm)
0.5	0.5 Strip		170	<5
	1 Strip		220	10-15
	1	1	200	5-10
	2	2	290	10-15
1.0	0.5 Strip		280	5-10
	1 Strip		330	15-20
	1	1	310	5-10
	2	2	400	20-25

These values are based on a geotechnical strength reduction factor of 0.5 and an average load factor of 1.5 (Factor of Safety = 3.0). It should be noted that these bearing pressures assume isolated vertical, non-eccentric loads. The assessment has been undertaken based on a static load and does not consider any dynamic or cyclic loading effects. It also does not consider any interaction of closely spaced foundations.

Subject to the earthworks and foundation preparation works being undertaken as described herein, it has been calculated that the total settlements of the footing configurations and design pressures outlined in Table 4 above is unlikely to exceed approximately 20mm to 25mm. Differential settlements are unlikely to exceed approximately one half of these values.

8.4 Retaining Wall Design

Localised cut and fill earthworks will be required along proposed property boundaries for subdivision layout and drainage purposes. All retaining wall footings will be founded on either reworked *in situ* or engineered sand fill material to depths of at least 0.5m. Based on this, recommended retaining wall design parameters are summarised in Table 5 below:

Table 5: Retaining Wall Design Parameters

Soil Unit	Y (kN/m^3)	Ø' (deg)	K_0	E' (MPa)	No wall friction		Wall friction = 2/3Ø	
					K_a	K_p	K_a	K_p
ENGINEERED FILL: SAND (medium dense)	18	34	0.441	60	0.283	3.537	0.254	8.952
SAND (medium dense)	18	34	0.441	60	0.283	3.537	0.254	8.952

Notes:
1. Refer to Table 1 for definition of soil unit levels.
2. Y – soil unit weight; Ø' - angle of internal soil friction; K_0 - coefficient of earth pressure at rest, K_a - coefficient of active earth pressure, K_p - coefficient of passive earth pressure; E' – long term Young's modulus.
3. Values of K_0 are based on initial conditions following construction of the walls.
4. The retaining wall designer must adopt the above set of K_a and K_p parameters relevant to the actual construction method adopted.
5. The above parameters are based on the condition of a horizontal ground surface behind the retaining structure. Applicable surcharge loads behind the wall must also be considered in the design.

Retaining structures should be designed in accordance with AS 4678-2002 "*Earth Retaining Structures*" or an alternate approved factor of safety approach. Should any fill be placed against the permanent retaining walls after construction, it is expected that the compaction induced pressures will be much greater than the above active earth pressures. The compaction equipment used to compact backfill behind the wall must be carefully selected and preferably light-weight compaction equipment should be used. The load on the retaining wall due to compaction equipment may be estimated from Figure J5 in AS4678-2002 *"Earth Retaining Structures".*

It is noted that some ground movement will occur behind temporary or permanent retaining walls. By definition, movement of the wall must occur to fully mobilise the active and passive earth pressure coefficients provided in Table 5 above. The extent of this movement is dependent on the height of retaining wall, type of wall selected and construction methodology. This must be considered during the design and construction of the retaining walls to ensure adjacent facilities are not adversely affected.

Any ground anchors associated with retaining wall construction should be designed on the basis of the above effective stress soil parameters and using appropriate design standards such as BS8081.

8.5 Site Classification

A site classification of CLASS A in accordance with AS2870-2011 is recommended subject to the foundation preparation recommendations provided in Section 8.2 above.

8.6 Environmental

The National Acid Sulfate Soils Map shows that the site is located in a "low to moderate risk area for ASS occurring within 3m of natural surface".

After discussions with Steve Foley (JDSi) during our site walkover, it was mentioned some asbestos may be present across the site following the demolition of old infrastructure. The area in question was along the western boundary of the central precinct by Hartwell Parade. Potential asbestos in the form of an old, fractured pipe was found in the upper 0.5m of this area in TP28 (pictured in the test pit photographs). The same pipe was also found in the upper 1.6m of TP34, on the edge of lake in the southeastern portion of the northern precinct.

During bulk earthworks asbestos will need to be appropriately managed by a competent environmental consultant.

8.7 Pavement CBR

Based on the field density testing undertaken using the PSP and our experience with similar materials, it is recommended that pavements be designed on the basis of a subgrade CBR value of 12% due to the sandy nature of the soils.

This design CBR value is subject to the exposed subgrade being moisture conditioned and compacted in accordance with the recommendations provided in Section 8.2 above. It is recommended that appropriate QA / QC testing be undertaken on subgrade and pavement materials during construction.

8.8 Drainage

It is recommended that soakwells and drainage basins be designed on the basis of a saturated soil coefficient of permeability of 5 m/day subject to them being located a distance of at least 3m away from any structure foundations. This does not allow for any clogging, silting or other design aspects of the soakwells.

9 CLOSURE

The findings contained within this report are the result of limited discrete investigations conducted in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, can it be considered that these findings represent the actual state of the ground conditions away from our investigation locations.

If the ground conditions encountered during construction are significantly different from those described in this report and on which the conclusions and recommendations were based, then we must be notified immediately.

This report has been prepared for use by Eastcourt Property Group in relation to the proposed Glen Iris Estate residential subdivision project in accordance with generally accepted consulting practice. No other warranty, expressed or implied, is made as to the professional advice included in this report. Use of this report by parties other than Eastcourt Property Group and their respective consultants and contractors is at their risk as it may not contain sufficient information for any other purposes.

For and on behalf of
CMW Geosciences Pty Ltd

Reviewed by:

Mitchell Owen
Engineering Geologist

Alex Petty
Principal Geotechnical Engineer

Distribution: 1 copy to Eastcourt Property Group (electronic)
Original held by CMW Geosciences Pty Ltd

GLEN IRIS ESTATE SUBDIVISON, JANDAKOT, WA – GEOTECHNICAL INVESTIGATION 23 DECEMBER 2020

10 REFERENCES

- Appendix 4, Control of Groundwater for Temporary Works (CIRIA Report No. 113)
- AS 1170, *Structural design actions,* Standards Australia, Sydney, 2007
- AS 1289, *Methods of testing soils for engineering purposes,* Standards Australia, Sydney
- AS 1726, *Geotechnical Site Investigations,* Standards Australia, Sydney, 2017
- AS 2870, *Residential slabs and footings,* Standards Australia, Sydney, 2011
- AS 3798 (inc. amendment 1), *Guidelines on earthworks for commercial and residential developments,* Standards Australia, Sydney, 2007
- AS 4678 (inc amendments 1 & 2), *Earth retaining structures,* Standards Australia, Sydney, 2002
- BS 1377-9:1990 Methods for test for soils for civil engineering purposes. In-situ tests.
- Department of Environment and Conservation (DEC), 2011, Treatment and management of soils and water in acid sulfate soil landscapes, Acid Sulfate Soils Guideline Series.
- *Guide to Residential Slabs and Footings in Saline Environments (CCAA T56),* Cement Concrete & Aggregates Australia, 2005
- Hvorslev J M, *Time lag and soil permeability in ground-water observations,* Bull. 36, 50 pp., U.S. Corps of Eng., Waterways Exp. Sta., Vicksburg, Miss., 1951
- *Perth Groundwater Atlas,* Second Edition, Perth: Department of Environment, 2004
- *Fremantle, Sheet 2033 I & 2033 IV,* Perth Metropolitan Region Environmental Geology Series, Geological Survey of Western Australia, 1986
- Schmertmann, 1970 and Schmertmann et al, 1978.
- Terzaghi, K. (1943). Theoretical soil mechanics. 1st ed. New York: J. Wiley and Sons, Inc.
- WA Online Atlas, Shared Land Information Platform – ASS Risk Map, https://www2.landgate.wa.gov.au/bmvf/app/waatlas/.

Figure

SITE LOCATION
PRECINCT 1
PRECINCT 2
PRECINCT 3
KWINANA FWY
BERRIGAN DR
TP01
TP02
TP03
TP04
TP05
TP06
TP07
TP08
TP09
TP10
TP11
TP12
TP13
TP14
TP15
TP16
TP17
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TP43
TP44
TP45
TP46
TP47
TP48
TP49
TP50
TP51
TP52
TP53
TP54
TP55
Perm 1
Perm 2
Perm 3
Perm 4
Perm 5
Perm 6
Perm 7
Perm 8
0 75 150 225 300 375 m
1:7500
LEGEND:
TP01 TEST PIT LOCATION
PSP01 PERMEABILITY TEST LOCATION
NOTES:
1. AERIAL FROM NEARMAP 20.11.20
CMW Geosciences
CLIENT: JDSi CONSULTING ENGINEERS
PROJECT: GLEN IRIS ESTATE JANDAKOT, WA
TITLE: SITE INVESTIGATION PLAN
DRAWN: DE
CHECKED: MO
REVISION: A
DATE: 22.12.20
PROJECT: PER2020-0452
DRAWING: 01
SCALE: 1:7500
SHEET: A3 P

Appendix A

Test Pit Logs, PSP Plots and Photos

TEST PIT LOG - TP01

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392145m N.6446295m
Elevation: 28 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			27.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			5 10 15	
						SP: SAND: fine to medium grained, subangular to subrounded; dark grey; trace fines; trace rootlets.		MD to D	6 6 6 5 6 6	
				1			D to M			1.05m: PSP conducted within base of test pit
						... from 1.40m to 1.70m, trace branches		L to MD	1 1 3 2 3 3	
			26.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

This report must be read in conjunction with accompanying notes and abbreviations.

