# Wokarena Heights Structure Plan

Shire of Chapman Valley

22 August 2025

The Power of Commitment

**ENDORSEMENT PAGE**

This structure plan is prepared under the provisions of the Shire of Chapman Valley Planning Scheme No.3

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

**09 OCTOBER 2013**

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

Date of Expiry: **19 OCTOBER 2035**

# Table of Amendments

| Amend No: | Summary (in bullet points) | Date approved by the WAPC |
|---|---|---|
| 1 | Revision of structure plan map to reflect approved subdivision of Lot 10 | 10.10.2013 |
| 2 | 1. Conversion of SP to reflect required form and manner<br>2. Amendments to development provisions to reflect legislative changes.<br>3. Updated Appendices – Technical Reports (Bushfire Management Plan (**Appendix C**) and Intersection Upgrade Design Report (**Appendix D**) added). | 08.12.2025 |

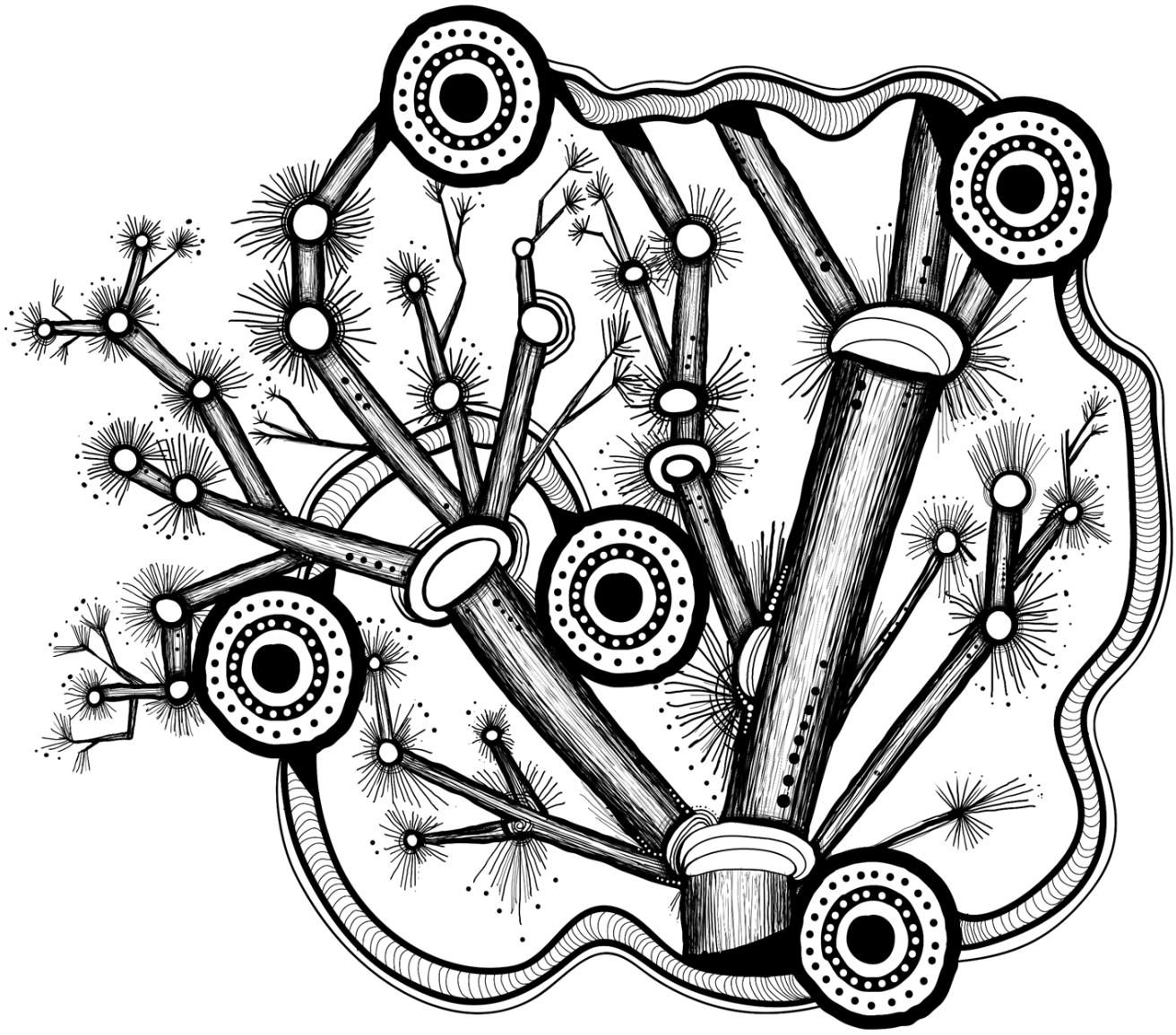
Prepared for the Shire of Chapman Valley by GHD Pty Ltd

| Revision | Author | Reviewer | Approved | |
|---|---|---|---|---|
| | | Name | Name | Date |
| A | C Dobson<br>N Thomas | C Downie | A Augustson | 23.07.2025 |
| 1 | C Dobson<br>N Thomas | C Downie | A Augustson | 22.08.2025 |

**GHD Pty Ltd | ABN 39 008 488 373**
Contact: Naomi Thomas, Urban and Regional Planner | GHD
999 Hay Street, Level 10
Perth, Western Australia 6000, Australia
**T** +61 8 6222 8222 | **F** +61 8 6222 8555 | **E** permail@ghd.com | **ghd.com**

# Acknowledgement of Country

GHD acknowledges Aboriginal and Torres Strait Islander peoples as the Traditional Custodians of the land, water and sky throughout Australia on which we do business. We recognise their strength, diversity, resilience and deep connections to Country. We pay our respects to Elders of the past, present and future, as they hold the memories, knowledges and spirit of Australia. GHD is committed to learning from Aboriginal and Torres Strait Islander peoples in the work we do.



# Executive Summary

The Wokarena Heights Structure Plan has been prepared to coordinate future land use, subdivision, and residential development within the Structure Plan Area, in a manner responsive to the site's location and environmental characteristics.

The Structure Plan was originally endorsed by the Western Australian Planning Commission on 9 October 2013. It provides for the creation of 253 Residential R2.5 lots, with 54 lots being created as of July 2025. As development and subdivision is not yet complete, the Structure Plan plays an ongoing and important role in guiding future development of the Structure Plan Area.

The Structure Plan comprises three components:

- **Part 1 – Implementation**, which includes the statutory implementation mechanisms and development requirements.
- **Part 2 – Explanatory**, which is to inform and guide the operation of the implementation requirements.
- **Appendices –** The Wokarena Heights Structure Plan is supported by a Local Water Management Strategy, a Frequently Asked Questions schedule and a Bushfire Management Plan.

A summary of all key statistics and planning outcomes of the Structure Plan are outlined in the table below.

| Item | Data | Structure Plan Ref (section no.) |
|---|---|---|
| Total area covered by the structure plan | 142 ha | 1. Structure Plan Area and Operation |
| Area of each land use proposed:<br>• Residential<br>• Commercial<br>• Industrial | Hectares:<br>• Residential 110.73 ha<br>• Commercial 0 ha<br>• Industrial 0 ha | Structure Plan Map |
| Total estimated lot yield | 253 Lots | 3.2 Density and Development |
| Estimated number of dwellings | 253 dwellings | 3.2 Density and Development |
| Estimated residential site density | 1.78 dwellings / ha | 3.2 Density and Development |
| Estimated population | 653 people | 3.2 Density and Development |
| Number of high schools | Nil | N/A |
| Number of primary schools | Nil | N/A |
| Estimated commercial floor space | Nil net lettable area | 3.5 Land Use |
| Estimated area and percentage of public open space given over to:<br>• Regional open space<br>• District open space<br>• Neighbourhood parks<br>• Local parks | <br><br>0 ha<br>12.29 ha, 8.7%<br>1.58 ha, 1.1%<br>0 ha | Structure Plan Map |
| Estimated percentage of natural area | 12.29 ha, 8.7% | Structure Plan Map |

# Contents

# Table index



# Figure index

# Appendices


# Part 1 | Implementation

# 1. Implementation of Structure Plan

## 1.1 Structure Plan area and operation

The Wokarena Heights Structure Plan (Structure Plan) applies to the land located within the 'Structure Plan Area' as depicted on Figure 1 – Structure Plan Map.

The Structure Plan, as amended, comes into effect from the date it is approved by the Western Australian Planning Commission (WAPC), as stated on the cover, and for a period of 10 years.

## 1.2 Structure Plan contents

This Structure Plan comprises:

– Part One – Implementation
– Part Two – Explanatory
– Appendices – Technical Reports

Part One of the Structure Plan comprises the Structure Plan Map and statutory provisions. Part Two is an explanatory report component, used to interpret and implement the requirements of Part One.

## 1.3 Structure Plan purpose

The objective of the Structure Plan is to provide a statutory planning framework that is responsive to the Structure Plan Area's location and environmental characteristics, facilitating coordinated subdivision and development for R2.5 residential dwellings.

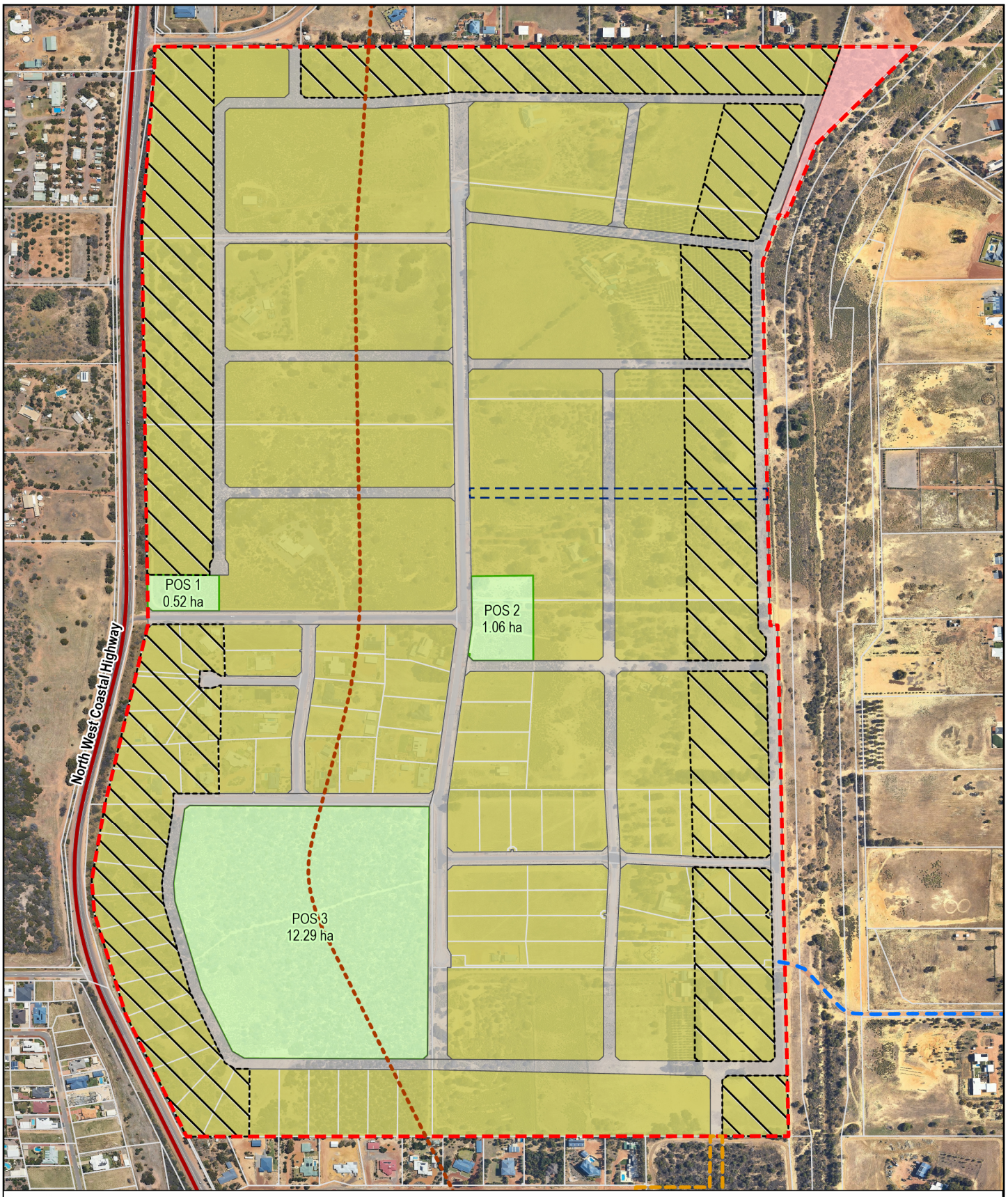
The Structure Plan has been prepared with reference to:

– The Shire of Chapman Valley (the Shire) Local Planning Scheme No.3 (the Scheme), and the wider local planning framework, as well as Council policies.
– State Planning Policies, Position Statements and guidelines of the WAPC.

## 1.4 Relationship to the Scheme

This Structure Plan is made pursuant to Part 4 of the *Planning and Development (Local Planning Schemes) Regulations 2015 Schedule 2 - Deemed provisions for local planning schemes* (Deemed Provisions) and is to be read in conjunction with the Scheme or any subsequent Scheme. In the event of any inconsistency between the Structure Plan and the Scheme, the Scheme shall prevail to the extent of the inconsistency.

Pursuant to the Deemed Provisions, a decision maker of an application for development approval is to have due regard to the provisions of this Structure Plan, including the Structure Plan Map, Implementation Report, Explanatory Report and Technical Reports.




**Legend**

- SPP 5.4 Strategic Freight and/or Major Traffic Route
- SPP5.4 Trigger Distance
- Emergency Access Track
- Structure Plan Area
- Cadastre
- Road Reserve
- Public Open Space
- Road Reserve (Primary Distributor)
- Residential (R2.5)
- Subject to Future Local Development Plan
- Temporary Access Way
- Future Road Connection

Paper Size ISO A4

0 50 100 150 200

Meters

Horizontal Datum: GDA2020
Grid: GDA2020

N

GHD

**Shire of Chapman Valley**
**Wokarena Heights Structure Plan**

Project No. **12655722**
Revision No. **0**
Date **21/08/2025**

## Structure Plan Map

# FIGURE 1

\\ghdnet\ghd\AU\Perth\Projects\61\12655722\GIS\Maps\Working\12655722_Figures\12655722_Figures.aprx
Print date: 21 Aug 2025 - 12:20

Data source: WANow;
World Imagery: Maxar. Created by: rbrown3

# 2. Staging

The Structure Plan will be implemented through subdivision processes, with each parent lot representing a stage of subdivision. The Structure Plan has been designed so that landowners of parent lots are able to subdivide independently of one another rather than being required to do so in sequence. The Structure Plan design also enables parent lot landowners to subdivide to the ultimate development layout through a single subdivision stage.

While it is recommended that subdivision progresses in stages from north to south, this is not a statutory requirement of the Structure Plan. Actual staging will occur according to the development aspirations of individual landholders.

Where subdivision does not follow the north-south pattern consistent with infrastructure upgrade planning, there may be a need for owners to undertake works in excess of what would be their proportionate contribution to the upgrade of (particularly water) infrastructure to facilitate earlier subdivision.

Staged subdivision may retain large lots around existing houses and improvements, whilst providing for part development as an interim measure.

# 3. Subdivision and development requirements

## 3.1 Land use zones and reserves

### 3.1.1 Zones

Figure 1 – Structure Plan Map designates the proposed zones and reserves applicable to land within the Structure Plan Area. Land use permissibility within the Structure Plan Area shall be in accordance with the corresponding zone or reserve under the Scheme.