TEST PIT LOG - TP02

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392135m N.6446325m
Elevation: 28 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			27.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			3	0.00m: test pit located behind retaining wall of lake
						FILL: SAND: fine to medium grained, subangular to subrounded; dark grey; trace fines; trace rootlets.			4	
						... at 0.20m, becoming pale yellow				
			27.6			SP: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets.			4	
						... at 0.60m, becoming grey brown with orange			3	
								L to MD	2	
				1			D to M		3	1.05m: PSP conducted within base of test pit
									2	
									1	
									3	
									5	
								MD to D	6	
			26.0	2		Test pit terminated at 2.00 m			4	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP03

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392058m N.6446394m
Elevation: 28 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			27.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			5	0.00m: test pit located behind retaining wall of lake
			27.8			FILL: SAND: fine to medium grained, subangular to subrounded; grey brown; trace fines; trace rootlets; trace organics.			7	
						FILL: SAND: fine to medium grained, subangular to subrounded; black with dark grey; trace fines; trace root and rootlets; trace coffee rock.		MD to D	5	
									6	
						... at 0.90m, no longer rootlets			7	
			27.0	1		SP: SAND: fine to medium grained, subangular to subrounded; grey; trace fines.	D to M	VD	11	
			26.0	2		COFFEE ROCK: fine to medium grained, subangular to subrounded; dark brown; weakly cemented; trace fines.				
			26.0			Test pit terminated at 2.05 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP04

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391978m N.6446343m
Elevation: 26 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
	0.0 - 0.1	D	25.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.		MD	4	
			25.7			FILL: SAND: fine to medium grained, subangular to subrounded; orange grey; trace fines; trace rootlets; trace organics.			11	
						FILL: SAND: fine to medium grained, subangular to subrounded; trace gravel; pale yellow; trace fines; trace rootlets; trace cobbles; gravel and cobbles are limestone; trace uncontrolled fill (bricks, rubbish).		D to VD	10	
									8	
			25.2			SP: SAND: fine to medium grained, subangular to subrounded; black with dark grey; trace fines; trace rootlets.			7	
				1			D to M		10	1.05m: PSP conducted within base of test pit
						... at 1.10m, no longer rootlets			4	
									5	
								MD to D	5	
									4	
									4	
			24.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP05

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392208m N.6446432m
Elevation: 28 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			27.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			5	
						SP: SAND: fine to medium grained, subangular to subrounded; dark grey; trace fines; trace rootlets.		D to VD	7	
									7	
									9	
									9	
				1			D to M		10	1.05m: PSP conducted within base of test pit
						... at 1.30m, trace branches			5	
									5	
								D	6	
									5	
									5	
			26.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP06

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392152m N.6446434m
Elevation: 26 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			25.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located next to lake
						SP: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets.		L	2, 3, 3	
						... at 0.30m, becoming pale grey				
				1			D to M	D to VD	5, 8, 8	1.05m: PSP conducted within base of test pit
									3, 5, 6	
								VD	10, 20	
			24.1			COFFEE ROCK: fine to medium grained, subangular to subrounded; black; weakly cemented; trace fines.				
			24.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP07

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392068m N.6446510m
Elevation: 27 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			26.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				
			26.7			FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets; trace organics.			6, 4	
						... at 0.20m, becoming pale grey with orange		MD to D	5, 4, 5, 6	
						SP: SAND: fine to medium grained, subangular to subrounded; black with dark grey; trace fines; trace root and rootlets; trace branches.				
						... at 0.50m, becoming grey				
				1			D to M			1.05m: PSP conducted within base of test pit
								L to MD	3, 3, 3, 3, 4, 4	
			25.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP08

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392172m N.6446593m
Elevation: 29 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			28.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				
						SP: SAND: fine to medium grained, subangular to subrounded; dark orange with brown; trace fines; trace rootlets.			5	
						... at 0.50m, becoming orange		D	5	
									6	
				1			D to M		5	
									6	
									5	1.05m: PSP conducted within base of test pit
									2	
								L to MD	3	
									3	
									4	
			27.0	2		Test pit terminated at 2.00 m			3	
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP09

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391961m N.6446622m
Elevation: 28 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			27.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation and branches.				
						SP: SAND: fine to medium grained, subangular to subrounded; grey with black orange; trace fines; trace root and rootlets; trace branches.			5	
									6	
									6	
									5	
						... at 0.80m, no longer branches				
				1			D to M	D to VD		1.05m: PSP conducted within base of test pit
									4	
						... at 1.40m, becoming orange			7	
									8	
									8	
									8	
			26.0	2		Test pit terminated at 2.00 m			9	
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP10

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392112m N.6446693m
Elevation: 31 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			30.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			4	
						SP: SAND: fine to medium grained, subangular to subrounded; grey with black orange; trace fines; trace rootlets.			4	
						... at 0.20m, becoming pale grey		D to VD	7	
									10	
						... at 0.80m, becoming orange			9	
				1			D to M		8	1.05m: PSP conducted within base of test pit
									2	
									3	
								L to MD	4	
									4	
									5	
			29.0	2		Test pit terminated at 2.00 m			4	
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP11

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392038m N.6446762m
Elevation: 31 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			30.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			3	0.00m: test pit located on a mound
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace root and rootlets; trace branches.			4	
						... at 0.30m, becoming orange with grey			5	
								MD to D	5	
			30.2			SP: SAND: fine to medium grained, subangular to subrounded; grey and orange; trace fines; trace root and rootlets.			4	
				1		... at 0.90m, no longer roots and rootlets	D to M		4	1.05m: PSP conducted within base of test pit
									5	
									8	
								VD	14	
			29.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP12

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392037m N.6446878m
Elevation: 29 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			29.0			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			5	0.00m: test pit located on a green
						FILL: SAND: fine to medium grained, subangular to subrounded; grey with orange; trace fines; trace rootlets.		D to VD	6	
						... at 0.20m, becoming dark grey with black				
			28.6			*... from 0.21m to 0.35m, coffee rock, only found in discrete area*			11	
						SP: SAND: fine to medium grained, subangular to subrounded; orange with grey; trace fines.			20	
				1			D to M			1.05m: PSP conducted within base of test pit
			27.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

This report must be read in conjunction with accompanying notes and abbreviations.

TEST PIT LOG - TP13

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392127m N.6446838m
Elevation: 28 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			27.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			6	
						SP: SAND: fine to medium grained, subangular to subrounded; orange with pale grey; trace fines; trace root and rootlets.			7	
						... at 0.40m, becoming grey with orange and black			6	
									8	
									10	
				1			D to M	D to VD	8	1.05m: PSP conducted within base of test pit
						... at 1.20m, becoming black with grey and orange			4	
									7	
									11	
									9	
									8	
			26.0	2		Test pit terminated at 2.00 m			8	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

This report must be read in conjunction with accompanying notes and abbreviations.

TEST PIT LOG - TP14

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 02/12/2020 1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP
Position: E.392214m N.6446932m
Elevation: 31 m
Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting
Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
	0.0 - 0.1	D	30.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			3	0.00m: test pit located on a tee box
						FILL: SAND: fine to medium grained, subangular to subrounded; dark grey with black; trace fines; trace root and rootlets.			4	
									4	
									5	
									4	
			30.0	1		SP: SAND: fine to medium grained, subangular to subrounded; pale grey with orange; trace fines; trace root and rootlets; trace branches.	D to M	MD to D	4	1.05m: PSP conducted within base of test pit
									3	
									4	
						... at 1.60m, no longer branches			6	
									5	
									6	
			29.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

This report must be read in conjunction with accompanying notes and abbreviations.

TEST PIT LOG - TP15

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020 1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP
Position: E.392112m N.6446995m
Elevation: 29 m
Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting
Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
	0.0 - 0.1	D	28.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			6	0.00m: test pit located on tee box
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets.			11	
			28.5			SP: SAND: fine to medium grained, subangular to subrounded; yellow; trace fines.			12	
						... from 0.60m to 0.80m, becoming black			12	
						... at 0.80m, becoming yellow, no longer rootlets			10	
				1			D to M	D to VD	10	1.05m: PSP conducted within base of test pit
									4	
									5	
									10	
									22	
			27.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

This report must be read in conjunction with accompanying notes and abbreviations.

TEST PIT LOG - TP16

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

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Logged by: MO
Checked by:AP

Position: E.392205m N.6447054m
Elevation: 30 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			29.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			6	0.00m: test pit located on mound
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets.		D to VD	7	
						... at 0.30m, becoming pale yellow			7	
									7	
			29.3			SP: SAND: fine to medium grained, subangular to subrounded; yellow; trace fines.			8	
				1			D to M		7	1.05m: PSP conducted within base of test pit
								L	1	
									1	
									2	
									2	
								D to VD	4	
			28.0	2		Test pit terminated at 2.00 m			8	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP17

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392177m N.6447122m
Elevation: 30 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
	0.0 - 0.1	D	29.8			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey black; trace fines; trace organics; trace roots and rootlets; trace vegetation.			3	0.00m: test pit located on mound
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets.			3	
						... at 0.50m, becoming white. Not a homogenous layer			3	
			29.3			SP: SAND: fine to medium grained, subangular to subrounded; yellow; trace fines.			5	
				1			D to M	MD to D	6	1.05m: PSP conducted within base of test pit
									6	
									3	
									3	
									4	
									5	
									6	
			28.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP18

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

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Logged by: MO
Checked by:AP

Position: E.392132m N.6447199m
Elevation: 28 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			27.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			5	
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets; trace branches; with some uncontrolled fill (old reticulation pipe, tree roots, bricks).		D to VD	5	
									6	
									5	
									5	
			27.1							
				1		SP: SAND: fine to medium grained, subangular to subrounded; yellow; trace fines; trace root.	D to M		7	1.05m: PSP conducted within base of test pit
						... at 1.10m, becoming grey			9	
									20	
			26.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP19

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392209m N.6447301m
Elevation: 29 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			28.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey brown; trace fines; trace organics; trace rootlets.			5	0.00m: test pit located on green
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow with grey; trace fines.			10	
									17	
			28.0	1		SP: SAND: fine to medium grained, subangular to subrounded; yellow; trace fines.	D to M	D to VD		1.05m: PSP conducted within base of test pit
									6	
									8	
									10	
									12	
									16	
			27.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP20

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392305m N.6447413m
Elevation: 30 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			29.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			6	
						FILL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey yellow; trace fines; trace rootlets; gravel is limestone.		D to VD	4	
									4	
									6	
			29.2			SP: SAND: fine to medium grained, subangular to subrounded; yellow; trace fines.			11	
				1			D to M		15	1.05m: PSP conducted within base of test pit
			28.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP21