### 3.1.2 Road reserves

The movement network will conform to the following requirements:

– The street network will be developed generally in accordance with Figure 1 – Structure Plan Map.
– The road hierarchy will be implemented as described below, and depicted in Part 2 – Figure 12:
  - Wokarena and Richards Roads are Neighbourhood Connector B (minor) roads; and
  - All other internal subdivision roads are Access Streets C and D.
– Road reserves will be developed generally in accordance with the design provisions set out under *Liveable Neighbourhoods*.
– Road reserves can support vehicle movements, informal on-street car parking, pedestrian links, and water management.
– New connections to North West Coastal Highway shall be achieved via Eliza Shaw Drive to the north of the Structure Plan Area, and through a future connection into Glassford Vista to the south in order to enhance access into the development area.
– The Emergency Access Track depicted on Figure 1 – Structure Plan Map, connecting Skyline Ridge to Cargeeg Bend, shall be retained.

### 3.1.3 Public open space

The provision of public open space (POS) will be generally in accordance with Figure 1 – Structure Plan Map and the POS schedule in Table 1 of this Structure Plan.

Three distinct areas of POS are proposed as follows:

– Neighbourhood Park (POS 1) – entry statement and passive recreational space.

– Neighbourhood Park (POS 2) – passive recreation and unstructured active play.
– District Park (POS 3) – passive recreation and protection of remnant vegetation.

*Table 1 POS Schedule*

| POS Schedule | Area (Hectares) |
|---|---|
| **Gross Structure Plan Area** | **142.79 ha** |
| **Deductions:**<br>– *Regional road reserves* | **1.0 ha**<br>*1.0 ha* |
| **Gross Subdivisible Area** | **141.8 ha** |
| **Required POS (10%)** | **14.18 ha** |
| **POS Provision:**<br>– *Neighbourhood Park (POS 1)*<br>– *Neighbourhood Park (POS 2)*<br>– *District Park (POS 3)* | **13.87 ha**<br>*0.52 ha*<br>*1.06 ha*<br>*12.29 ha* |

[1] The minor deviation (0.2%) from the required 10% POS noted in the calculations above is the result of the staged nature of subdivision within the Structure Plan Area and consequential amendments to the Structure Plan.

# 3.2 Density and development

## 3.2.1 Density and residential development

As depicted on Figure 1 – Structure Plan Map, land within the Residential Zone is subject to R2.5 density coding.

All provisions, standards and requirements of the Residential Zone as set out in the Scheme shall apply, in addition to the following requirements:

– The orientation and design of buildings shall be sympathetic to existing landform and landscape elements.
– The use of reflective roof and wall materials which prejudice the landscape amenity of the surrounding landform, will not be permitted.
– Ancillary structures shall be of a design and construction complementary to the design and materials used in the primary residence.
– Boundary fencing shall be permeable. Alternative internal fencing shall only be permitted where it can be demonstrated that it will not reduce passive surveillance from the street.
– No direct vehicular access shall be permitted to the North West Coastal Highway or Wokarena Road.

## 3.2.2 Residential Design Code variations

For any lot directly abutting the Rural Residential lots to the north of the Structure Plan Area, the Residential Design Codes are varied so that the minimum rear setback is 30 metres.

## 3.2.3 Local Development Plan requirements

A Local Development Plan shall be required as a condition of approval for a plan of subdivision, for those lots and locations identified on Figure 1 – Structure Plan Map.

Local Development Plans shall include provisions with regard to:

– Minimum setback of buildings to POS
– Passive surveillance of the POS
– Orientation of the building to the POS
– Quiet house requirements, where a noise level contour map accompanying the subdivision determines that outdoor and indoor noise levels are likely to exceed noise targets set out under State Planning Policy 5.4 - Road and rail noise (SPP 5.4)

– Identification of building envelopes with a minimum rear setback of 30 metres for any lot abutting the Rural Residential lots to the north of the Structure Plan Area
– The provision of a minimum 3 metre firebreak and 10 metre landscape buffer at the rear boundary for any lot abutting the Rural Residential lots to the north of the Structure Plan Area

# 4. Other requirements

## 4.1 Bushfire protection

This Structure Plan is supported by a Bushfire Management Plan (BMP), refer to **Appendix C**. Any development on land within the Structure Plan Area shall be constructed in accordance with the recommendations outlined in the BMP and shall comply with the requirements of Australian Standard 3959 – Construction of Buildings in Bushfire Prone Areas.

In accordance with State Planning Policy 3.7: Bushfire (SPP3.7) and the Planning for Bushfire Guidelines November 2024, development applications within areas designated as bushfire prone on the Department of Fire and Emergency Services (DFES) Map of Bushfire Prone Areas, are to be accompanied by a compliance certificate to confirm that the indicative Bushfire Attack Levels (BALs) identified in the BMP remain accurate. If the pre-development BAL assessment indicates that the proposed habitable building(s) will have a potential radiant heat impact exceeding 29kW/m² then a bushfire management plan should accompany the development application.

## 4.2 Road and rail noise

As identified on Figure 1 – Structure Plan Map, subdivision within the Trigger Distance specified under SPP5.4 shall be accompanied by a noise level contour map prepared in accordance with the road and rail noise implementation guidelines.

Where a noise level contour map determines that outdoor and indoor noise levels are likely to exceed noise targets set out under SPP5.4, quiet house requirements shall be enforced through a Local Development Plan required as a condition of approval for a plan of subdivision.

## 4.3 Infrastructure arrangements

Subdividers shall be responsible for the upgrade of Richards Road and Wokarena Road, including its intersection with North West Coastal Highway (‘road upgrades’). A detailed cost estimate for the upgrade of shall be prepared by the Shire and reviewed annually.

## 4.4 Infrastructure contributions

No formal development contribution scheme is proposed for the Structure Plan Area. Cost contributions will be implemented through conditions of approval of subdivision and development by the Shire, in accordance with State Planning Policy 3.6 – Infrastructure Contributions (SPP 3.6).

Developers shall be responsible for the following infrastructure items:

– Upgrade of Richards Road and Wokarena Road, including its intersection with North West Coastal Highway (‘road upgrades’). As all lots will contribute to the need for upgrades, cost contributions have been apportioned across all parent lots based on the area of residential land that will be created on each lot, excluding POS and roads.
– POS costs, to be shared across the Structure Plan Area through implementation of cash in-lieu provisions under SPP3.6.
– Water management costs required as identified in the Local Water Management Strategy (refer **Appendix A**) that provides a coordinated approach to drainage locations. The location of drainage swales for 100-year flood events within POS will facilitate the sharing of drainage land costs through POS cash-in-lieu processes.

The following method of cost apportionment shall be used to determine the amount payable at the time of subdivision:

**R / L x 100 = P**

**C x P = A**

R = Area of residential land on the lot

L = Total area of residential land in the structure plan area

P = Percentage of total contribution required from landowner

C = Cost of road upgrades

A = Amount payable

The Shire will be responsible for undertaking required upgrade works once contributions have been received. However, if a subdivision application is deemed to require an upgrade in the shorter term to ensure safety of road users, then the applicant may be required to construct part or all of the upgrade works as a condition of subdivision, irrespective of proportionate responsibility.

## 4.5 Notifications on title

In respect of applications for subdivision, the Shire may recommend to the WAPC that a condition be imposed requiring a notification be placed on the Certificate(s) or Title in the following circumstances:

1. Lots abutting North West Coastal Highway: *No direct vehicular access shall be permitted to the North West Coastal Highway.*
2. Lots abutting Wokarena Road: *No direct vehicular access shall be permitted to Wokarena road*.
3. Lots directly abutting Rural Residential lots to the north of the Structure Plan Area: *Controlled stocking is permitted on adjacent rural-residential lots, with possible associated livestock impact on adjacent properties.*
4. Lots within a bushfire prone area: *This land is within a bushfire prone area as designated 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.*
5. For lots within the SPP 5.4 Trigger Distance, where a noise level contour map determines that outdoor noise levels exceed noise targets set out under SPP5.4: *This lot is in the vicinity of a transport corridor and is affected, or may in the future be affected, by road and rail transport noise. Road and rail transport noise levels may rise and fall over time depending on the type and volume of traffic*.

## 4.6 Water resource management

A Local Water Management Strategy has been prepared for the Structure Plan, and is provided as **Appendix A**.

The proposed stormwater management strategy employs the following principles for managing water quantity:

– For the 1-year ARI event lot and road runoff will be infiltrated as close to source as practical using water sensitive urban design (WSUD) measures such as infiltration devices. These include swales and soakwells.
– Events greater than the 5-year ARI event and up to and including the 100-year ARI event will be collected and conveyed via roadside swales into drainage basins integrated within POS located throughout the Structure Plan Area. These swales and basins have been sized to compensate for major events up to the 100-year ARI event.

Furthermore, the following measures are advised for managing water quality:

– Structural measures - Using WSUD and best management practices to ensure that stormwater is infiltrated as close to the source as practical; and
– Non-structural measures - Nutrient control and landscaping, sediment and litter control and construction management, and community awareness and education.

# 5. Additional details

## 5.1 Information to be submitted with an application:

The following technical reports are to be prepared in support of applications for subdivision or development.

*Table 2 Information to be submitted with an application*

| Additional/information / purpose | Approval stage | Responsible agency |
|---|---|---|
| **Noise Level Contour Map**<br>Where subdivision is proposed within the SPP 5.4 Trigger Distance. | Subdivision | WAPC |
| **BAL Compliance Certificate**<br>Where a habitable building is proposed within an area identified as bushfire prone, a compliance certificate shall be prepared to confirm that the indicative BAL presented in the BMP (**Appendix C**) remains accurate. | Development | Shire<br>DFES |
| **Bushfire Management Plan**<br>Where a habitable building is proposed within an area identified as bushfire prone and a pre-development BAL assessment indicates that the proposed habitable building(s) will have a potential radiant heat impact exceeding 29kW/m² then a bushfire management plan shall accompany the development application. | Development | Shire<br>DFES |

## 5.2 Studies to be required under condition of subdivision approval

The following technical reports are to be required under condition of subdivision approval.

*Table 3 Studies to be required under condition of subdivision approval*

| Conditions of approval | Approval stage | Responsible agency |
|---|---|---|
| Noise Management Plan or Quiet House Package (where indicated on the structure plan map as subject to trigger distance under SPP5.4) | Subdivision | WAPC |
| Local Development Plan (where indicated on the structure plan map) | Subdivision | WAPC |
| Infrastructure Contributions | Subdivision | WAPC |
| Notification on Title: Lots abutting North West Coastal Highway | Subdivision | WAPC |
| Notification on Title: Lots abutting Wokarena Road | Subdivision | WAPC |
| Notification on Title: Lots directly abutting the Rural Residential lots to the north of the Structure Plan Area | Subdivision | WAPC |
| Notification on Title: lots within the SPP 5.4 Trigger Distance | Subdivision | WAPC |

# Part 2 | Explanatory

# 1. Introduction

The Wokarena Heights Structure Plan was prepared to coordinate land use, subdivision, and residential development in a manner responsive to the Structure Plan Area's location and environmental characteristics. The Structure Plan applies to the area of land zoned 'Residential' within the suburb of Buller, defined by the 'Structure Plan Boundary' as depicted on Figure 1 – Structure Plan.

The Structure Plan was originally endorsed by the WAPC on 9 October 2013, providing for the creation of 253 Residential R2.5 lots. As of July 2025, 54 lots have been created. As development and subdivision is not yet complete, the Structure Plan plays an ongoing and important role in guiding development of the Structure Plan Area.

The original content of Part Two – Explanatory has largely been retained from the version endorsed in 2013, as it provides context and remains generally relevant in the context of the Structure Plan – noting that some sections contain dated terminology and references of the time of drafting. Adjustments to content of some sections within Part Two – Explanatory have been made to provide an overview of development that has occurred to date, outline new supporting information, and discuss land use changes in the broader region, specifically the Oakajee Strategic Industrial Area (SIA).

It is noted that the Structure Plan was originally prepared under the Shire's Town Planning Scheme No. 1 (TPS1). At the time, the Shire was preparing its Local Planning Scheme No. 2 (LPS2), which was adopted on 20 November 2013. Under LPS2, the Structure Plan Area was rezoned from 'General Farming' to 'Residential R2.5'. The Shire has since adopted Local Planning Scheme Local Planning Scheme No. 3 (LPS3), gazetted on 23 July 2019, which is in effect at the time of writing. The Shire is currently preparing Local Planning Scheme No. 4 (LPS4).

## 1.1 Purpose

The purpose of the Structure Plan is to:

– provide a statutory land use plan for the defined area;
– provide a comprehensive framework for land use to facilitate future subdivision and development of the area;
– coordinate the provision and planning of local infrastructure and facilities; and
– provide the general basis for subdivision that will comprise a more detailed level of planning.

This structure plan report includes 3 main components: Part One - Statutory Section, Part Two - Explanatory Section, and appendices.

Part One sets out statutory provisions that apply to all subdivision and development within the structure plan area and includes the structure plan map. Part Two is non-statutory. This section elaborates on the intent of Part One and provides additional guidance and examples for the future development of Wokarena Heights.

Appendix A includes a Local Water Management Strategy, which explains how water and stormwater is to be managed in a coordinated way. The Local Water Management Strategy provides a basis for the development of more detailed Urban Water Management Plans to be prepared by developers at the time of subdivision.

Appendix B provides a list of 'Frequently Asked Questions' about subdivision and development processes. It provides information to landowners, potential purchasers and developers about how the subdivision of land occurs, infrastructure required to be provided by subdividers and why, and other requirements and obligations for developers

Appendix C is a Bushfire Management Plan, prepared to demonstrate compliance under SPP3.7 and the accompanying Guidelines. Any development on land within the Structure Plan Area shall be constructed in accordance with the recommendations outlined in the BMP and shall comply with the requirements of Australian Standard 3959 – Construction of Buildings in Bushfire Prone Areas.

Appendix D is the North West Coastal Highway / Wokarena Road Intersection Upgrade Design Report, prepared for the Shire of Chapman Valley and Main Roads WA. Subdividers shall be responsible for contributing to this upgrade and the Shire shall maintain a detailed cost estimate for this upgrade.

# 2. Site and Context Analysis

## 2.1 Land description

### 2.1.1 Location

The Wokarena Heights study area is located approximately 12 km north of Geraldton's city centre, adjacent to the North West Coastal Highway (see Figure 1). The site is bounded by the North West Coastal Highway to the west, a proposed future highway realignment corridor to the east, and existing development to the north and south.

Since the Structure Plan's original adoption in 2013, the Greater Geraldton area has experienced significant population growth, with accompanying urban development. Planning for the Oakajee Strategic Industrial Area (SIA), 1.4 km north of the Structure Plan at its closest point, has progressed – with land allocations to several proponents and early-phase construction commencing on some supporting infrastructure. The Oakajee SIA aims to attract industries such as renewable hydrogen production, advanced manufacturing, and downstream processing, likely leading to future employees and their families seeking housing and amenities within the Structure Plan Area.

### 2.1.2 Area and land use

The unsubdivided areas of the Structure Plan Area consist of primarily rural lifestyle land uses, featuring existing houses, limited remnant vegetation, and largely cleared areas. Areas where subdivision has occurred feature large-lot suburban style houses. An aerial photo of the site is included as Figure 2.