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392233m N.6447425m
Elevation: 31 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			30.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			4	0.00m: test pit located on mound
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow with black; trace fines; trace rootlets.		MD to D	5	
						... at 0.50m, no longer branches			5	
									2	
									2	
				1			D to M		2	1.05m: PSP conducted within base of test pit
								L	2	
			29.1			SP: SAND: fine to medium grained, subangular to subrounded; orange with grey.			2	
			29.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP22

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392210m N.6447383m
Elevation: 31 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			30.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on mound
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow with grey; trace fines; trace rootlets.		MD to D	4 4 5 4 4 3	
						... at 0.70m, no longer rootlets	D to M			
				1						1.05m: PSP conducted within base of test pit
								L	1 1 1 1 1 1 1 1 1	
			29.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP23

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392132m N.6447358m
Elevation: 29 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			28.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on driving range
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets.		MD to D	4 3 7	
			28.4			SP: SAND: fine to medium grained, subangular to subrounded; pale grey white; trace fines.		VD	10 12 10	
				1			D to M			1.05m: PSP conducted within base of test pit
								MD to D	3 4 5 5 6	
			27.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP24

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392095m N.6447310m
Elevation: 30 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			29.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace branches; trace vegetation.		MD to D	4, 6, 6, 5, 6, 4	0.00m: test pit located on tee box
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow with grey; trace fines; trace rootlets.	D to M			
				1						1.05m: PSP conducted within base of test pit
						... at 1.30m, becoming dark grey		D to VD	6, 9, 10, 7, 6	
			28.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP25

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392026m N.6447373m
Elevation: 32 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			31.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; trace gravel; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace branches; trace vegetation.		D	5, 6, 6, 7, 7, 7	0.00m: test pit located on mound
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow with grey; trace fines; trace root and rootlets; trace branches.	D to M			
						... at 0.45m, no longer branches				
				1						1.05m: PSP conducted within base of test pit
								MD to D	2, 4, 5, 4, 5	
			30.1			SP: SAND: fine to medium grained, subangular to subrounded; yellow.				
			30.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP26

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392008m N.6447494m
Elevation: 28 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			27.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			3	0.00m: test pit located on driving range
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets.		MD to D	4 5	
			27.3			SP: SAND: fine to medium grained, subangular to subrounded; pale grey with black; trace fines; trace rootlets.			6 6	
				1		... at 0.90m, no longer rootlets	D to M		6	1.05m: PSP conducted within base of test pit
								L	1 1	
								MD	3 3 3	
				2		... at 2.10m, becoming pale brown			4	
			25.8			Test pit terminated at 2.20 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP27

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391844m N.6447426m
Elevation: 27 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			26.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			5	0.00m: test pit located on mound
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace root and rootlets; trace branches.			4	
			26.5			SP: SAND: fine to medium grained, subangular to subrounded; pale grey; trace fines.		D to VD	7 9 10 10	
				1			D to M			1.05m: PSP conducted within base of test pit
								MD to D	3 5 5 5 6	
			25.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP28

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391771m N.6447468m
Elevation: 28 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			27.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on green
						FILL: SAND: fine to medium grained, subangular to subrounded; grey with pale yellow; trace fines; trace root and rootlets; trace branches; with some uncontrolled fill (tree roots, potential asbestos at 0.5m).	D to M	D to VD	4, 6, 6, 4, 4, 4	
				1						1.05m: PSP conducted within base of test pit
								L	1, 1, 1, 1	
								MD to D	3, 7, 7	
			26.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP29

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391692m N.6447613m
Elevation: 27 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
	0.0 - 0.1	D	26.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on tee box
						SP: SAND: fine to medium grained, subangular to subrounded; grey with orange; trace fines; trace rootlets.		MD to D	3, 4, 4	
						... at 0.45m, becoming pale grey				
						... at 0.60m, no longer rootlets			7	
								VD	10, 9	
				1			D to M			1.05m: PSP conducted within base of test pit
									2, 2	
								L to MD	3, 4, 4, 4	
						... at 1.80m, becoming brown orange				
			25.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP30

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391668m N.6447725m
Elevation: 26 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			25.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on a mound
						SP: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace root and rootlets.		D to VD	7, 8, 7, 6, 6	
				1		*... from 1.00m to 1.60m, high root content*	D to M		7	1.05m: PSP conducted within base of test pit
									3, 8, 14	
			24.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP31

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391798m N.6447972m
Elevation: 26 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			25.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				
						SP: SAND: fine to medium grained, subangular to subrounded; dark grey with black; trace fines; trace root and rootlets; trace branches.		D	5, 5, 7	
						... at 0.40m, becoming pale grey			5, 6	
				1		*... at 0.90m, no longer roots, rootlets or branches*	D to M		5	1.05m: PSP conducted within base of test pit
								L	2, 2, 3	
								MD to D	4, 4, 5	
			24.0	2		Test pit terminated at 1.80 m				
				3						

Termination Reason: Test pit walls collapsing

Remarks: Backfilled.

TEST PIT LOG - TP32

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391789m N.6447873m
Elevation: 27 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 1.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			27.0			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; with organics; trace rootlets; trace vegetation.			5	0.00m: test pit located on green
			26.9			FILL: SAND: fine to medium grained, subangular to subrounded; brown orange; trace fines; trace rootlets; trace organics.		D to VD	9	
						SP: SAND: fine to medium grained, subangular to subrounded; orange.			9	
						... at 0.60m, becoming black with grey			9	
									9	
				1		... at 1.00m, becoming grey with black	D to M		8	1.05m: PSP conducted within base of test pit
								L	2	
									4	
									6	
								MD to D	5	
									5	
			25.0	2		Test pit terminated at 2.00 m			6	
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP33

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391914m N.6447886m
Elevation: 29 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 1.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			29.0			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; with organics; trace rootlets; trace vegetation.			5	0.00m: test pit located on green
			28.9			FILL: SAND: fine to medium grained, subangular to subrounded; brown orange; trace fines; trace root and rootlets; trace organics.			7	
						SP: SAND: fine to medium grained, subangular to subrounded; grey with orange.			7	
								MD to D	4	
									4	
				1			D to M		5	1.05m: PSP conducted within base of test pit
									5	
									9	
									10	
								VD	12	
									11	
			27.0	2		Test pit terminated at 2.00 m			12	
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP34

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391798m N.6447972m
Elevation: 27 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			26.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; with gravel, coarse grained, subangular to subrounded; with cobbles and boulders, subangular to subrounded (surface); dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation and branches.		MD to D	4, 5, 6, 6	0.00m: test pit located next to lake
						FILL: SAND: fine to medium grained, subangular to subrounded; orange brown with black; trace fines; trace rootlets.				0.20m: plastic liner
								VD	8, 10	
				1			D to M			1.05m: PSP conducted within base of test pit
						... at 1.40m, increasing black colouration		VL to L	1, 1, 3	
						... at 1.60m, potential asbestos pipe				
			25.2			Test pit terminated at 1.80 m		D to VD	5, 6, 8	
				2						
				3						

Termination Reason: Test pit walls collapsing
Remarks: Backfilled.

TEST PIT LOG - TP35

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391695m N.6447961m
Elevation: 26 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			25.9	0		TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.		D to VD	6, 8, 12, 17	
						SP: SAND: fine to medium grained, subangular to subrounded; dark grey; trace fines; trace root and rootlets.				
						... at 0.50m, becoming pale grey				
				1			D to M			
				2						
			23.8			Test pit terminated at 2.20 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP36

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391780m N.6448083m
Elevation: 33 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			33.0			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; with organics; trace fines; trace rootlets; trace vegetation.			4	0.00m: test pit located on green
			32.8			FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace root and rootlets; trace organics.			7	
						SP: SAND: fine to medium grained, subangular to subrounded; orange; trace fines.		D to VD	10	
						... at 0.70m, becoming pale yellow with orange			10	
									12	
				1			D to M		14	1.05m: PSP conducted within base of test pit
			31.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP37

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391641m N.6448108m
Elevation: 31 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			30.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation and branches.			8	
						FILL: SAND: fine to medium grained, subangular to subrounded; pale grey orange; trace fines; trace rootlets.		VD	9	
			30.5			SP: SAND: fine to medium grained, subangular to subrounded; orange; trace fines; trace rootlets.			10	
									11	
									14	
				1			D to M			1.05m: PSP conducted within base of test pit
			29.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP38

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391687m N.6448201m
Elevation: 40 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			39.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			5 10 15	0.00m: test pit located on a mound
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow; trace fines; trace root and rootlets.		L	3	
									2	
									3	
									3	
			39.2			SP: SAND: fine to medium grained, subangular to subrounded; orange; trace fines; trace rootlets.	D to M	MD to D	4	
				1					4	
									6	
								VD	13	
			38.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

This report must be read in conjunction with accompanying notes and abbreviations.

TEST PIT LOG - TP39

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391604m N.6448263m
Elevation: 39 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			38.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation and branches.			5 10 15	0.00m: test pit located on a mound
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow; trace fines; trace rootlets.		D to VD	6	
									7	
									10	
			38.4			SP: SAND: fine to medium grained, subangular to subrounded; orange; trace fines.	D to M		12	
				1					16	
			37.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

This report must be read in conjunction with accompanying notes and abbreviations.

TEST PIT LOG - TP40

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391717m N.6448301m
Elevation: 37 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			36.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			5	
			36.7			FILL: SAND: fine to medium grained, subangular to subrounded; orange brown; trace fines; trace rootlets.			6	
						SP: SAND: fine to medium grained, subangular to subrounded; orange with black; trace fines; trace rootlets.			6	
									6	
									6	
				1			D to M	D to VD	7	1.05m: DCP conducted within base of test pit
									5	
									8	
									9	
									9	
									8	
			35.0	2		Test pit terminated at 2.00 m			8	
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP41

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391656m N.6448386m
Elevation: 40 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
	0.0 - 0.1	D	39.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			5	0.00m: test pit located on a mound
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow with black; trace fines; trace rootlets.		D	6	
									6	
									6	
									7	
				1			D to M		7	1.05m: DCP conducted within base of test pit
								L	2	
			38.6			SP: SAND: fine to medium grained, subangular to subrounded; orange with black; trace fines; trace rootlets.			3	
									6	
								D to VD	9	
									15	
			38.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP42

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391769m N.6448368m
Elevation: 36 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			35.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark brown; trace fines; trace organics; trace roots and rootlets; trace vegetation and branches.			5	
			35.7			FILL: SAND: fine to medium grained, subangular to subrounded; orange brown; trace fines; trace rootlets.			7	
						SP: SAND: fine to medium grained, subangular to subrounded; orange; trace fines; trace root and rootlets.			14	
				1			D to M	D to VD		1.05m: DCP conducted within base of test pit
									5	
									6	
									6	
									6	
									5	
			34.0	2		Test pit terminated at 2.00 m			6	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP43

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391858m N.6448357m
Elevation: 35 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			34.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.		MD	4	
						FILL: SAND: fine to medium grained, subangular to subrounded; grey orange; trace fines; trace rootlets.			4	
									7	
			34.4			SP: SAND: fine to medium grained, subangular to subrounded; orange with black white; trace fines; trace rootlets.			7	
									8	
				1			D to M	D to VD	12	1.05m: DCP conducted within base of test pit
									7	
									15	
			33.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP44

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391800m N.6448352m
Elevation: 35 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			34.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; with gravel, coarse grained, subangular to subrounded; with cobbles and boulders, subangular to subrounded (surface); dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation and branches.		MD	3	0.00m: test pit located next to lake
			34.8			FILL: SAND: fine to medium grained, subangular to subrounded; brown orange; trace fines; trace root and rootlets.			5	0.20m: plastic liner
						SP: SAND: fine to medium grained, subangular to subrounded; orange; trace fines; trace rootlets.		D to VD	6	
				1			D to M		9	
									9	
									9	
			33.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP45

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391830m N.6448277m
Elevation: 37 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			36.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			5	0.00m: test pit located on a tee box
						FILL: SAND: fine to medium grained, subangular to subrounded; grey with black; trace fines; trace rootlets.		D	6	
									6	
			36.4			SP: SAND: fine to medium grained, subangular to subrounded; orange with black white; trace fines; trace rootlets.			7	
				1			D to M		11	
								D to VD	17	1.05m: DCP conducted within base of test pit
									7	
									13	
			35.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP46

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.391760m N.6448174m
Elevation: 42 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
	0.0 - 0.1	D	41.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation and branches.		MD to D	8	0.00m: test pit located on a mound
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow; trace fines; trace root and rootlets; trace branches.			5	
									4	
			41.4			SP: SAND: fine to medium grained, subangular to subrounded; orange; trace fines; trace rootlets.			8	
									10	
				1			D to M	D to VD	9	1.05m: PSP conducted within base of test pit
									7	
									13	
			40.0	2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP47

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392020m N.6447932m
Elevation: 27 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			26.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation and branches.			7	
			26.7			FILL: SAND: fine to medium grained, subangular to subrounded; brown orange; trace fines; trace root and rootlets.		D to VD	8	
						SP: SAND: fine to medium grained, subangular to subrounded; white; trace fines; trace root and rootlets.			9	
									11	
						... at 0.90m, becoming orange				
				1			D to M			1.05m: DCP conducted within base of test pit
									3	
									4	
								MD to D	5	
									6	
									6	
			25.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP48

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392002m N.6447829m
Elevation: 26 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
	0.0 - 0.1	D	25.9			TOPSOIL: CLAYEY SAND: fine to medium grained, subangular to subrounded; clay, low plasticity; dark grey brown; with organics; trace roots and rootlets; very light, crusted material found at base of lake.	M	VL to L	1, 2, 3	0.00m: test pit located on a previous lake
						FILL: SAND: fine to medium grained, subangular to subrounded; orange brown; trace fines.	W			
			25.5			SP: SAND: fine to medium grained, subangular to subrounded; white; trace fines.			6, 6, 7	0.50m: plastic liner
				1			M	MD to D	3, 5, 6, 7, 7, 7	1.05m: DCP conducted within base of test pit
				2		Test pit terminated at 2.00 m				
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP49

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392001m N.6447777m
Elevation: 28 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			27.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				0.00m: test pit located on a mound
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow; trace fines; trace rootlets.			8, 8, 8	
						... at 0.70m, becoming pale yellow with black		VD	8, 9, 10	
				1			D to M		9	1.05m: DCP conducted within base of test pit
								MD to D	3, 5, 5, 4, 3	
			26.0	2		Test pit terminated at 2.00 m			4	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP50

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392027m N.6447786m
Elevation: 27 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			26.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				
			26.8			FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace root and rootlets.				
						SP: SAND: fine to medium grained, subangular to subrounded; pale grey; trace fines; trace root and rootlets; trace branches.				
						... at 0.70m, becoming orange				
				1			D to M	MD to D	5, 4, 5, 4, 4, 4	1.05m: PSP conducted within base of test pit
									3, 4, 5, 5, 6	
			25.0	2		Test pit terminated at 2.00 m			6	
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP51

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 7

Logged by: MO
Checked by:AP

Position: E.392051m N.6447678m
Elevation: 27 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			26.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.				
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace root and rootlets.		D	6, 6, 7	
			26.4			SP: SAND: fine to medium grained, subangular to subrounded; pale grey; trace fines; trace rootlets.			7, 7, 7	
				1			D to M			1.05m: PSP conducted within base of test pit
								L	2, 3	
								MD	4, 4	
			25.0	2		Test pit terminated at 2.00 m			11, 11	
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP52

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 01/12/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392157m N.6447272m
Elevation: 26 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			25.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; with gravel, coarse grained, subangular to subrounded; with cobbles and boulders, subangular to subrounded (surface); dark grey; trace fines; trace organics; trace roots and rootlets; trace vegetation and branches.		MD	3	0.00m: test pit located on edge of lake 0.10m: plastic liner on lake embankment
			25.7			SAND: FILL; fine to medium grained, subangular to subrounded; brown orange, trace roots and rootlets.			6	
						SP: SAND: fine to medium grained, subangular to subrounded; pale grey; trace fines; trace root and rootlets.			8	
									8	
							D to M	D to VD	9	
						... at 0.90m, becoming orange			8	
			25.0	1		COFFEE ROCK: fine to medium grained, subangular to subrounded; dark brown; weakly cemented; trace fines.				1.05m: DCP conducted within base of test pit
									4	
								VD	20	
			24.3			Test pit terminated at 1.70 m				
				2						
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP53

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392109m N.6447575m
Elevation: 28 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm)	Structure & other observations
			27.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			5	0.00m: test pit located on mound
						FILL: SAND: fine to medium grained, subangular to subrounded; grey; trace fines; trace rootlets.			7	
			27.6			SP: SAND: fine to medium grained, subangular to subrounded; pale grey; trace fines; trace root and rootlets.		D to VD	7	
									6	
									7	
				1			D to M		9	1.05m: PSP conducted within base of test pit
									4	
									5	
								MD to D	6	
									6	
									6	
			26.0	2		Test pit terminated at 2.00 m			6	
				3						

Termination Reason: Target depth reached
Remarks: Backfilled.

TEST PIT LOG - TP54

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392112m N.6447508m
Elevation: 30 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			29.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			2	0.00m: test pit located on mound
						FILL: SAND: fine to medium grained; dark grey with black; trace fines; trace rootlets.			1 1 1 1 1 1	
				1			D to M	L		1.05m: PSP conducted within base of test pit
									1	
									1 2	
								MD	4 6	
			28.1			SP: SAND: fine to medium grained, subangular to subrounded; pale grey.			8	
			28.0	2		Test pit terminated at 2.00 m		VD	8	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

TEST PIT LOG - TP55

Client: JDSi Consulting Engineers
Project: Glen Iris Estate
Location: Jandakot, WA
Project: PER2020-0452
Date: 30/11/2020

1:23 Sheet 1 of 1

Logged by: MO
Checked by:AP

Position: E.392174m N.6447445m
Elevation: 29 m

Plant: JCB 8 tonne backhoe
Contractor: ANH Contracting

Dimensions : 0.50m x 3.50m

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description: Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Perth Sand Penetrometer (Blows/150mm) 5 10 15	Structure & other observations
			28.9			TOPSOIL: SAND: fine to medium grained, subangular to subrounded; dark grey brown; trace fines; trace organics; trace roots and rootlets; trace vegetation.			6	
						FILL: SAND: fine to medium grained, subangular to subrounded; pale yellow; trace fines; trace rootlets.		D	7 7 7 7 6	
				1			D to M			1.05m: PSP conducted within base of test pit
			27.8			SP: SAND: fine to medium grained, subangular to subrounded; orange; trace fines.			3 3	
								MD to D	4 5 6	
			27.0	2		Test pit terminated at 2.00 m			5	
				3						

Termination Reason: Target depth reached

Remarks: Backfilled.