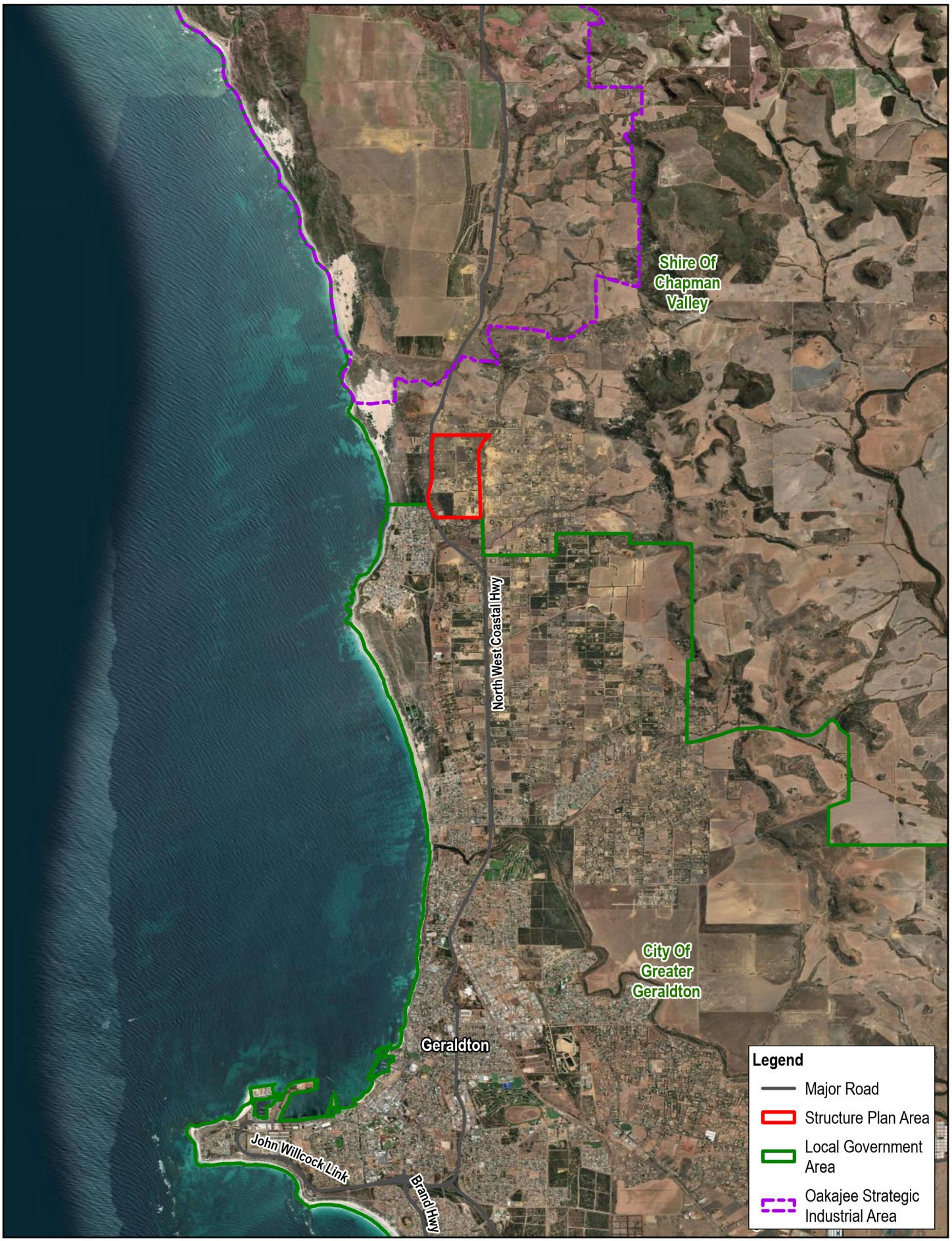
The total area of the LPS is 142.79 ha.

### 2.1.3 Legal description and ownership

The site consists of 63 freehold lots, under private ownership. Lots previously identified as '2', '9' and '10' have been subdivided, as outlined in Table 2.

*Table 4 Ownership and Certificate of Title Details*

| Lot | Owner | Certificate of Title (Volume / Folio) |
|---|---|---|
| 1 | S Hadinoto & T Husni | 1133/226 |
| 2 | *Refer below* | *Refer below* |
| 3 | K & B Mitsuda | 1986/257 |
| 4 | J Henderson & D Austin | 1741/327 |
| 5 | RNTJ Funding Pty Ltd | 1741/328 |
| 6 | H & M Taylor | 1741/329 |
| 7 | B & P Lodge | 1741/330 |
| 8 | J Bowbridge | 1741/331 |
| 9 | *Refer below* | *Refer below* |
| 10 | *Refer below* | *Refer below* |
| 11 | N Bouzalakos | 1741/334 |
| **Subdivided Lots** | | |
| **Parent Parcel** | **Date of Subdivision Approval** | **Number of lots created** |
| Lot 2 | 20 November 2013 | 25 |
| Lot 9 | 10 September 2018 | 6 |
| Lot 10 | 10 September 2018 | 25 |




Paper Size ISO A4

0 1 2 3 4

Kilometers

Horizontal Datum: GDA2020
Grid: GDA2020

N

GHD

**Shire of Chapman Valley**
**Wokarena Heights Structure Plan Review**

**Location of Wokarena Heights Structure Plan Area**

Project No. **12655722**
Revision No. **0**
Date **19/08/2025**

**FIGURE 1**

\\ghdnet\ghd\AU\Perth\Projects\61\12655722\GIS\Maps\Working\12655722_Figures\12655722_Figures.aprx
Print date: 19 Aug 2025 - 11:12

Data source: World Imagery: Earthstar Geographics. Created by: rbrown3


Paper Size ISO A4

0 50 100 150 200

Meters

Horizontal Datum: GDA2020
Grid: GDA2020

N

GHD

**Shire of Chapman Valley**
**Wokarena Heights Structure Plan Review**

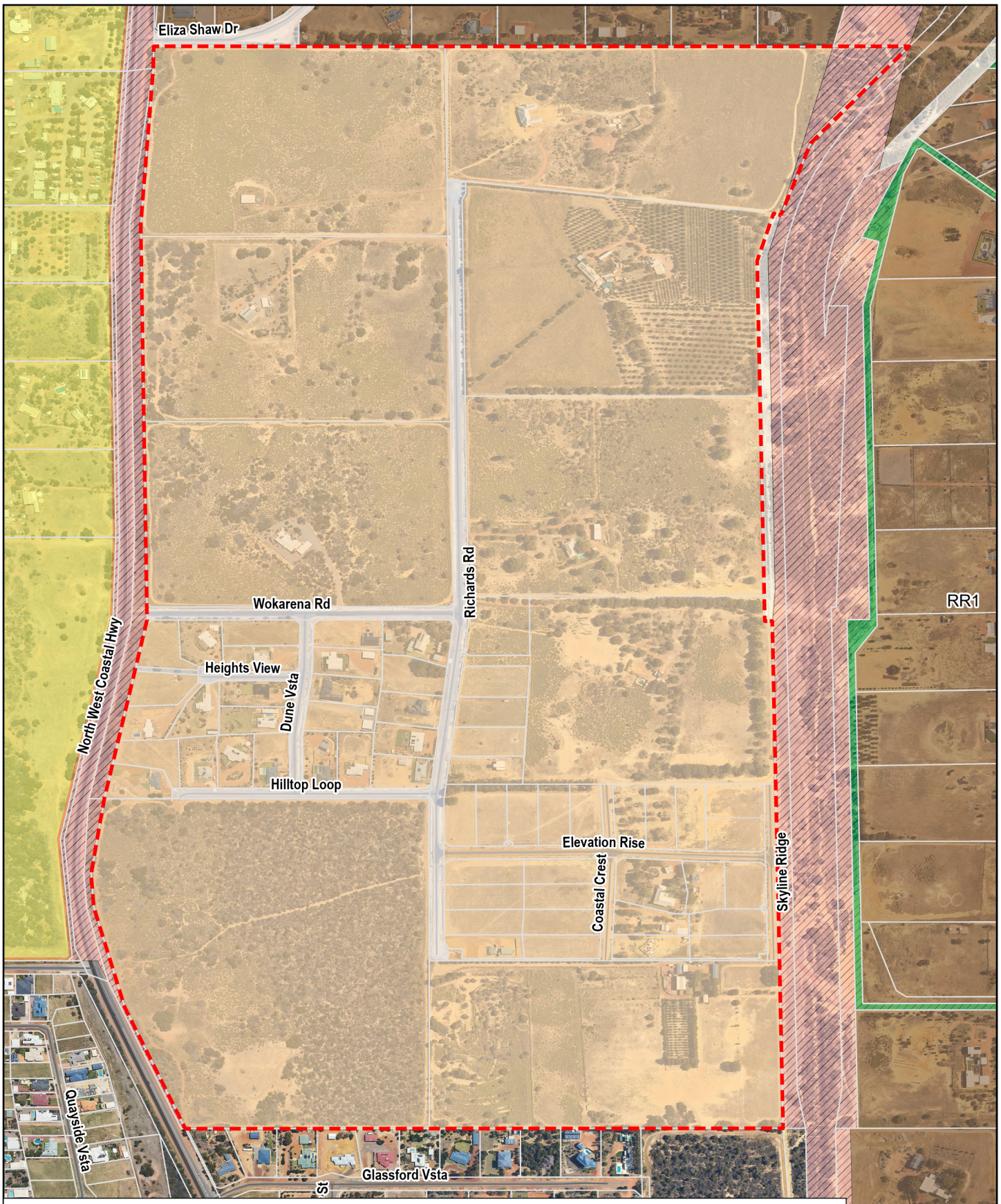
Project No. **12655722**
Revision No. **0**
Date **19/08/2025**

## Wokarena Heights Site Area

# FIGURE 2

\\ghdnet\ghd\AU\Perth\Projects\61\12655722\GIS\Maps\Working\12655722_Figures\12655722_Figures.aprx
Print date: 19 Aug 2025 - 14:13

Data source: WANow;
World Imagery: Maxar. Created by: rbrown3




**Legend**

- State Road
- Local Road
- Cadastre
- Structure Plan Area
- **Local Planning Scheme**
- Local road
- Primary distributor road
- Public open space
- Residential
- Rural residential
- Urban development

Paper Size ISO A4

0 50 100 150 200

Meters

Horizontal Datum: GDA2020
Grid: GDA2020

N

GHD

**Shire of Chapman Valley**
**Wokarena Heights Structure Plan Review**

**Local Planning Scheme No. 3**

Project No. **12655722**
Revision No. **0**
Date **19/08/2025**

# FIGURE 3

\\ghdnet\ghd\AU\Perth\Projects\61\12655722\GIS\Maps\Working\12655722_Figures\12655722_Figures.aprx
Print date: 19 Aug 2025 - 11:13

Data source: WANow;
World Imagery: Maxar. Created by: rbrown3

# 2.2 Planning framework

## 2.2.1 Zoning and reservations

Under LPS2, the Structure Plan Area was rezoned to 'Residential', with a density coding of R2.5 (on 23/11/2010). A small portion of Lot 6 was reserved 'Primary Distributor Road', reflecting a potential realignment of the North West Coastal Highway along the former Geraldton – Northampton railway alignment, in accordance with Main Roads WA planning and the WAPC's Greater Geraldton Structure Plan. Roads within the Structure Plan Area are reserved 'Local Road'.

Under the current scheme, LPS3 (refer Figure 3), the zoning of the Structure Plan Area remains unchanged from LPS2.

At the time of writing, the Shire is advertising LPS4, which was given consent to advertise by the WAPC in the first quarter of 2025. Under LPS4 (refer Figure 4), the Structure Plan Area remains zoned predominantly 'Residential', with a density coding of R2.5. A portion of Lot 6 remains reserved 'Primary Distributor Road'. Roads within the Structure Plan Area are reserved 'Local Road'. The only zoning change proposed by LPS4 is at Richard Pym Park (POS 2), which is proposed to be reserved 'Public Open Space'.

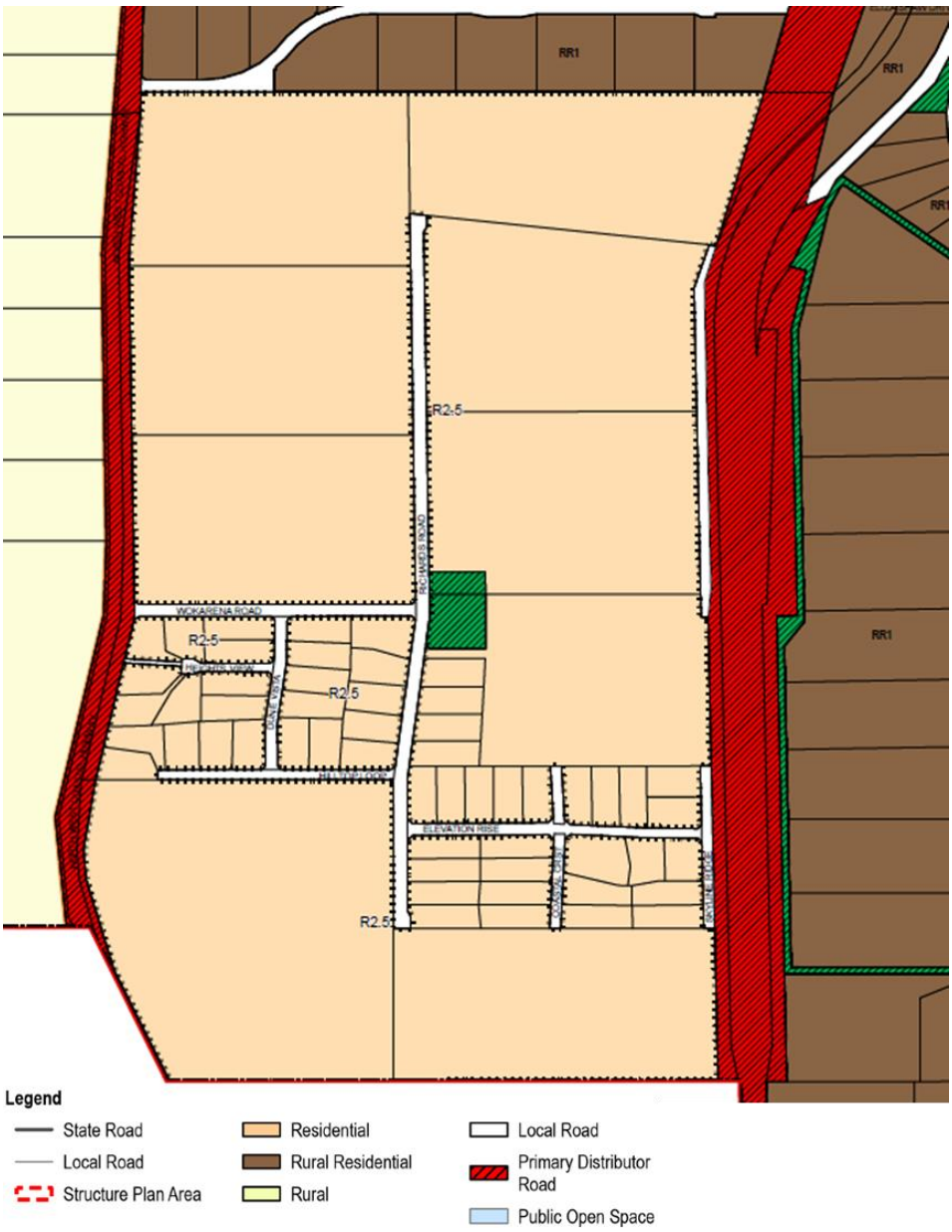



*Figure 4 Local Planning Scheme No. 4*

## 2.2.2 Regional and Sub-Regional Structure Plan

The current Greater Geraldton Structure Plan (GGSP) was released in June 2011 and is an update of the 1999 Greater Geraldton Structure Plan. The document was intended as an interim measure until local governments had prepared new local planning strategies and/or district structure plans. It is also used as a basis for the preparation of wider strategic regional planning.

The Structure Plan Area is identified within the GGSP as 'Future Urban', with an 'indicative rapid public transport alignment' identified along North West Coastal Highway (Figure 5).