Appendix B

Permeability Test Results

CMW Geosciences

CLIENT:	JDSi Consulting Engineers	DESIGNER:	MO
PROJECT:	Glen Iris Estate Jandakot, WA	CHECKED:	AP
		REVISION:	1
TITLE:	Falling Head Permeability Test 1	DATE:	3/12/2020
		PROJECT:	PER2020-0452

Specifications - Open-Ended Tube

Length L_1:	1.41	m
Diameter:	80	mm
Non-Perm L_2:		m
Above Gnd L_3:	0.05	m

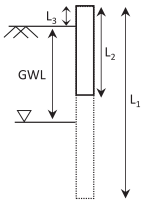
Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m: 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.36 m BGL



Hydraulic Conductivity (k)

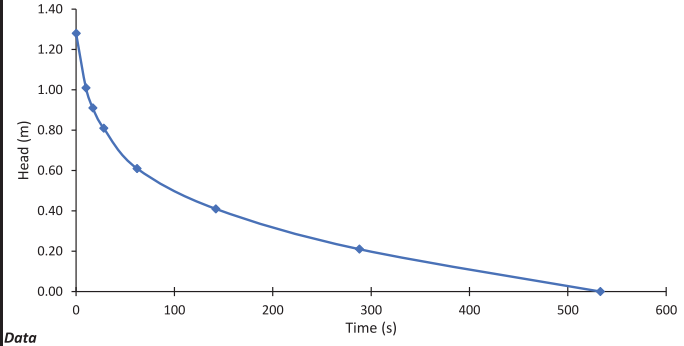
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 3.15E-04 ms^{-1} = 27.22 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2 ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 6.50E-05 ms^{-1} = 5.61 m/day



STRATIGRAPHIC LOG
Sand
EOH @ 1.36m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})
0	0.130	1.280				
10	0.400	1.010	1.145		5.55E-05	4.01E-04
17	0.500	0.910	0.960		3.95E-05	2.49E-04
28	0.600	0.810	0.860		3.02E-05	1.76E-04
62	0.800	0.610	0.710		2.71E-05	1.39E-04
142	1.000	0.410	0.510		1.99E-05	8.19E-05
288	1.200	0.210	0.310		2.44E-05	7.49E-05
533	1.410	0.000	0.105		2.58E-04	1.08E-03

12.00

CMW Geosciences	CLIENT: JDSi Consulting Engineers	DESIGNER:	MO
	PROJECT: Glen Iris Estate Jandakot, WA	CHECKED:	AP
		REVISION:	1
	TITLE: Falling Head Permeability Test 2	DATE:	3/12/2020
		PROJECT:	PER2020-0452

Specifications - Open-Ended Tube

Length L_1:	1.43	m
Diameter:	80	mm
Non-Perm L_2:		m
Above Gnd L_3:	0.01	m

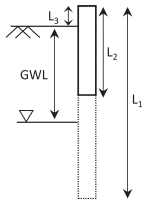
Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m: 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.42 m BGL



Hydraulic Conductivity (k)

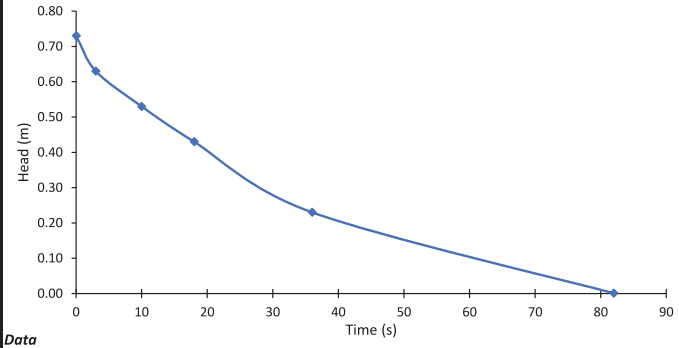
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 1.22E-03 ms^{-1} = 105.00 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2\, ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 2.99E-04 ms^{-1} = 25.84 m/day



STRATIGRAPHIC LOG

Sand

EOH @ 1.42m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})	
0	0.700	0.730					
3	0.800	0.630	0.680		1.64E-04	8.08E-04	
10	0.900	0.530	0.580		9.12E-05	4.03E-04	
18	1.000	0.430	0.480		1.09E-04	4.22E-04	
36	1.200	0.230	0.330		1.79E-04	5.68E-04	
82	1.429	0.001	0.116		9.52E-04	3.87E-03	49.11

CMW Geosciences	CLIENT: JDSi Consulting Engineers	DESIGNER:	MO
	PROJECT: Glen Iris Estate Jandakot, WA	CHECKED:	AP
		REVISION:	1
	TITLE: Falling Head Permeability Test 3	DATE:	3/12/2020
		PROJECT:	PER2020-0452

Specifications - Open-Ended Tube

Length L_1:	1.39	m
Diameter:	80	mm
Non-Perm L_2:		m
Above Gnd L_3:	0.04	m

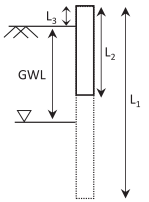
Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m: 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.35 m BGL



Hydraulic Conductivity (k)

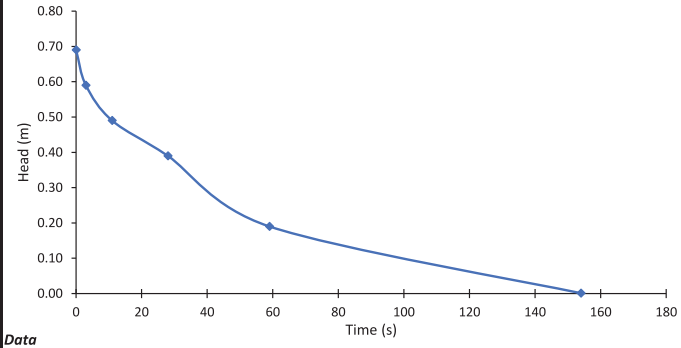
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 6.73E-04 ms^{-1} = 58.18 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2\, ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 1.85E-04 ms^{-1} = 16.00 m/day



STRATIGRAPHIC LOG

Sand

EOH @ 1.35m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})	
0	0.700	0.690					
3	0.800	0.590	0.640		1.81E-04	8.56E-04	
11	0.900	0.490	0.540		8.97E-05	3.77E-04	
28	1.000	0.390	0.440		5.87E-05	2.15E-04	
59	1.200	0.190	0.290		1.28E-04	3.80E-04	
154	1.389	0.001	0.095		4.68E-04	1.54E-03	32.79

CMW Geosciences	CLIENT: JDSi Consulting Engineers	DESIGNER:	MO
	PROJECT: Glen Iris Estate Jandakot, WA	CHECKED:	AP
		REVISION:	1
	TITLE: Falling Head Permeability Test 4	DATE:	3/12/2020
		PROJECT:	PER2020-0452

Specifications - Open-Ended Tube

Length L_1:	1.42	m
Diameter:	80	mm
Non-Perm L_2:		m
Above Gnd L_3:	0.04	m

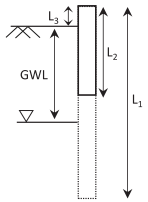
Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m: 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.38 m BGL



Hydraulic Conductivity (k)

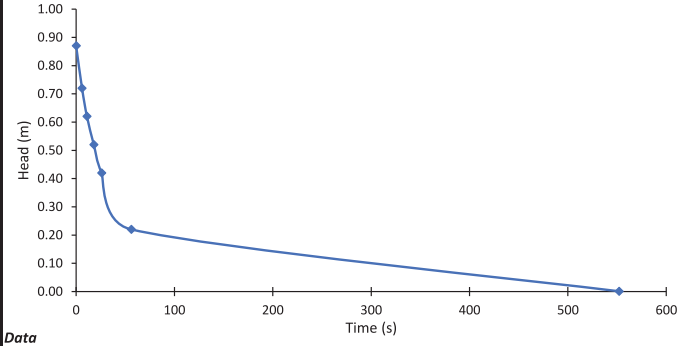
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 4.25E-04 ms^{-1} = 36.75 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2 \ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 1.01E-04 ms^{-1} = 8.69 m/day



STRATIGRAPHIC LOG

Fill

EOH @ 1.38m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})	
0	0.550	0.870					
6	0.700	0.720	0.795		9.50E-05	5.25E-04	
11	0.800	0.620	0.670		1.01E-04	4.92E-04	
18	0.900	0.520	0.570		9.39E-05	4.10E-04	
26	1.000	0.420	0.470		1.12E-04	4.30E-04	
56	1.200	0.220	0.320		1.13E-04	3.52E-04	
552	1.419	0.001	0.111		8.87E-05	3.43E-04	

37.18

CMW Geosciences	CLIENT: JDSi Consulting Engineers	DESIGNER:	MO
	PROJECT: Glen Iris Estate Jandakot, WA	CHECKED:	AP
		REVISION:	1
	TITLE: Falling Head Permeability Test 5	DATE:	3/12/2020
		PROJECT:	PER2020-0452

Specifications - Open-Ended Tube

Length L_1:	1.42	m
Diameter:	80	mm
Non-Perm L_2:		m
Above Gnd L_3:	0.02	m

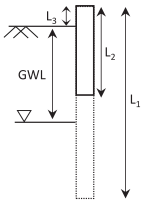
Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m: 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.40 m BGL



Hydraulic Conductivity (k)

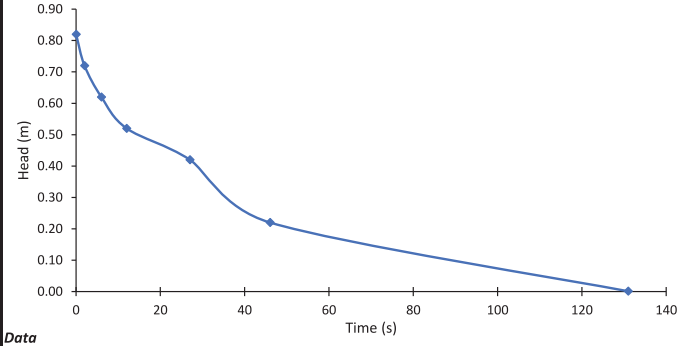
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 8.26E-04 ms^{-1} = 71.39 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2 \ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 1.99E-04 ms^{-1} = 17.16 m/day



STRATIGRAPHIC LOG

Sand

EOH @ 1.4m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})	
0	0.600	0.820					
2	0.700	0.720	0.770		2.00E-04	1.08E-03	
6	0.800	0.620	0.670		1.26E-04	6.15E-04	
12	0.900	0.520	0.570		1.10E-04	4.78E-04	
27	1.000	0.420	0.470		5.99E-05	2.29E-04	
46	1.200	0.220	0.320		1.78E-04	5.56E-04	
131	1.419	0.001	0.111		5.18E-04	2.00E-03	

19.83

CMW Geosciences	CLIENT: JDSi Consulting Engineers	DESIGNER:	MO
	PROJECT: Glen Iris Estate Jandakot, WA	CHECKED:	AP
		REVISION:	1
	TITLE: Falling Head Permeability Test 6	DATE:	3/12/2020
		PROJECT:	PER2020-0452

Specifications - Open-Ended Tube

Length L_1:	1.44	m
Diameter:	80	mm
Non-Perm L_2:		m
Above Gnd L_3:	0.04	m

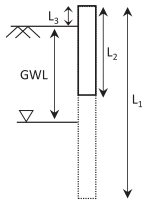
Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m: 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.40 m BGL



Hydraulic Conductivity (k)