The GGSP provides the following guidance for these areas:

– The indicative rapid public transport alignment reinforces the linear form of 'urban' Geraldton. The notional alignment will assist local governments in identifying the location and extent of future district and neighbourhood activity centres in the northern and southern coastal corridors as the eventual delivery of the public transport corridor will ultimately reinforce their strategic importance.
– The development of 'future urban' areas is subject to localised structure planning and the provision of infrastructure and services. Environmental considerations, indigenous and cultural heritage issues may require resolution during structure planning. The long-term development of 'future urban' areas may be constrained by the capacity of key utilities and service infrastructure including power, water and wastewater.
– The orderly and proper planning of 'future urban' areas can be compromised if they are further fragmented. In this regard, ad hoc subdivision should not be supported. The final location and extent of district activity centres in the northern and southern coastal corridors are subject to further investigation by the local governments. This will have ramifications for future structure planning and the provision of public transport infrastructure.

The Structure Plan provides the framework for urban development of the precinct consistent with the recommendations of the GGSP.

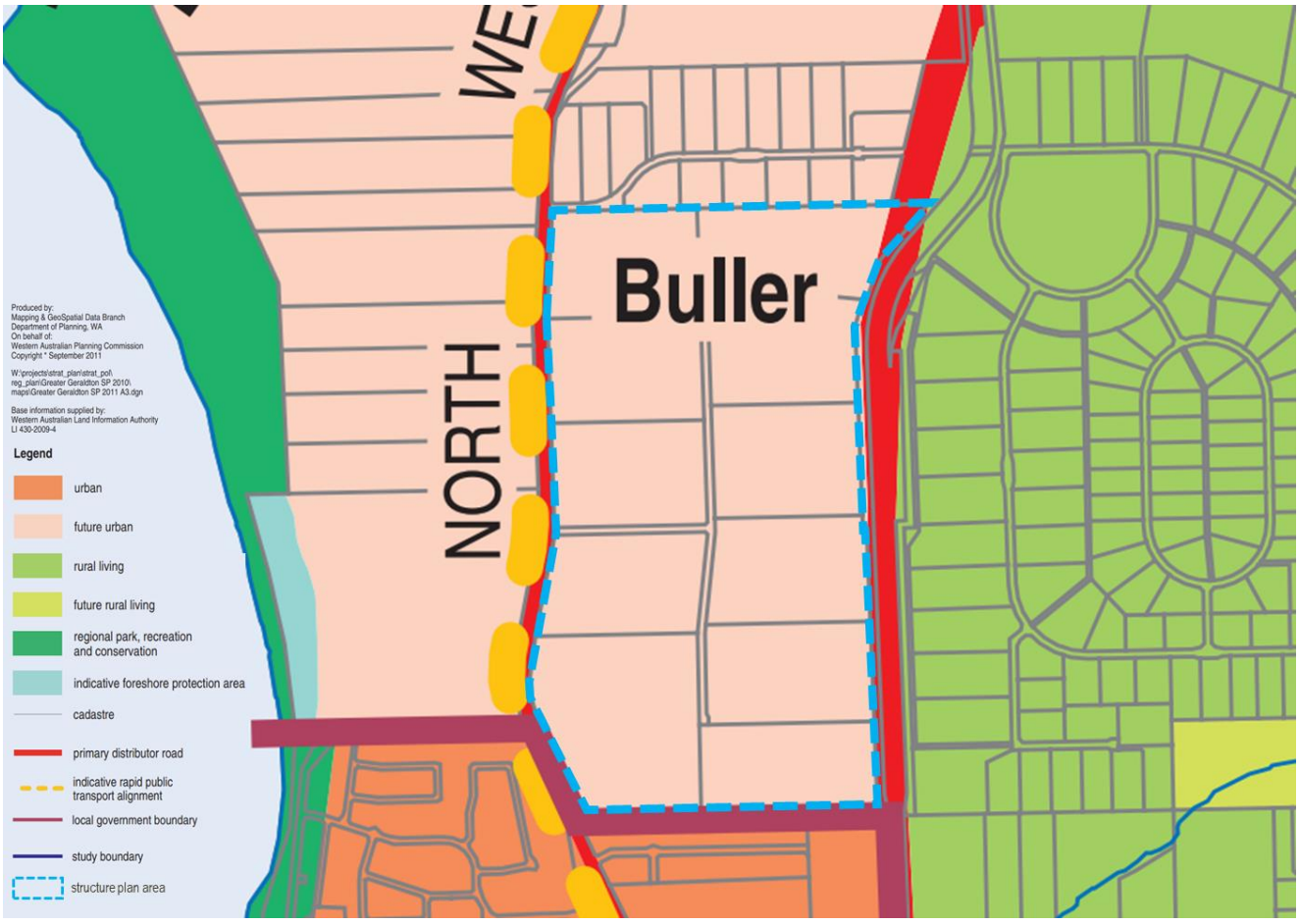



*Figure 5 Greater Geraldton Structure Plan*

### 2.2.3 Planning Policies

The Structure Plan has been prepared in compliance with the following key policies and strategies:

- Geraldton Region Plan 1999;
- Greater Geraldton Structure Plan 2011;
- Moresby Range Management Strategy 2009;
- Moresby Range Management Plan 2010;
- Geraldton Regional Flora and Vegetation Survey 2010;
- Shire of Chapman Valley Town Planning Scheme No. 1
- Shire of Chapman Valley Local Planning Scheme No. 2;
- Shire of Chapman Valley Local Planning Scheme No. 3
- Shire of Chapman Valley Local Planning Scheme No. 4
- Shire of Chapman Valley Local Planning Strategy 2007;
- State Planning Policy 3.6 – Infrastructure Contributions;
- State Planning Policy 3.7 – Bushfire
- State Planning Policy 5.4 – Road and Rail Noise
- Planning Bulletin 92 Urban Water Management; and
- WA Planning Manual Guidance for Structure Plans

### 2.2.4 State Planning Policy 3.7 – Bushfire

SPP 3.7 and the accompanying Planning for Bushfire Guidelines November 2024 seek 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. The Policy applies to areas designated as bushfire prone by the Fire and Emergency Services Commissioner under s 18P of the *Fire and Emergency Services Act 1998*. As portions of the Structure Plan Area are designated as bushfire prone (refer Figure 6), a BMP has been prepared (refer to **Appendix C**).

Land with the Structure Plan Area was assessed as having pre-development vegetation classifications of Class G Grassland, Class C Shrubland, Class D Scrub, and Class B Woodland. Excluded areas of non-vegetated and Low threat areas were identified around roads, buildings, managed gardens, lawns, and POS. Based on the existing extent of vegetation within and outside the Structure Plan Area, some land would be subject to an initial Bushfire Attack Level (BAL) of BAL-Flame Zone (BAL-FZ), if unmanaged.

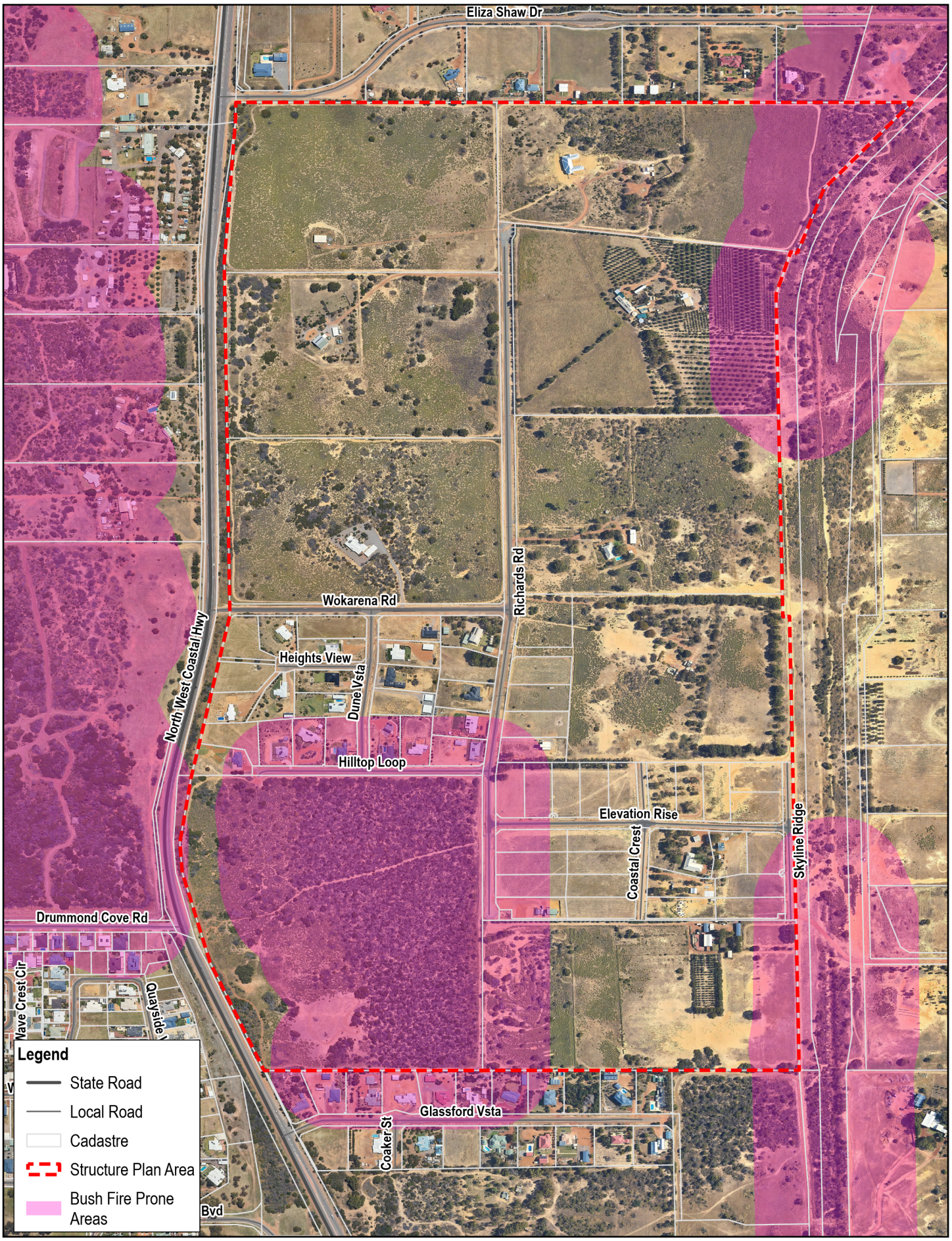
The assessed post-development bushfire risk is acceptable as it is expected that vegetation within the Structure Plan Area will be managed to a low threat state to the extent that future dwellings will be able to achieve BAL-29 or lower. Provision of a coherent internal vehicular access network is required to ensure occupants are able to egress away from bushfire, and fire brigade has appropriate and flexible access to habitable development and direct interfaces with unmanaged vegetation.

Any development on land within the Structure Plan Area shall be constructed in accordance with the recommendations outlined in the BMP and shall comply with the requirements of Australian Standard 3959 – Construction of Buildings in Bushfire Prone Areas.

### 2.2.5 State Planning Policy 5.4 – Road and Rail Noise

SPP5.4 and the accompanying road and rail noise implementation guidelines guide planning decision-making to limit the impact North West Coastal Highway adjacent to the Structure Plan Area is classified under SPP 5.4 as a ‘Strategic freight and/or major traffic route’ (refer Figure 7). As identified on Figure 1 – Structure Plan Map, several lots are within the Trigger Distance specified under SPP5.4.

Future subdivision within the Trigger Distance shall be accompanied by a noise level contour map prepared in accordance with the road and rail noise implementation guidelines. Where a noise level contour map determines that outdoor and indoor noise levels are likely to exceed noise targets set out under SPP5.4, quiet house requirements shall be required as a condition of approval for a plan of subdivision.




Paper Size ISO A4

0 50 100 150 200

Meters

Horizontal Datum: GDA2020
Grid: GDA2020

N

GHD

**Shire of Chapman Valley**
**Wokarena Heights Structure Plan Review**

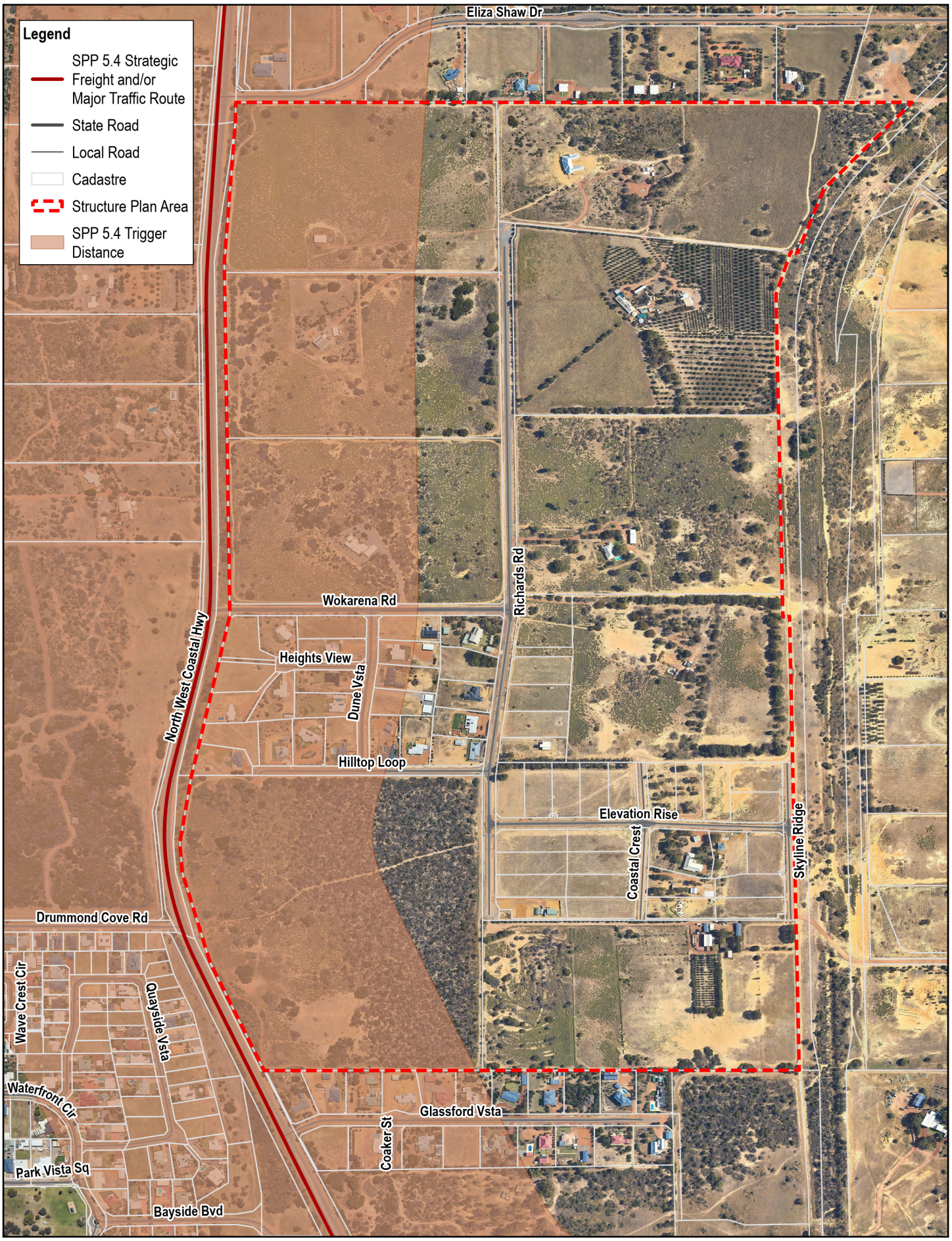
**Bushfire Prone Areas**

Project No. **12655722**
Revision No. **0**
Date **19/08/2025**

**FIGURE 6**

\\ghdnet\ghd\AU\Perth\Projects\61\12655722\GIS\Maps\Working\12655722_Figures\12655722_Figures.aprx
Print date: 19 Aug 2025 - 11:13

Data source: WANow;
World Imagery: Maxar. Created by: rbrown3




Paper Size ISO A4

0 50 100 150 200

Meters

Horizontal Datum: GDA2020
Grid: GDA2020

N

GHD

**Shire of Chapman Valley**
**Wokarena Heights Structure Plan Review**

Project No. **12655722**
Revision No. **0**
Date **19/08/2025**

## Noise Level Trigger Distance

# FIGURE 7

\\ghdnet\ghd\AU\Perth\Projects\61\12655722\GIS\Maps\Working\12655722_Figures\12655722_Figures.aprx
Print date: 19 Aug 2025 - 11:14

Data source: WANow;
World Imagery: Maxar. Created by: rbrown3

## 2.3 Environment assets and constraints

### 2.3.1 Vegetation

The majority of the subject land is cleared, with some scattered trees and an area of remnant vegetation in the southeast of the Structure Plan Area. The remnant vegetation has been mapped as Beard Vegetation Association 359: Shrublands, Acacia and Banksia scrub through the Geraldton Regional Flora and Vegetation Survey 2010 (GRFVS).