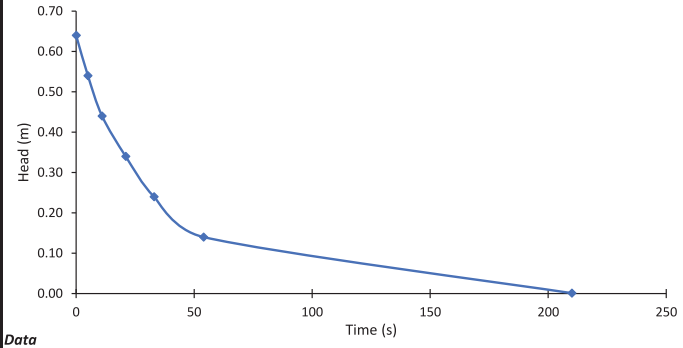
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 5.05E-04 ms^{-1} = 43.61 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2 \ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 1.67E-04 ms^{-1} = 14.46 m/day



STRATIGRAPHIC LOG

Sand

EOH @ 1.4m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})	
0	0.800	0.640					
5	0.900	0.540	0.590		1.24E-04	5.55E-04	
11	1.000	0.440	0.490		1.40E-04	5.52E-04	
21	1.100	0.340	0.390		1.21E-04	4.10E-04	
33	1.200	0.240	0.290		1.60E-04	4.51E-04	
54	1.300	0.140	0.190		1.73E-04	3.82E-04	
210	1.439	0.001	0.070		2.86E-04	6.80E-04	

38.92

CMW Geosciences	CLIENT: JDSi Consulting Engineers	DESIGNER:	MO
	PROJECT: Glen Iris Estate Jandakot, WA	CHECKED:	AP
		REVISION:	1
	TITLE: Falling Head Permeability Test 7	DATE:	3/12/2020
		PROJECT:	PER2020-0452

Specifications - Open-Ended Tube

Length L_1:	1.44	m
Diameter:	80	mm
Non-Perm L_2:		m
Above Gnd L_3:	0.03	m

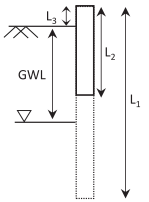
Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m: 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.41 m BGL



Hydraulic Conductivity (k)

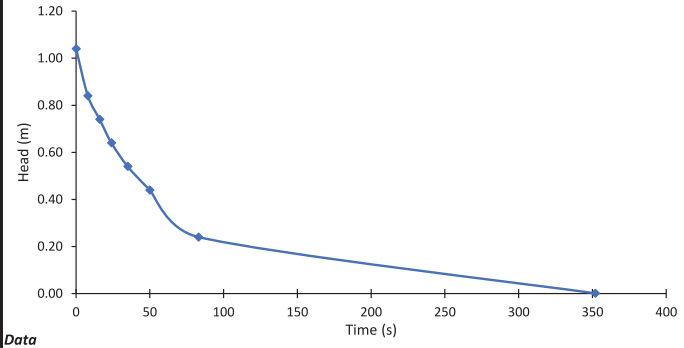
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 3.54E-04 ms^{-1} = 30.55 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2 \ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 7.82E-05 ms^{-1} = 6.75 m/day



STRATIGRAPHIC LOG

Sand

EOH @ 1.41m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})	
0	0.400	1.040					
8	0.600	0.840	0.940		7.18E-05	4.48E-04	
16	0.700	0.740	0.790		4.79E-05	2.63E-04	
24	0.800	0.640	0.690		6.00E-05	2.99E-04	
35	0.900	0.540	0.590		5.65E-05	2.52E-04	
50	1.000	0.440	0.490		5.60E-05	2.21E-04	
83	1.200	0.240	0.340		9.31E-05	3.00E-04	
352	1.439	0.001	0.121		1.62E-04	6.92E-04	

21.81

CMW Geosciences

CLIENT:	JDSi Consulting Engineers	DESIGNER:	MO
PROJECT:	Glen Iris Estate Jandakot, WA	CHECKED:	AP
		REVISION:	1
TITLE:	Falling Head Permeability Test 8	DATE:	3/12/2020
		PROJECT:	PER2020-0452

Specifications - Open-Ended Tube

Length L_1:	1.44	m
Diameter:	80	mm
Non-Perm L_2:		m
Above Gnd L_3:	0.03	m

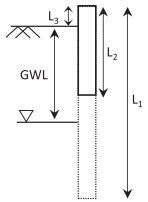
Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m: 1 $m = \sqrt{k_h / k_v}$

Bottom of Test Hole: 1.41 m BGL



Hydraulic Conductivity (k)

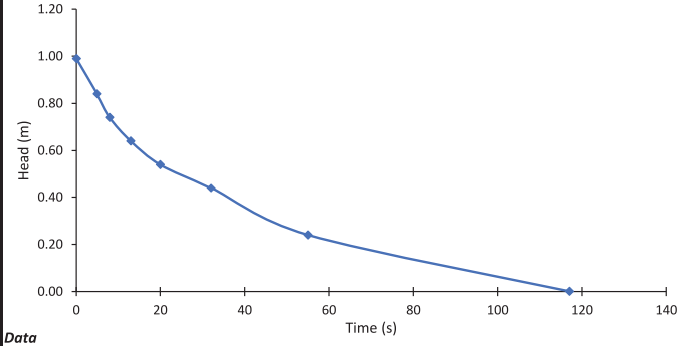
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 8.32E-04 ms^{-1} = 71.89 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2 \, ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 1.87E-04 ms^{-1} = 16.13 m/day



STRATIGRAPHIC LOG

Sand

EOH @ 1.41m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})	
0	0.450	0.990	0.915		9.18E-05	5.60E-04	
4.9	0.600	0.840	0.790		1.24E-04	6.78E-04	
8	0.700	0.740	0.690		9.60E-05	4.78E-04	
13	0.800	0.640	0.590		8.87E-05	3.97E-04	34.27
20	0.900	0.540	0.490		7.00E-05	2.76E-04	
32	1.000	0.440	0.340		1.34E-04	4.31E-04	
55	1.200	0.240	0.121		7.03E-04	3.00E-03	
117	1.439	0.001					

Appendix C

Laboratory Test Results

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - ASTM D2974-14 (Test Method C)

Client:	CMW Geosciences	*Ticket No.*	S2166
Client Address:	Suite 1, Level 3/29 Flynn Street, Wembley WA	*Report No.*	WG20/11347-11354_1_OI
Project:	Geotechnical Investigation	*Sample No.*	WG20/11347-11354
Location:	Glen Iris Golf Course	*Date Sampled:*	Not Specified
Sample Identification:	Various - See Below	*Date Tested:*	4-12-2020

TEST RESULTS - Organic Content

Sampling Method: Sampled by Client, Tested as Received

Testing Completed By: WGLS - KT

Furnace Temperature (°C): 440

Sample Number	Sample Identification	Ash Content (%)	Organic Content (%)
WG20/11347	TP04 0.01m	95.8	4.2
WG20/11348	TP14 0.01m	94.7	5.3
WG20/11349	TP29 0.01m	96.0	4.0
WG20/11350	TP41 0.01m	91.4	8.6
WG20/11351	TP46 0.01m	95.6	4.4
WG20/11352	TP48 0.01m	74.5	25.5
WG20/11353	TP23 0.01m	94.6	5.4
WG20/11354	TP15 0.01m	96.7	3.3

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 05-December-2020

NATA Accreditation No. 20599
Accredited for compliance with ISO/IEC 17025 - Testing

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APPENDIX D
WATER CORPORATION COMMENTARY

Blair Trew

From: Land Planning <LandPlanning@watercorporation.com.au>
Sent: Tuesday, 18 July 2023 9:32 AM
To: Christopher Elms
Subject: RE: SF0009009 RE: L 509 No 76 Dean Road Jandakot - Glen Iris Golf Course
Attachments: Glen_Iris_Golf_Course_plan.pdf

Hi Chris

Thanks for your query below.

From what I can initially see from the updated plan you have provided I can say the information regarding the upgrades previously determined would be still the minimum of what will be required. Unfortunately due to the changes in development density in different locations we will need to undertake a review of our planning and the information we previously provided will need to be checked to see if there are any additional upgrades required. To help with the planning review could you please provide shape files or DWG files of the Indicative Subdivision Concept. I will find out when the review can take place and when we should be able to get back to you. I have included the plan referred to on 30 April 2021 regarding the wastewater upgrades required. But as I said this is the minimum required and we still need to determine if additional upgrades are required.

I'll let you know when we can provide that updated information. I hope to hear from you soon regarding the shape files or DWG files.

Regards

Kevin Purcher
Snr Plnr - Land Planning
Development Services

E Kevin.Purcher@watercorporation.com.au
T (08) 9420 2385

watercorporation.com.au

From: Christopher Elms <Chris.Elms@jdsi.com.au>
Sent: Friday, 14 July 2023 2:10 PM
To: Land Planning <LandPlanning@watercorporation.com.au>
Cc: Blair Trew <blair.trew@jdsi.com.au>; Steven Foley <steven.foley@jdsi.com.au>; Kevin Purcher <Kevin.Purcher@watercorporation.com.au>
Subject: SF0009009 RE: L 509 No 76 Dean Road Jandakot - Glen Iris Golf Course

Hi,

The Structure Plan for the proposed development is progressing and we have been requested to update the Servicing Report for this project to reflect the Water Corps most recent sewer catchments and water supply and any associated funding.

This is quite urgent and as such, your earliest attention to this would be greatly appreciated.

Kind regards,

Chris Elms
Senior Civil Engineer

M: 0432 731 998
P: 08 9227 0595
F: 08 9227 8617

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432 Murray Street
Perth WA 6000

PO Box 7483
Cloisters Square PO WA 6850

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From: Kevin Purcher <Kevin.Purcher@watercorporation.com.au>
Sent: Wednesday, 5 May 2021 7:06 AM
To: Steven Foley <steven.foley@jdsi.com.au>
Cc: Blair Trew <blair.trew@jdsi.com.au>; Brett Coombes <Brett.Coombes@watercorporation.com.au>
Subject: RE: L 509 No 76 Dean Road Jandakot - Glen Iris Golf Course

Hi Steven

We have now completed the water scheme review and the following should be noted.

Again there are upgrades required to our headworks infrastructure including distribution mains. But the Water Corporation will undertake them when required at our expense.