The vegetation type has more than 10 percent but less than 30 percent of its original extent in WA, the region, and the Shire of Chapman Valley, and little of the current extent is protected within reserves. The GRFCS indicates that the vegetation type is regionally significant and vulnerable due to being under-represented and poorly protected.

### 2.3.2 Fauna

As part of the environmental review of the adjacent Buller Development Zone to support Local Planning Scheme No.2, a search was undertaken through DEC threatened Fauna database, which includes species declared as 'Rare or likely to become extinct (Schedule 1)', 'Birds protected under an international agreement (Schedule 3)', and 'Other specially protected fauna (Schedule 4)'. Due to the geographical proximity, search results are applicable to the Wokarena Heights precinct. Results are shown in Table 5.

The site presents little vegetation of sufficient quality to provide significant habitat for fauna species. However, remnant vegetation within the Wokarena Heights Precinct may provide habitat for some native species.

***Table 5 Threatened Fauna***

| Species / Details | General Information | Likelihood of Occurring at the Site |
|---|---|---|
| Name: Bothriembryon whiteyi, N/A (snail) Protection Status: S2 Record No / Date: 1, no date provided. | This species occurs in open heath, amongst and under rocks (Department of Environment), Water, Heritage and the Arts, 2007). Very few specimens of this species of snail have been collected in more than 50 years | This species has been classified as 'presumed extinct' (S2 - refer to Table 15 Appendix D), therefore, it is unlikely to occur at the site. The site does not provide suitable habitat for the species. |
| Name: Calyptorhynchus latirostris,<br>Carnaby's Black Cockatoo<br>Protection Status: S1, Endangered - EPBC Act<br>Record No / Date: 5 from 1983 | This species moves around seasonally in flocks to feeding areas in proteaceous scrubs and heaths and eucalypt woodlands as well as pine plantations. Breeding occurs in winter/spring, mainly in the eastern forests and wheatbelt where they can find mature hollow-bearing trees to nest in. | The site does contain feed plant species, and it is possible, although considered unlikely, that the species would utilise the site for foraging. The site does not contain suitable breeding trees for this species |
| Name: Cyclodomorphus branchialis, Grilled Slender Bluetongue Protection Status: S1 Record No / Date: 3, no date provided | A ground-dwelling and largely nocturnal skink which shelters in spinifex, leaf litter and under fallen timber. | The skink occurs in coastal environments and is unlikely to utilise the site. |
| Name: Dermochelys Coriacea, Leatherback Turtle Protection Status: S1 Record No / Date: Vulnerable - EPBC Act 1 in 1993 | This species of marine turtle has been recorded at numerous locations along the WA coast. | This site is not on the coast and does not offer habitat suitable for the turtle |
| Name: Falco peregrinus, Peregrine Falcon Protection Status: S4 Record No / Date: 3 from 1975 | This species is uncommon and prefers areas with rocky ledges, cliffs, watercourses, open woodland or margins with cleared land | This species could potentially utilise the site for foraging, although it prefers areas with rocky ledges, cliffs and watercourses for breeding habitat (the Buller River to the northeast may provide some suitable breeding area). |
| Name: Idiosoma nigrum, Shield-backed Trapdoor Spider. Protection Status: S1 Record No / Date: 2 from 1983 & 1997 | This species is in decline in its patchy distribution through the northern and central wheatbelt and coastal plain. It is | The understorey of the site has been disturbed. It is considered unlikely that the species would exist at the Site. |

| Species / Details | General Information | Likelihood of Occurring at the Site |
|---|---|---|
| | a long-lived species that is very sensitive to disturbance. | |
| Name: Macropus irma, Western Brush Wallaby Protection Status: P4 Record No / Date:1 in 1954 | This species occurs in areas of forest and woodland supporting a dense shrub layer | The site is at the northern extent of the Western Brush Wallaby's known range (Department of Environment and Conservation, 2006). This species required large patches of vegetation to sustain its populations and would be unlikely to occur at the site. The species has not been identified in the WA Museum database as known to occur in the area |
| Name: Pomatostomus suerciliosusashbyi, White-browed Babbler Protection Status: P4 Record No/ Date: 3 from 1980, 1981 and 1983. | This species of bird lives in eucalypt forests and woodlands, and forages on or near the ground for insects and seeds. | The habitat at site is generally unsuitable for this species, therefore, the likelihood of impacting the species is considered to be low. |
| Name: Psacadonotus, cricket Protection Status: P1 Record No / Date: 1, no date provided. | This species of cricket is only known from Champion Bay near Geraldton. | Little is known about the habitat preferences of this species. There is the possibility that this species may exist on site |
| Name: Tyto novaehollandiae novaehollandiae, Masked Owl (SW ssp) Protection Status: P3 Record No / Date: 1 in 1983 | This species is an inhabitant of forests and woodlands, nests in tree hollows and has declined in the south-west. Its large talons are adapted for preying on small to medium sized mammals | The habitat is generally unsuitable for this species and the site does not contain suitable breeding trees for this species, there, the likelihood of impacting the species is considered to be low. |

### 2.3.3 Landform and soils

The Wokarena Heights development site is located in the coastal land system. This system consists of two phases of major coastal dunes, the Tamala and the Quindalup. The Tamala dune system comprises of lithified limestone overlain by deep yellow sands and red loams. The younger Quindalup dune system contains white calcareous sands and can be mobile. The dunes are generally stable but are susceptible to erosion. Yellow sands contain some clay and therefore have water retention capacity (WAPC 2008).

There are no known regions of acid sulfate soil risk within the study area. Mapping by Landgate indicates that there is one area approximately 0.3 km west of the proposed development where there is high to moderate risk of acid sulfate soils occurring within 3 metres of the ground surface. This area is approximately 1.48 km long and is 160 metres wide at its broadest and located outside of the study area.

The northeast corner of the study area is elevated towards the Moresby Ranges, with a maximum elevation between 70 metres Australian Height Datum (AHD) and 75 metres AHD based on existing LandGate contours. The elevation decreases steadily towards the southwest corner of the study area, to a minimum between 30 metres AHD and 25 metres AHD.

### 2.3.4 Groundwater and surface water

There are no surface water bodies (watercourses or wetlands) located on the site. There is no groundwater contour data readily available for the Wokarena Heights development area. Groundwater levels for Department of Water and Environmental Regulation bores within 5 km of the site centre were assessed, however none of the bores were within the development area. Bores located to the north and south of the area indicated that groundwater level is likely to be deeper than 10 metres below ground level.

### 2.3.5 Heritage

No sites of either Aboriginal or European heritage are listed within the Wokarena Heights Precinct. An Aboriginal heritage region borders the northern edge of the study area, however, will not be impacted by the structure plan.

The adjacent decommissioned rail reserve, outside the study area, incorporates the previous alignment of the Wokarena-Naraling Branch of the Geraldton to Northampton Railway. To the north of the study area, this reserve has been identified as a potential trail to recognise the alignment of the rail line. Along the eastern boundary of the study area, the reserve has been identified as an option available for the realignment of the North West Coastal Highway.

The former Geraldton to Northampton railway alignment was identified by the Hritage Council WA staff for consideration for the State Register of Heritage Places in 2021. This proposal was objected to by all three local governments along the alignment (the Shire of Chapman Valley, Shire of Northampton and City of Greater Geraldton).

## 2.4 Opportunities and constraints analysis

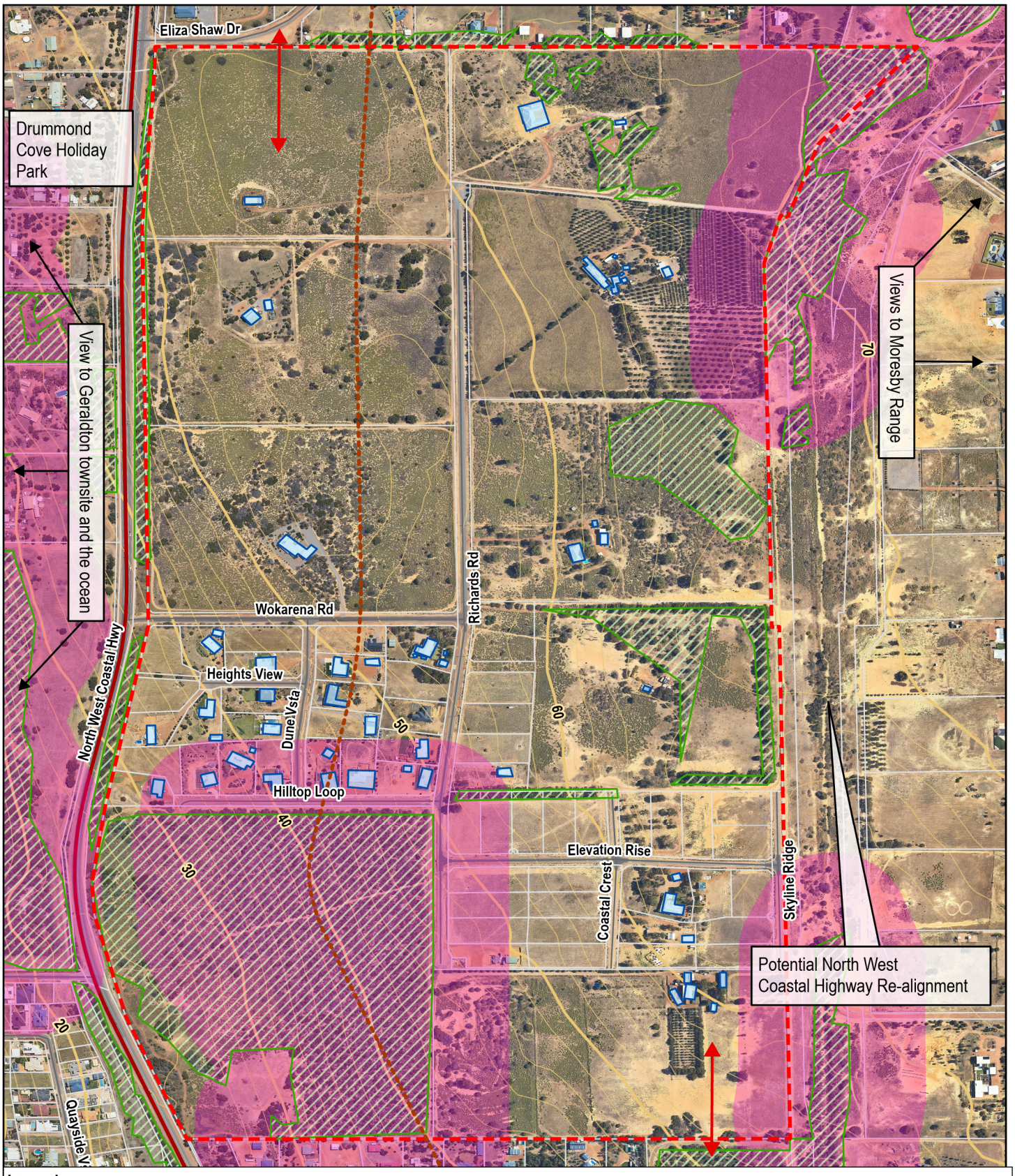
Figure 8 illustrates the key opportunities and constraints for the Structure Plan Area.

### Key opportunities:

- Unique and extensive views to the coast, Geraldton port, and the Moresby Ranges
- Few environmental constraints
- Opportunity to enhance access to the North West Coastal Highway through adjacent developments
- Opportunity to upgrade the Wokarena Road intersection to enhance safety of road users
- Opportunity to enhance the quality of remnant vegetation through management

### Key challenges:

- High level of fragmentation in land ownership
- Bushfire risk posed by vegetation area requiring attention to firebreaks and enhanced emergency access
- Noise impacts of North West Coastal Highway and future possible realignment of the Highway to the eastern boundary of the site
- Future realignment of the North West Coastal Highway requiring additional ceding of road Reserve




**Legend**

- SPP 5.4 Strategic Freight and/or Major Traffic Route
- SPP5.4 Trigger Distance
- **Ground Elevation Contours**
  - 10m
  - 2m
- Future Road Connections
- State Road
- Local Road
- Cadastre
- Structure Plan Area
- Existing Buildings
- Remnant Native Vegetation Extent
- Bush Fire Prone Areas

Paper Size ISO A4

0 50 100 150 200

Meters

Horizontal Datum: GDA2020
Grid: GDA2020

N

GHD

**Shire of Chapman Valley**
**Wokarena Heights Structure Plan Review**

**Opportunities and Constraints**

Project No. **12655722**
Revision No. **0**
Date **19/08/2025**

**FIGURE 8**

\\ghdnet\ghd\AU\Perth\Projects\61\12655722\GIS\Maps\Working\12655722_Figures\12655722_Figures.aprx
Print date: 19 Aug 2025 - 14:14

Data source: WANow;
World Imagery: Maxar. Created by: rbrown3

# 3. Design response

## 3.1 Residential

The structure plan facilitates the residential development of the subject land at a density of R2.5. An indicative lot layout is shown in Figure 9.

Lot orientation is designed to take maximum advantage of views experienced within the precinct. The proposed density, with lot sizes of approximately 4,000 m2, will complement the adjacent existing urban developments of Drummond Cove and Glenfield, and the rural residential development of White Peak. The proposed density provides an appropriate grading of density from urban development areas, reducing in scale to rural residential uses.

The proposed density provides an opportunity for alternative dwelling choice for those seeking large lot accommodation and a rural lifestyle in proximity to the major regional centre of Geraldton. The future development of the Buller Development Zone will provide supporting centre (retail and commercial) and community uses to support a higher density population. With the lower densities provided within the Wokarena Heights Precinct, these supporting uses are not considered necessary or viable within the Structure Plan Area. The retail and community needs of future residents in the Wokarena Heights Precinct will be met through adjacent development areas.

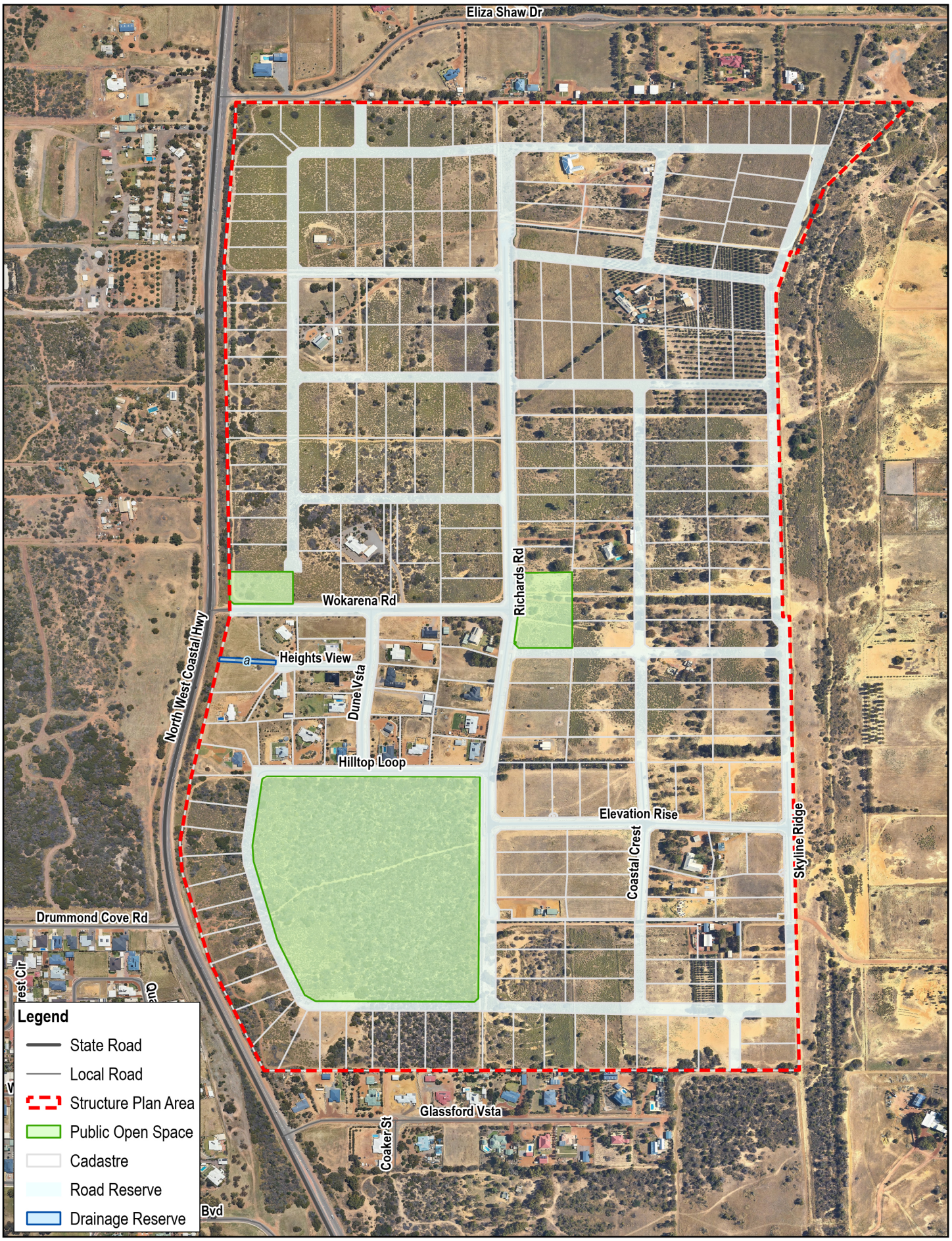
There is an existing community centre 0.75km to the east of the Structure Plan Area on Bill Hemsley Park in the adjacent Rural Residential subdivision.

*Table 6 Structure Plan Summary*

| Item | |
|---|---|
| Total area covered by the structure plan: | 142.79 ha |
| Area of specific land uses | Residential: 110.10 ha |
| List of land uses proposed by the structure plan | Residential, POS |
| Estimated lot yield | 253 lots |
| Estimated number of dwellings | 253 dwellings |
| Estimated population | 653 people |
| Number and area of POS | 13.87 ha |
| District open space | 1 district park: 12.29 ha |
| Neighbourhood parks | 2 neighbourhood parks: 1.58 ha |

*Table 7 Indicative Lot Yield*

| Parent Lot | Area Residential Land (excluding road reserves and open space) | Number of lots |
|---|---|---|
| 1 | 7.41 | 18 |
| 2 | 10.22 | 25 (now subdivided) |
| 3 | 10.22 | 22 |
| 4 | 10.43 | 25 (now subdivided) |
| 5 | 10.46 | 24 |
| 6 | 9.67 | 21 |
| 7 | 10.30 | 23 |
| 8 | 10.66 | 25 |
| 9 | 9.9 | 22 (now partially subdivided) |
| 10 | 10.43 | 25 |
| 11 | 10.39 | 23 |
| Total | 110.10 | 253 |




Paper Size ISO A4

0 50 100 150 200

Meters

Horizontal Datum: GDA2020
Grid: GDA2020

N

GHD

**Shire of Chapman Valley**
**Wokarena Heights Structure Plan Review**

**Indicative Lot Layout**

Project No. **12655722**
Revision No. **0**
Date **19/08/2025**

**FIGURE 9**

\\ghdnet\ghd\AU\Perth\Projects\61\12655722\GIS\Maps\Working\12655722_Figures\12655722_Figures.aprx
Print date: 19 Aug 2025 - 14:14

Data source: WANow;
World Imagery: Maxar. Created by: rbrown3

## 3.2 Movement network

### 3.2.1 Road network hierarchy

The structure plan proposes a movement network that maximises permeability and legibility.

New connections to North West Coastal Highway could be achieved via Eliza Shaw Drive to the north of the structure plan area, and through a future connection into Glassford Vista to the south in order to enhance access into the development area.

The proposed movement network in the west of the structure plan area relies on strong north south linkages that facilitate east-west lot orientation to maximise exposure to views and minimise the number of lots along view corridors. On the eastern part of the precinct, which due to topography has lesser view exposure, the movement network maximises connectivity whilst minimising the expanse of subdivisional roads.

The road hierarchy uses appropriate road types from *Liveable Neighbourhoods* and matches them to traffic and parking demands of the structure plan area (Figure 12). Throughout the structure plan area, vehicle movements are anticipated to be up to a total of 2,250 per day at time of completed subdivision and development.

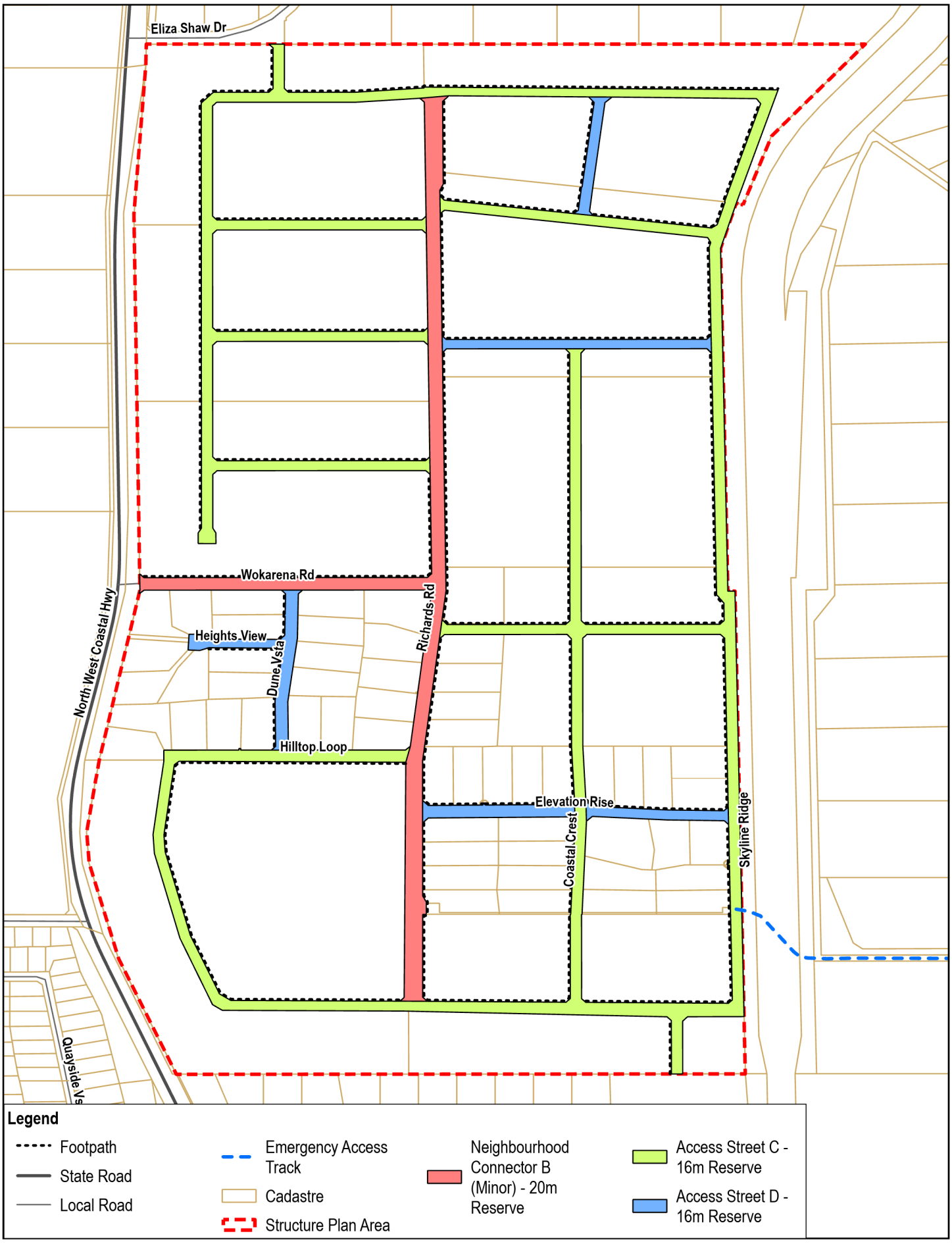
Neighbourhood connector B (minor) roads are proposed for Wokarena Road and Richards Road as the key access and egress connectors for the structure plan area. Neighbourhood connector B (minor) roads are designed to accommodate 3,000 or less vehicle movements per day, and support on-street car parking. The Structure Plan proposes neighbourhood connectors to recognise the primary connections of Wokarena Road and Richards Road, and in response to the existing road reserve widths of these roads. Cross sections for neighbourhood connectors within the precinct (Figure 13) illustrate the proposal for informal on-street car parking in recognition of the limited demand likely to be presented by the low density residential land use compared to that required by *liveable Neighbourhoods*.

Internal subdivision roads are proposed to be access streets C and D, designed for use in areas of 3,000 vehicle movements or less per road. Cross sections in Figure 13 show how the function of road corridors support vehicle movements, informal on-street car parking, pedestrian links, and water management.

The road network facilitates independent development of most lots, with vehicle access directly to the existing Wokarena Heights road network. Lots 8 does not have a formal link to Richard Road in the Structure Plan; however, development ahead of either Lots 7 or 9 can occur by providing these links can be achieved through temporary east-west access ways over proposed lots that enable access to subdivision roads. Once formal road links are developed, the accessway can be decommissioned and the additional lots subdivided (or it can remain as a road reserve). Lot 5 has additional connection to Eliza Shaw Drive to the north, and a shared road along the southern boundary of sufficient width for temporary access that will facilitate independent development ahead of subdivision on Lot 4.

*Figure 10 View along north west coastal highway*

*Figure 11 Wokarena Road*




Paper Size ISO A4

0 50 100 150 200

Meters

Horizontal Datum: GDA2020
Grid: GDA2020

N

GHD

**Shire of Chapman Valley**
**Wokarena Heights Structure Plan Review**

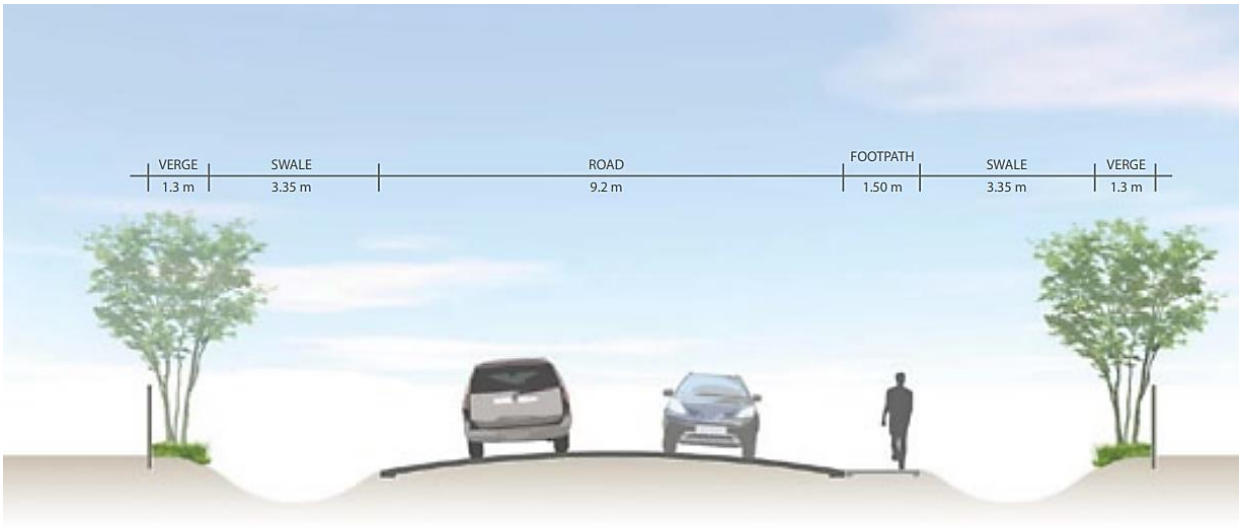
**Movement Network**

Project No. **12655722**
Revision No. **0**
Date **19/08/2025**

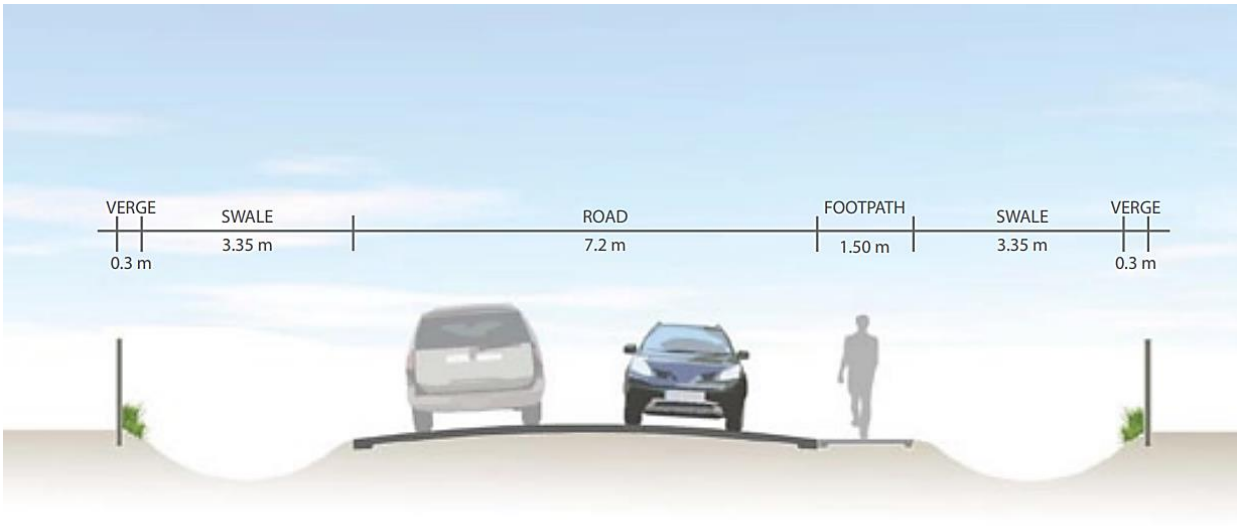
**FIGURE 12**

\\ghdnet\ghd\AU\Perth\Projects\61\12655722\GIS\Maps\Working\12655722_Figures\12655722_Figures.aprx
Print date: 19 Aug 2025 - 14:14

Data source: . Created by: rbrown3




NEIGHBOURHOOD CONNECTOR




ACCESS ROAD

***Figure 13 Indicative Road Cross Sections***

## 3.2.2 Traffic generation and management

The existing intersection of Wokarena Road with North West Coastal Highway is considered unsuitable to support the total traffic generated from the development of the precinct.

Traffic generation for 250 dwellings has been determined from the New South Wales Roads & Traffic Authority's "Guide to Traffic-Generating Developments", Version 2.2 (October 2002). According to this guide, using the rate for "dwelling houses", 250 dwellings would generate 2,250 daily vehicular trips, with 212 in the weekday peak hour.