A new DN150 reticulation main from the Berrigan Drive DN500 distribution main for water servicing South of Berrigan Drive is required. This new main would be required to be integrate into the existing reticulation system during the subdivision stage. (see sketch below)

If you have any further queries please don't hesitate to ask.

Regards

Kevin Purcher
Snr Plnr - Land Planning
Development Services

E Kevin.Purcher@watercorporation.com.au
T (08) 9420 2385

watercorporation.com.au

From: Kevin Purcher
Sent: Friday, 30 April 2021 3:28 PM
To: Steven Foley <steven.foley@jdsi.com.au>
Cc: Blair Trew <blair.trew@jdsi.com.au>; Brett Coombes <Brett.Coombes@watercorporation.com.au>
Subject: RE: L 509 No 76 Dean Road Jandakot - Glen Iris Golf Course

Hi Steve

Sorry but we have only just finalised the Wastewater review and are still awaiting the finalisation of the water scheme review. Please note the following.

Water – still to be provided

Wastewater
Glen Iris Golf Course is currently within both Bibra Lake and Jandakot Sewer Districts. Based on the existing contours, a small area northeast of the golf course (highlighted in yellow on the attached plan), which is currently included in Bibra Lake SD, will be changed to Jandakot SD, and would be served by Glenbawn Dr SPS instead of Virgilia Tce SPS. That may affect how the development is serviced.
There are numerous upgrades required to our downstream headworks infrastructure including collection sewers, pump stations and pressure mains. But the Water Corporation will undertake them when required at our expense.
As a result of the proposed development there is a retic sewer that is downstream of the development that needs to be upgraded when development takes place. 825m of existing DN225 retic sewer from manhole number T9948 to S0697 needs to be upgraded to DN300. (refer to plan attached) This will need to be undertaken by the developer at the developers expense as part of the future development (subdivision) process.

If you have any queries please don't hesitate to contact me.

Regards

Kevin Purcher
Snr Plnr - Land Planning
Development Services

E Kevin.Purcher@watercorporation.com.au
T (08) 9420 2385

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From: Steven Foley <steven.foley@jdsi.com.au>
Sent: Thursday, 29 April 2021 6:13 PM

To: Kevin Purcher <Kevin.Purcher@watercorporation.com.au>
Cc: Blair Trew <blair.trew@jdsi.com.au>; Brett Coombes <Brett.Coombes@watercorporation.com.au>
Subject: RE: L 509 No 76 Dean Road Jandakot - Glen Iris Golf Course

Hi Kevin,

Just following up on the below. JDSi's report is due cob tomorrow so hoping to get the updated planning advice on the upgrades prior to then.

Regards,

Steven Foley
DIRECTOR

M: 0411 153 087
P: 08 9227 0595
F: 08 9227 8617

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432 Murray Street
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From: Steven Foley
Sent: Wednesday, 14 April 2021 1:20 PM
To: Kevin Purcher <Kevin.Purcher@watercorporation.com.au>
Cc: Blair Trew <blair.trew@jdsi.com.au>; Brett Coombes <Brett.Coombes@watercorporation.com.au>
Subject: RE: L 509 No 76 Dean Road Jandakot - Glen Iris Golf Course

Hi Kevin,

Answers below in green.

Regards,

Steven Foley
DIRECTOR

M: 0411 153 087
P: 08 9227 0595
F: 08 9227 8617

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From: Kevin Purcher <Kevin.Purcher@watercorporation.com.au>
Sent: Wednesday, 14 April 2021 11:56 AM
To: Steven Foley <steven.foley@jdsi.com.au>
Subject: RE: L 509 No 76 Dean Road Jandakot - Glen Iris Golf Course

Hi Steven

Sorry for not getting back to you I thought I had. We will try our best to have it completed by the end of April. But how close I'm not sure. Is there an actual date? Would it be an issue if we could only reply by say the first week of May? The LSP is aiming to be lodged in the first week of May so we would ideally like it no later than Fri 30th April.

With your question about any issues, are you referring to upgrades of mains and other infrastructure? Yes this is correct If so until we have the review complete it is difficult to answer. The simple answer would be if there are upgrades required for reticulation works then the developer would pay and arrange them. Noted But if there are upgrades to headworks items then funding of them needs to be determined depending on what they are. Noted

I hope that helps. Please ask if you have a query.

Regards

Kevin Purcher
Snr Plnr - Land Planning
Development Services

E Kevin.Purcher@watercorporation.com.au
T (08) 9420 2385

watercorporation.com.au

From: Steven Foley <steven.foley@jdsi.com.au>
Sent: Tuesday, 13 April 2021 5:02 PM
To: Kevin Purcher <Kevin.Purcher@watercorporation.com.au>
Cc: Blair Trew <blair.trew@jdsi.com.au>; Brett Coombes <Brett.Coombes@watercorporation.com.au>
Subject: RE: L 509 No 76 Dean Road Jandakot - Glen Iris Golf Course

Hi Kevin,

Are you able to provide any updates on the below? Have the planners had a chance to look into this? JDSi need to have our servicing report completed by the end of April and I would ideally like to have some confirmation from the WC that we don't have any issues – if we do, what we can do to resolve them down the track.

Regards,

Steven Foley
DIRECTOR

M: 0411 153 087
P: 08 9227 0595
F: 08 9227 8617

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From: Kevin Purcher <Kevin.Purcher@watercorporation.com.au>
Sent: Tuesday, 30 March 2021 3:01 PM
To: Steven Foley <steven.foley@jdsi.com.au>
Subject: RE: L 509 No 76 Dean Road Jandakot - Glen Iris Golf Course [Filed 30 Mar 2021 15:29]

Thanks for the update Steven.

I will be finding out when those reviews will be able to take place and then I will let you know as soon as I can.

Regards

Kevin Purcher
Snr Plnr - Land Planning
Development Services

E Kevin.Purcher@watercorporation.com.au
T (08) 9420 2385

watercorporation.com.au

From: Steven Foley <steven.foley@jdsi.com.au>
Sent: Tuesday, 30 March 2021 2:49 PM
To: Kevin Purcher <Kevin.Purcher@watercorporation.com.au>
Cc: Blair Trew <blair.trew@jdsi.com.au>; Brett Coombes <Brett.Coombes@watercorporation.com.au>
Subject: RE: L 509 No 76 Dean Road Jandakot - Glen Iris Golf Course

Thanks Kevin,

Given we are submitting a servicing report to support the LSP we are probably going to need some more definitive answers in regards to any water/sewer upgrades required. Given the highly sensitive nature of the project any gaps will be scrutinised. To assist receiving these more definitive answers I can advise (based on the current plan) the following:

Water – number of lots is 408. The number of dwellings is 550.

Sewer – the proposed flows from the entire development based on the number of dwellings is approx 5.5l/s.

In regards to timing, it is likely a WAPC application will be lodged within 12mths. I would suggest it will then be at least another 18mths from receipt of the WAPC approval that first water/sewer may be required.

If you need anything further please call, alternatively happy to come in and have a meeting.

Regards,

Steven Foley
DIRECTOR

M: 0411 153 087
P: 08 9227 0595
F: 08 9227 8617

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From: Kevin Purcher <Kevin.Purcher@watercorporation.com.au>
Sent: Tuesday, 30 March 2021 1:56 PM
To: Steven Foley <steven.foley@jdsi.com.au>
Subject: L 509 No 76 Dean Road Jandakot - Glen Iris Golf Course

Hi Steven

Thank you for your request for servicing information regarding the above location. We offer the following comments in regards to the proposal.

Water
Reticulated water is currently available to the subject area. Due to the increase in lots being developed, upgrading of the current system may be required to prevent existing customers being affected by the proposed development. A review of our scheme planning will be required to determine what upgrades will be required. If you are able to provide more detail of demands required that will help with the review. Timing of the review is currently unknown but we will look at the current planned work to be undertaken and let you know where it can be fitted in.
Existing water mains are located within the subject area. Pressured water mains shall not be located in private land and should be located in and protected by reserves (i.e. road reserves) as no development would be allowed in this area. The developer is required to fund the full cost of protecting, relocating or modifying any of the existing infrastructure which may be affected by the above proposal.

Water Source
The subject area falls within the Jandakot Underground Water Pollution Control Area (UWPCA). Developers within a UWPCA need to fulfill their legal responsibilities including those covering 'land use' planning, environmental, health and building permit matters. The Department of Water and Environmental Regulation is responsible for managing and protecting Western Australia's water resources. The subject area is also affected by several 300m Wellhead Protection Buffers. These buffers are declared to protect the quality of

groundwater being extracted for drinking water. In these zones groundwater moves rapidly towards wells and any surface contamination moving through the soil could find its way into scheme water supplies. Activities and land uses in these areas are restricted and subject to the Department of Water and Environmental Regulation approval processes in accordance with the Western Australian Planning Commissions current State Planning Policy 2.7.

Sewer
Reticulated wastewater is currently available to the subject area. Due to the increase in lots being developed, upgrading of the current system may be required. A review of our scheme planning will be required to determine what upgrades will be required. If you are able to provide more detail of the additional flows being created that will help with the review. As per above the timing of the review is currently unknown but we will look at the current planned work to be undertaken and let you know where it can be fitted in.
It should be noted that existing sewerage mains are located within the subject land. Due consideration will be required when developing in these areas. The developer is required to fund the full cost of protecting or modifying any of the existing infrastructure which may be affected by the proposed development.

The developer is expected to provide all water and sewerage reticulation. A contribution for Water and Sewerage headworks will also be required. In addition the developer may be required to fund new works or the upgrading of existing works and protection of all works.

Water Corporation easements are located in the development area. This proposal will require our Procurement and Property Branch approval prior to any development taking place.

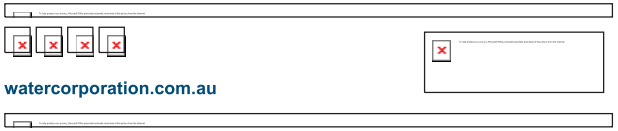
The information provided above is subject to review and may change. If the proposal has not proceeded within the next 12 months, please contact us to confirm that this information is still valid.

Should you have any queries or require further clarification on any of the above issues, please do not hesitate to contact me.