Surveyed flows on the North West Coastal Highway have been obtained from Main Roads. The survey data is for the Highway, south of Coronation Beach Road, and the average daily volume for the period Monday 16th May 2011 to Friday 20th May 2011 was used as a reasonable reflection of flows experienced along the Wokarena Heights Precinct. This daily volume is 1,421. It is assumed that the peak-hour flow is 10% of daily flow, giving 142 vehicles per hour.

Austroads "Guide to Road Design" Part 4A "Unsignalised and Signalised Intersections" (2009) provides guidance on the type of turning treatments, i.e. basic, auxiliary lane or channelized in Section 4.8. Given the above traffic volumes, and a design speed of 100 km/h (speed limit plus 10 km/h), the appropriate treatments would be channelised right turn treatment with short turn slot; and auxiliary left-turn treatment with short left-turn lane on the major road.

The following dimensions can be considered as probable requirements to manage the additional traffic generation from Wokarena Heights to the North West Coastal Highway:

– Right-turn treatment: additional width of 3.5 metres over a length of 219 metres, assuming flat grade and assuming no B-doubles or road trains turning into Wokarena Road;
– Left-turn treatment: additional width of 3.5 metres over a length of 70 metres, assuming flat grade;
– In total, the additional width requirements would therefore be 7 metres; this is in addition to the existing requirements which include, on each side, a 1-metre sealed shoulder, an unsealed shoulder (typically 1 metre) and a verge (typically 5-metres);
– Vehicle turning templates should be used to determine the exact requirements, along with other detailed considerations; and
– It may be advisable to also include additional treatments to reduce conflicts between cyclists and left-turning vehicles.

The existing road reserve widths of North West Coastal Highway and Wokarena Road are considered sufficient to accommodate required intersection upgrades.

Required intersection treatments for subdivisional roads will be determined at the time of subdivision in accordance with the requirements of the Shire of Chapman Valley.

**Appendix D** provides the North West Coastal Highway / Wokarena Road Intersection Upgrade Design Report.

### 3.2.3 Pedestrian network

All roads within the precinct, as shown by the movement network (Figure 12 and Figure 13), will include footpaths to facilitate pedestrian access throughout the site.

## 3.3 Open space

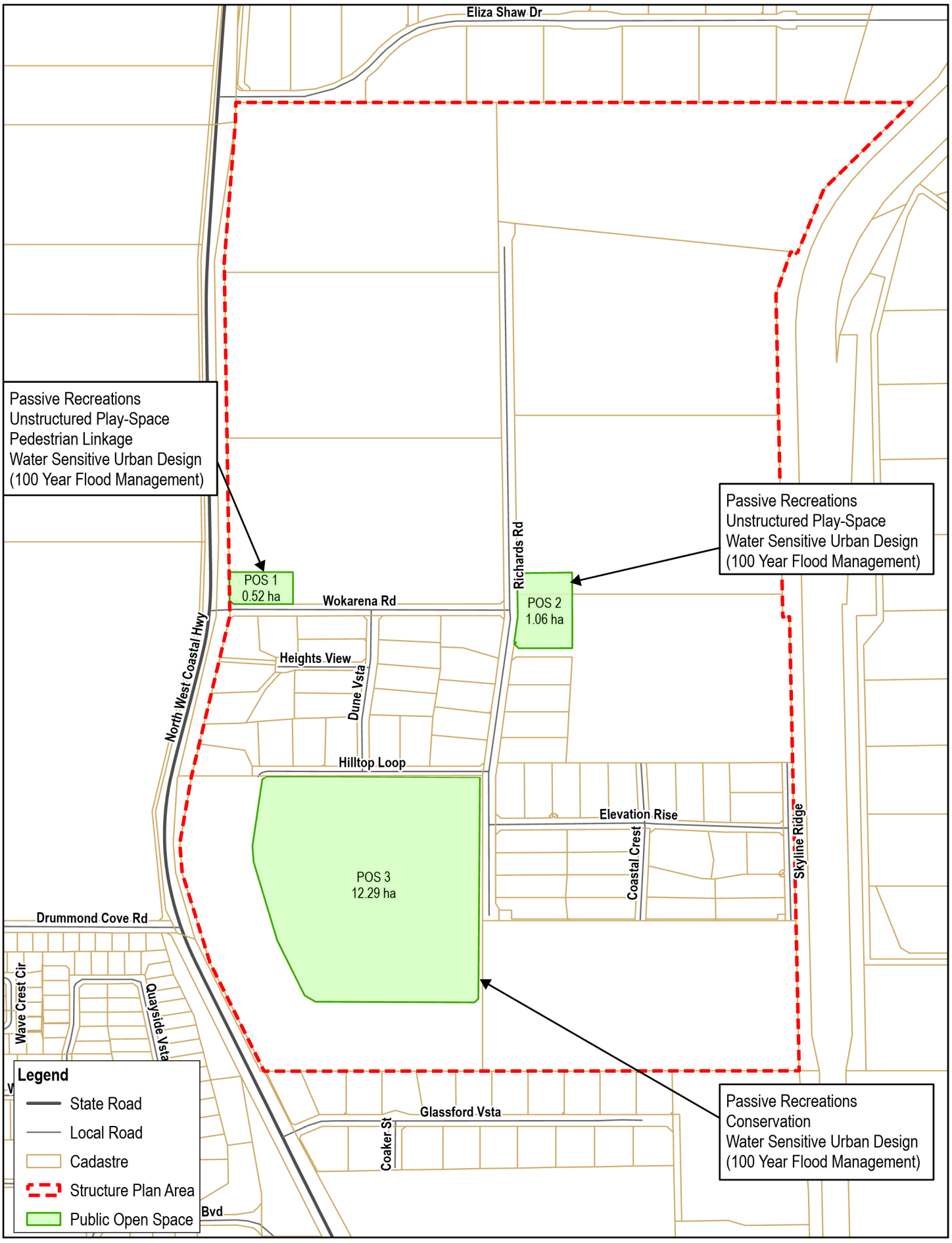
A schedule of POS is shown in Table 8, identifying the land areas set aside for district and neighbourhood parks to provide a range of passive and unstructured active recreational opportunities, incorporating landscape protection, activation of conservation areas, and water sensitive urban design. As part of the design process, POS planning at Wokarena Heights will ensure universal access to benefit all members of the community.

Consistent with the requirements of *Liveable Neighbourhoods*, the Structure Plan originally proposed ten percent of the subdivisible area for POS. A minor deviation (0.2%) noted in the calculations below is the result of the staged nature of subdivision within the Structure Plan Area and consequential amendments to the Structure Plan.

Figure 14 illustrates the locations and key functions of POS.

***Table 8 POS Schedule***

| Item | Hectares |
|---|---|
| Total structure plan area | 142.79 |
| Total developable area | 141.8 ha |
| Required POS (10%) | 14.18 ha |
| **Deductions** | |
| Regional road reserve | 1.0 ha |
| **POS** | |
| District Park | 12.29 ha |
| Neighbourhood Parks | 1.58 ha |
| Total | 13.87 ha |




Paper Size ISO A4

0 50 100 150 200

Meters

Horizontal Datum: GDA2020
Grid: GDA2020

N

GHD

**Shire of Chapman Valley**
**Wokarena Heights Structure Plan Review**

Project No. **12655722**
Revision No. **0**
Date **19/08/2025**

## Public Open Space

# FIGURE 14

\\ghdnet\ghd\AU\Perth\Projects\61\12655722\GIS\Maps\Working\12655722_Figures\12655722_Figures.aprx
Print date: 19 Aug 2025 - 14:42

Data source: . Created by: rbrown3

*POS 1 – Neighbourhood Park*

POS 1, located at the primary entry to the Structure Plan area, is proposed to be a passive recreational space that works as an entry statement to the Structure Plan Area.

Its highly visible position along North West Coastal Highway makes it a suitable location for the provision of public art and to be a point of interest along the Highway.

POS1 will be a visual link between the Structure Plan area and the Buller Development Zone. Following possible future realignment of the North West Coastal Highway, enabling greater pedestrian access across the current alignment, the space will be an important part of the pedestrian link from Richards Road, into the Buller Development Zone, through to the coast.

***Figure 15*** ***Entry statement example within a passive recreational space***

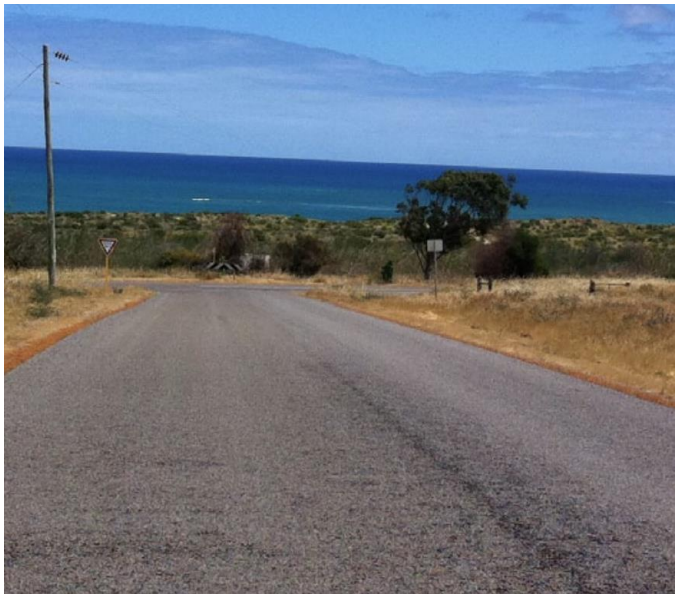


***Figure 16*** ***View from POS1***

*POS 2 – Neighbourhood Park*

POS 2 is a neighbourhood park that will combine passive recreation and unstructured active play opportunities. The location of the space will provide public access to exceptional coastal views and provide an aesthetic entry statement to the precinct. The space can include an area for unstructured active play and facilities, such as seating or a gazebo/lookout.

***Figure 17*** ***Example unstructured play space***

*POS 3 – District Park POS*

POS 3 incorporates and proposes the protection of remnant vegetation in the southeast of the precinct. The protection of the vegetation will provide opportunity for passive recreation based on the conservation value of the site. Retention of the vegetation in public ownership will facilitate the active management of the area for its conservation value.

The space can include an area for unstructured active play and facilities, such as seating and barbecue facilities that provide for the activation of the conservation area and foster community ownership and stewardship to enhance management.

POS 3, in addition to providing important recreation functions, will also provide an important conservation function through the protection of approximately 11.6 hectares of the Beard Vegetation Association 359: Shrublands, Acacia and Banksia as mapped in the Geraldton Regional Flora and Vegetation Survey 2010. Currently in private landownership, the vegetation is threatened by potential land use change or degradation due to inadequate active management of the vegetation for its conservation value. Inclusion of the vegetation into a local reserve for the purpose of conservation and passive recreation will increase the formal protection of Beard Vegetation Association 359 in the region. Through reservation and public ownership, increased active management for conservation purposes will provide for increased quality of the vegetation and its conservation value.

***Figure 18*** ***Example unstructured public open space***

***Figure 19*** ***Example recreational space alongside a conservation area***

# 3.4 Bushfire management

As portions of the Structure Plan are designated as bushfire prone, a BMP has been prepared as **Appendix C**.

The Structure Plan proposes a number of elements to manage bushfire risk presented by the remnant vegetation. Importantly, a road interface is provided between the bushland and all private land to assist as a firebreak. An additional road link between Lot 1 and 11 introduces access and escape opportunity in the event of a fire for those lots in Lot 1 and is an essential component of bushfire management. The introduction of additional north south roads and additional links to the highway also enhances emergency access and egress.

The subdivider of Lot 10 has now created an emergency access alignment leading east to Connect with Cargeeg Bend in the neighbouring Rural Residential subdivision. The subdivider of Lot 5 will create an access to Eliza Shaw Drive.

The installation of fire hydrants will be required at the time of subdivision. Development applications within areas designated as bushfire prone are to be accompanied by a compliance certificate to confirm that the indicative BALs identified in the BMP remain accurate. If the pre-development BAL assessment indicates that the proposed habitable

building(s) will have a potential radiant heat impact exceeding 29kW/m² then a bushfire management plan should accompany the development application.

## 3.5 Water management

A Local Water Management Strategy has been prepared for the Structure Plan, and is provided as **Appendix A**.

The proposed stormwater management strategy employs the following principles for managing water quantity:

– For the 1-year ARI event lot and road runoff will be infiltrated as close to source as practical using WSUD measures such as infiltration devices. These include swales and soakwells.
– Events greater than the 5-year ARI event and up to and including the 100-year ARI event will be collected and conveyed via roadside swales into drainage basins integrated within POS located throughout the area. These swales and basins have been sized to compensate for major events up to the 100-year ARI event.

Furthermore, the following measures are advised for managing water quality:

– Structural measures – Using WSUD and best management practices to ensure that stormwater is infiltrated as close to the source as practical; and
– Non-structural measures – Nutrient control and landscaping, sediment and litter control and construction management, and community awareness and education.

## 3.6 Groundwater management

To ensure that existing groundwater levels and quality is maintained, the quality of the stormwater infiltration will be maximised using WSUD and best management practices to ensure that stormwater is infiltrated as close to the source as practical.

## 3.7 Educational facilities

No school facilities are required within the Wokarena Heights Precinct. Several primary schools have been planned in Drummond Cove and Glenfield that will service the development. The Structure Plan abuts the school bus route to the high schools precinct located in the Geraldton City Centre, 12km to the south.

## 3.8 Infrastructure coordination

### 3.8.1 Water

Existing development within the Structure Plan Area is connected to reticulated water supply with existing street hydrants. There is also existing reticulated water supply and street hydrants along public roads outside the project area, including North West Coastal Highway, Eliza Shaw Drive and Glassford Vista.

It is expected that future development will be connected to reticulated water supply and additional street hydrants will be installed in accordance with the relevant Water Corporations design standards.

Upgrades and additional infrastructure will need to be funded by developers at the time of subdivision. The upgrade of water reticulation can be undertaken in stages, with stages commencing at the north of the precinct and moving consecutively to the south as staged subdivision occurs.

Subdivision of the precinct, however, will be determined by the time frames of individual landholders. If a developer chooses to subdivide ahead of staged infrastructure upgrades through the northern part of the precinct, there may be requirement for that developer to fund the upgrade of water reticulation based on advice from and negotiation with the Water Corporation.

### 3.8.2 Wastewater

No reticulated wastewater scheme is proposed for the development area, with onsite treatment and disposal of effluent through aerobic treatment units on individual lots permitted by the proposed lot sizes and the Government Sewerage Policy (2019).

### 3.8.3 Power

There are existing electrical connections into the study area, although the capacity of the electricity network in the region is limited. The need for any reinforcement works or infrastructure upgrades should be determined at the time of subdivision through a Western Power feasibility study.

### 3.8.4 Telecommunications

All lots in the Wokarena Heights structure plan will be connected to Telstra by copper wire connection and the National Broadband Network (NBN).

Corridors through local roads should be considered in the design and construction of each subdivision. Telecommunications infrastructure must be in accordance with appropriate guidelines of network providers.

The Geraldton to Port Hedland fibre optic cable is proposed to be installed along the southern and western boundaries of the Wokarena Heights Precinct. This will allow the optimal connection point or multiple connection points to the National Broadband Network.

## 3.9 Development contribution arrangements

No formal development contribution scheme is proposed for the Structure Plan Area. Cost contributions will be implemented through conditions of approval of subdivision and development by the Shire, in accordance with State Planning Policy 3.6 – Infrastructure Contributions (SPP 3.6).

Developers shall be responsible for the following infrastructure items:

– Upgrade of Richards Road and Wokarena Road, including its intersection with North West Coastal Highway ('road upgrades'). As all lots will contribute to the need for upgrades, cost contributions have been apportioned across all parent lots based on the area of residential land that will be created on each lot, excluding POS and roads.
– POS costs, to be shared across the Structure Plan Area through implementation of cash in-lieu provisions under SPP3.6.
– Water management costs required as identified in the Local Water Management Strategy (refer **Appendix A**) that provides a coordinated approach to drainage locations. The location of drainage swales for 100-year flood events within POS will facilitate the sharing of drainage land costs through POS cash-in-lieu processes.