Regards

Kevin Purcher
Snr Plnr - Land Planning
Development Services

E Kevin.Purcher@watercorporation.com.au
T (08) 9420 2385



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APPENDIX E
MOBILE BLACK SPOT PROGRAM
COMMENTARY

Blair Trew

From: Blair Trew
Sent: Tuesday, 22 February 2022 10:47 AM
To: 'mobile coverage'
Subject: RE: Automatic reply: Mobile Black Spot Program - Berrigan Drive, Jandakot WA [SEC=OFFICIAL] [Filed 22 Feb 2022 10:46]
Attachments: JDS201817_SK101-DEV AREA.pdf; JDS201817_SK100-DEV AREA.pdf; ECM_8029590_v6_Structure-Plans-Telecommunications-Infrastructure-LPP5.pdf

Hi Mobile Black Spot Program Team,

A residential and commercial land development project is proposed in the area of Berrigan Drive, Jandakot (Western Australia). The development is currently progressing through a Local Structure Planning process.

The development will consist of approximately 550 residential dwellings, a small local retail lot and public open space. Attached plans show the development area (in yellow).

The development is located within the City of Cockburn and I have attached a copy of their Local Planning Policy LPP5.19 relating to "Structure Plans & Telecommunications Infrastructure".

In order to comply with this policy we are seeking feedback with regards to:

- Telecommunications network coverage, capacity and quality for the subject area.
- Any above ground telecommunications infrastructure currently proposed for the area.
- Any future requirements for above ground telecommunications infrastructure to support the proposed development and surrounding community.

Should you require any further information please don't hesitate to contact the undersigned.

Regards,

Blair Trew
ENGINEERING MANAGER

M: 0423 329 157
P: 08 9227 0595
F: 08 9227 8617

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432 Murray Street
Perth WA 6000

PO Box 7483
Cloisters Square PO
Perth WA 6850

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From: mobile coverage <mobilecoverage@communications.gov.au>
Sent: Tuesday, 22 February 2022 10:41 AM
To: Blair Trew <blair.trew@jdsi.com.au>
Subject: Automatic reply: Mobile Black Spot Program - Berrigan Drive, Jandakot WA [SEC=OFFICIAL]

Mobile Black Spot Program

Thank you for your email regarding the Mobile Black Spot Program.
This is an automatically generated email which provides answers to frequently asked questions.

If this information does not address your specific concerns, please reply to this email and a member of the Mobile Black Spot Program team will respond to you shortly.

Round 5

In April 2020, the Minister for Communications, Cyber Safety and the Arts, The Hon Paul Fletcher MP, together with the Minister for Regional Health, Regional Communications and Local Government, The Hon Mark Coulton MP, announced the results of the Round 5 competitive assessment process.

Round 5 is funding the 182 new mobile base stations which will address coverage issues across regional and remote Australia, including 33 base stations that specifically target Public Interest Premises such as economic centres and emergency services facilities. For further information about Round 5 see the Mobile Black Spot Program's FAQs page.

Round 5A

The Government is proposing to run an additional Round 5A of the Program. This Round will use the uncommitted Round 5 funds to continue to expand and improve mobile coverage for regional and remote Australia.

In April 2020 the Government released a discussion paper seeking feedback from industry and community on options for the design of this next round of the Program. Further information can be found on the Round 5A 'Have your say' page, Consultation on design options for Round 5A of the Mobile Black Spot Program.

Frequently asked questions:

1. **I don't have mobile coverage, or the mobile coverage that I have isn't reliable. What can I do about it?**
2. **I've heard there is a Mobile Black Spot Database. Can I nominate my area?**
3. **What is the Mobile Black Spot Program?**
4. **What is the Mobile Black Spot Program doing in my area?**
5. **Why hasn't my area been selected for mobile coverage improvement?**
6. **What are Public Interest Premises, and how are they nominated?**
7. **How do I contact the mobile carriers about my mobile coverage issues?**

1. I don't have mobile coverage, or the mobile coverage that I have isn't reliable. What can I do about it?

Be aware that there are a range of factors that affect reception

There are a number of local factors that can interfere with mobile reception and therefore impact a user's ability to obtain or maintain a mobile phone signal at any given time or place. These factors include mountainous or hilly terrain, buildings (including their internal structure) or other physical obstacles interrupting the line-of-sight from the mobile base station.

Check the coverage maps for your mobile carrier and shop around to see which carrier has the best coverage in your area

The mobile carriers publish their coverage mapping information on their websites:

- *Optus:* www.optus.com.au/shop/mobile/network/coverage
- *Telstra:* www.telstra.com.au/coverage-networks/our-coverage
- *Vodafone:* www.vodafone.com.au/network/coverage-checker

Ensure your mobile handset suits your local conditions

The particular handset used can also affect mobile reception. Each of the mobile phone providers are able to provide advice on the best handsets for local conditions. For example, Telstra uses a 'blue tick' label on the phones it recommends for use in poor coverage areas. Optus has also recently announced their 'Top Picks for Regional Coverage' device rating program, enabling consumers to choose mobile phones that will work best on the Optus regional network.

Consider products which can improve reception

New products to improve mobile reception are regularly released. For example, Telstra has released a 'Smart Antenna' to improve indoor reception on its network, and Optus has released an app which allows its customers to receive calls and texts over a Wi-Fi connection. Another effective way to improve reception is to use an external antenna or in-car kit. The most appropriate antenna may depend upon the network, and prices can vary. These accessories can be readily obtained from mobile phone shops and dealers.

Check the rollout schedule for the Mobile Black Spot Program to see if a mobile base station is being deployed in your area

Information about the expected timing of the rollout of the 1047 mobile base stations funded under the Mobile Black Spot Program is available on Optus, Telstra and Vodafone's websites:

- *Optus:* www.optus.com.au/shop/mobile/network/mobile-black-spot-program
- *Telstra:* www.telstra.com/blackspots
- *Vodafone:* www.vodafone.com.au/red-wire/vodafone-mobile-black-spot-investment

The rollout sequence is being determined by the mobile carriers based on various factors, including obtaining local government planning approval, landowner agreement where necessary, and access to existing infrastructure, power and backhaul.

Consider the use of Satellite Phones

It is also important to realise that for people living, working and travelling in areas where there is poor or no mobile coverage, alternative devices, such as low cost satellite personal location beacons (PLBs) and/or satellite phones, should be considered in case of an emergency. These devices are readily available from a number of providers and can operate across the entire Australian landmass.

Contact your mobile provider to let them know that you have poor coverage, and that there is demand for improved mobile coverage in your area.

Contact details for the mobile network operators are included at the end of this email.

2. I've heard there is a Mobile Black Spot Database. Can I nominate my area?

The Department previously accepted nominations of mobile black spot locations for inclusion on the Mobile Black Spot Database, however the nomination period closed in October 2018. New nominations are not being accepted at this time.

The Database is available to view on the National Map. The purpose of the database is to assist mobile network operators to identify areas with mobile black spots when applying for funding under the

Mobile Black Spot Program. However, a location does not need to be on the database to be eligible for funding under the current round. Mobile network operators may still apply to construct a mobile base station in areas which are not on the database.

If your broader geographic area is not listed on the Database, you can contact your local council or mobile provider to make them aware of your mobile coverage concerns. Contact details for the mobile network operators are at the end of this email.

3. What is the Mobile Black Spot Program?

The Mobile Black Spot Program (the Program) is the Australian Government's initiative to extend mobile coverage and competition in regional and remote Australia. The Government has committed $380 million to the Program to invest in telecommunications infrastructure to improve mobile coverage and competition across Australia.

This Program is supported by co-contributions from state and local governments, mobile network operators (Optus, Telstra and Vodafone), businesses and local communities.

Under the first five rounds of the Program, the Government's commitment has generated investment of more than $836 million, funding a total of 1,229 new base stations across Australia. The indicative locations of these base stations can be viewed on the National Map.

Further information on the Mobile Black Spot Program, including lists of the base stations funded under the first four rounds of the Program is available on the department's website.

4. What is the Mobile Black Spot Program doing in my area?

The indicative locations of the 1,229 mobile base stations funded under the Program can be viewed on the National Map. Information about the expected timing of the rollout is available on Optus, Telstra and Vodafone's websites:

- *Optus:* www.optus.com.au/shop/mobile/network/mobile-black-spot-program
- *Telstra:* www.telstra.com/blackspots
- *Vodafone:* www.vodafone.com.au/red-wire/vodafone-mobile-black-spot-investment

The rollout sequence is being determined by the mobile carriers based on various factors, including obtaining local government planning approval, landowner agreement where necessary, and access to existing infrastructure, power and backhaul.

5. Why hasn't my area been selected for mobile coverage improvement?

In order to be selected for mobile coverage improvement, a base station must be included in an application from an eligible applicant (i.e. Mobile Network Operators or Mobile Network Infrastructure Providers) under the Program. All base stations included in applications are then assessed against the assessment criteria included in the Program Guidelines for that funding round.

Areas which have not been selected for improved mobile coverage to date are either ineligible, have not been included in an application from an eligible applicant, or the proposed base station was not assessed as delivering value for money to the Commonwealth (for instance due to offering minimal new coverage).

6. What is a Public Interest Premises and how are they nominated?

A Public Interest Premises is defined as a premises or location that the Program considers is used on a continuing basis for a public interest purpose, and which may include:

- an economic centre;
- an emergency services facility;
- a health facility;
- an educational facility;

- **an indigenous community organisation;**
- **a local government facility; or**
- **a not-for-profit organisation.**

Public Interest Premises are nominated by applicants in their applications. Applicants are required to provide evidence of support or endorsement by the relevant oversight organisation or governing body as part of their application.

7. How do I contact the mobile carriers about my mobile coverage issues?

Telstra
Mobile coverage report system
https://service.telstra.com.au/customer/general/forms/coverage-feedback

Optus
Customer Service: 133 937
www.optus.net.au

Vodafone
Community Relations: 1300 302 703
communityrelations@vodafone.com.au
www.vodafone.com.au

Regards
Mobile Black Spot Program Team
www.communications.gov.au/mbsp
Department of Communications and the Arts
GPO Box 2154 Canberra ACT 2601

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