Cost contributions have been apportioned across all parent lots based on the area of residential land that will be created on each lot, excluding POS and roads as shown by Figure 21 and summarised in Table 9, and therefore the contribution of that lot to the need for the upgrade works.

The following method of cost apportionment shall be used to determine the amount payable at the time of subdivision:

**R / L x 100 = P**

**C x P = A**

R = Area of residential land on the lot

L = Total area of residential land in the structure plan area

P = Percentage of total contribution required from landowner

C = Cost of road upgrades

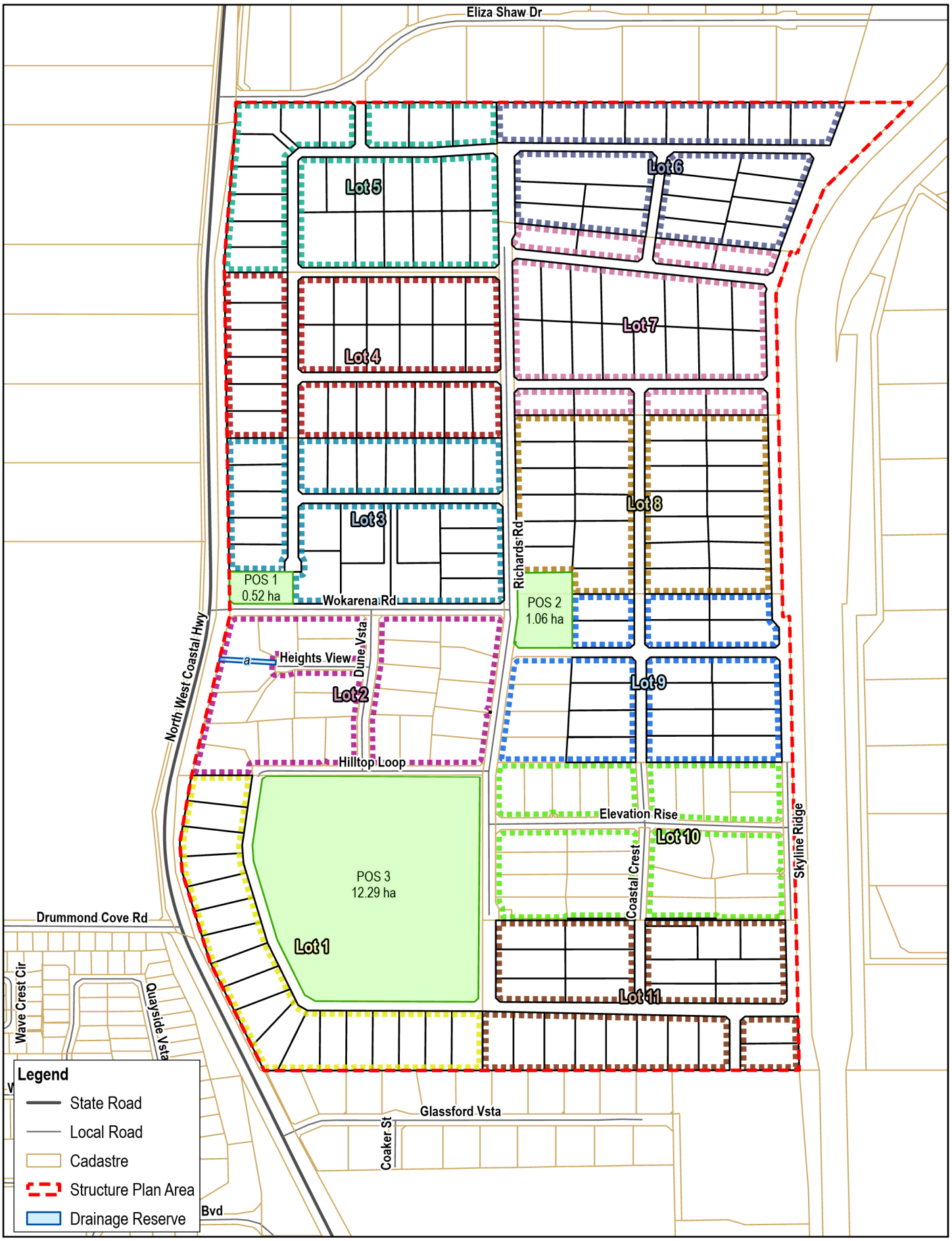
A = Amount payable

The Shire will be responsible for undertaking required upgrade works once contributions have been received. However, if a subdivision application is deemed to require an upgrade in the shorter term to ensure safety of road users, then the applicant may be required to construct part or all of the upgrade works as a condition of subdivision, irrespective of proportionate responsibility.

*Table 9 Development Contributions*

| Lot | Created Residential Land | Contribution |
|---|---|---|
| 1 | 7.41 | 6.7% |
| 2 | 10.22 | 9.2% |
| 3 | 10.22 | 9.2% |
| 4 | 10.43 | 9.5% |
| 5 | 10.46 | 9.5% |
| 6 | 9.67 | 8.8% |
| 7 | 10.30 | 9.4% |
| 8 | 10.66 | 9.7% |
| 9 | 9.9 | 9.0% |
| 10 | 10.43 | 9.5% |
| 11 | 10.39 | 9.5% |
| Total | 110.10 | - |

*Figure 20 The intersection of Wokarena Road and North West Coastal Highway will require upgrades*




Paper Size ISO A4

0 50 100 150 200

Meters

Horizontal Datum: GDA2020
Grid: GDA2020

N

GHD

Shire of Chapman Valley
Wokarena Heights Structure Plan Review

Project No. 12655722
Revision No. 0
Date 19/08/2025

## Development Yields

# FIGURE 21

\\ghdnet\ghd\AU\Perth\Projects\61\12655722\GIS\Maps\Working\12655722_Figures\12655722_Figures.aprx
Print date: 19 Aug 2025 - 14:14

Data source: . Created by: rbrown3

## 3.10 Implementation

Implementation of the structure plan will be through application of the provisions of Part 1 of the Structure Plan through subdivision processes.

A number of technical studies and surveys will be required to facilitate subdivision of the site. These include:

– Flora and fauna survey (Lot 1 only, prior to application for subdivision)
– Urban Water Management Plan (condition of subdivision)
– Noise level contour plan, for subdivision within the Trigger Distance specified under SPP5.4 (condition of subdivision)
– A compliance certificate, for development applications within areas designated as bushfire prone to confirm that the indicative BALs identified in the BMP remain accurate. If the pre-development BAL assessment indicates that the proposed habitable building(s) will have a potential radiant heat impact exceeding 29kW/m² then a BMP should accompany the development application. (condition of development approval)

Each parent lot will represent a stage of subdivision; the Structure Plan has been designed so that landowners of parent lots are able to subdivide independently of one another rather than being required to do so in sequence. The structure plan design also enables parent lot landowners to subdivide to the ultimate development layout through a single subdivision stage or in gradual stages. Staged subdivision may retain large lots around existing houses and improvements, whilst providing for part development as an interim measure.

Figure 22 provides an example of a staged subdivision for Lot 7.

It is recommended that subdivision move along stages from north to south, however this is not a statutory requirement of the structure plan and in reality, staging will be according to the development aspirations of individual landholders.

Where subdivision does not follow the north-south pattern consistent with infrastructure upgrade planning, there may be a need for owners to undertake works in excess of what would be their proportionate contribution to the upgrade of (particularly water) infrastructure to facilitate earlier subdivision.

The Structure Plan and Local Water Management Strategy provide for coordinated stormwater management, with basins for the 100-year flood located within POS. Subdivision stages occurring ahead of the development of POS on other lots will need to incorporate temporary measures and areas for flood mitigation. The sizing, location, and decommissioning of temporary drainage infrastructure should be incorporated within Urban Water Management Plans prepared as a condition of subdivision.

Several potential issues arising through development of the Structure Plan will require further detailed planning to resolve. These include:

1. Noise impacts associated with the North West Coastal Highway, and the potential realignment of the highway to the eastern boundary of the subject area;
2. Managing the interface between Wokarena Heights and the adjacent Rural Residential subdivision on the northern boundary; and
3. Managing the interface between POS and abutting private lots.

To manage these impacts, specific provisions for lots in these locations will be required. Local Development Plans, which provide additional development standards for particular circumstances, will be required to be developed for lots identified by the Structure Plan Map to manage potential impacts.

Key issues to be considered and resolved in the preparation and adoption of Local Development Plans include:

1. Lots abutting highway:
    - Increased rear setbacks and landscape buffering to assist noise attenuation;
    - ‘Quiet house design’.
2. Lots abutting the Rural Residential subdivision to the north:
    - Increased rear setbacks and landscape buffers to provide visual buffer for residents;

- Specified building envelopes and site coverage requirements to maintain the amenity of residents.

3. Lots abutting POS:
    - Passive surveillance of POS areas
    - Activated frontages along POS and roadways

Figure 23 provides a conceptual example of a Local Development Plan for lots abutting the Rural Residential subdivision on the northern boundary of Wokarena Heights. This example provides additional design standards to manage potential impacts of increased density within Wokarena Heights on rural-residential neighbours to the north.


Paper Size ISO A4

0 25 50 75 100

Meters

Horizontal Datum: GDA2020
Grid: GDA2020

N

GHD

**Shire of Chapman Valley**
**Wokarena Heights Structure Plan Review**

**Example Staged Subdivision for Lot 7**

Project No. **12655722**
Revision No. **B**
Date **18/07/2025**

# FIGURE 22

\\ghdnet\ghd\AU\Perth\Projects\61\12655722\GIS\Maps\Working\12655722_Figures\12655722_Figures.aprx
Print date: 18 Jul 2025 - 10:31

Data source: WANow:
World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
World Imagery: Maxar. Created by: rbrown3

SUBDIVISIONAL/DEVELOPMENT STANDARDS

The requirements of the R-Codes apply unless otherwise provided below or by the Wokarena Heights Local Structure Plan.

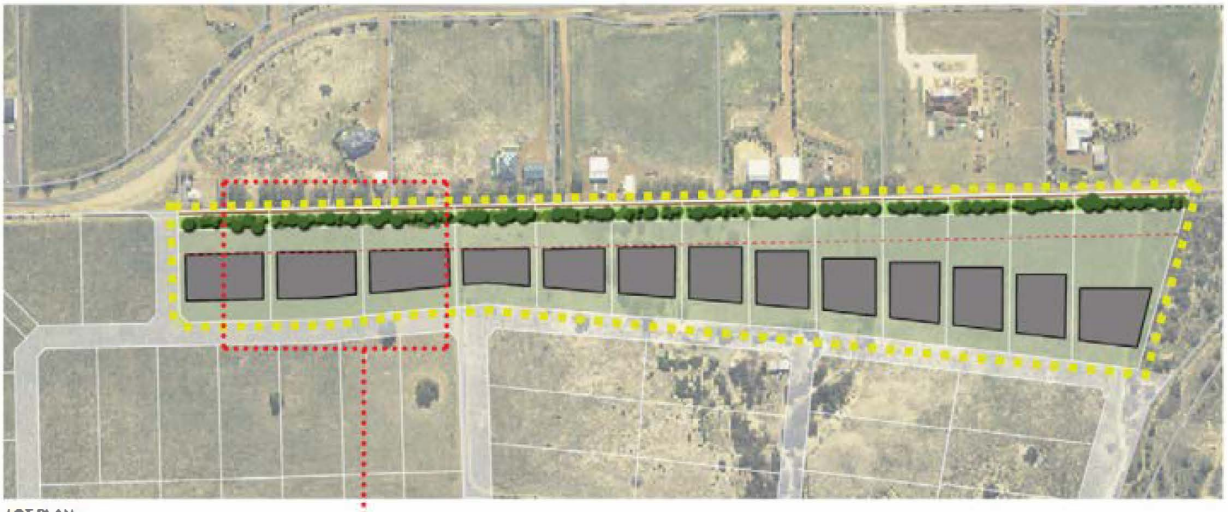
1. Dwellings and all incidental development is to be contained within the prescribed building envelope.

2. Dwellings and incidental development is not to exceed 20 percent of the total site area.

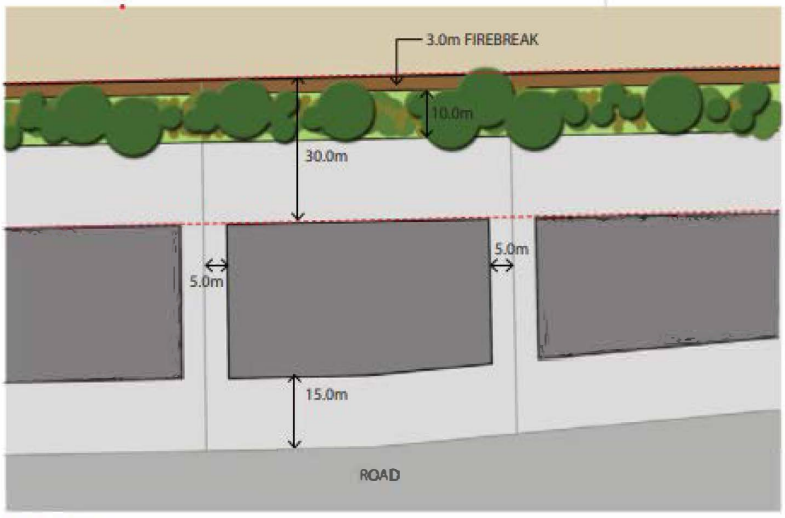
3. All lots are to provide and maintain a ten metre wide landscape buffer strip, to provide visual screening, along the rear boundary.

4. All lots are to maintain a three metre firebreak along the rear boundary.

KEY PLAN



LOT PLAN




LEGEND:

BUILDING ENVELOPE

3.0m FIREBREAK

10.0m LANDSCAPE BUFFER

DETAIL PLAN *(Not to scale)*

Paper Size ISO A4

0 50 100 150 200

Meters

Horizontal Datum: GDA2020
Grid: GDA2020

N

GHD

**Shire of Chapman Valley**
**Wokarena Heights Structure Plan Review**

**Example Detailed Area Plan for lots abutting Rural Residential subdivision**

Project No. **12655722**
Revision No. **A**
Date **18/07/2025**

**FIGURE 23**

\\ghdnetghd\AU\Perth\Projects\61\12655722\GIS\Maps\Working\12655722_Figures\12655722_Figures.aprx
Print date 18 Jul 2025 - 10:48

Data source: WANow
World Imagery: Maxar Created by: rbrown3

# Appendix A

## Local Water Management Strategy

# Shire of Chapman Valley

## Report for Wokarena Heights Structure Plan

### Local Water Management Strategy

August 2012

*This Wokarena Heights Structure Plan Local Water Management Strategy (Report):*

1. *has been prepared by GHD Pty Ltd ("GHD") for the Shire of Chapman Valley;*
2. *may only be used and relied on by the Shire of Chapman Valley;*
3. *must not be copied to, used by, or relied on by any person other than the Shire of Chapman Valley may only be used for the purpose of providing input into the Local Structure Plan and guidance for water management in the study area (and must not be used for any other purpose).*

*GHD and its servants, employees and officers otherwise expressly disclaim responsibility to any person other than the Shire of Chapman Valley arising from or in connection with this Report.*

*To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the Report are excluded unless they are expressly stated to apply in this Report.*

*The services undertaken by GHD in connection with preparing this Report:*

- *were limited to those specifically detailed in section 1 of this Report;*
- *did not include any field testing or monitoring at the site.*

*The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD when undertaking services and preparing the Report ("Assumptions"), including (but not limited to):*

- *currently available spatial data*
- *the structure plan as presented in Appendix A*
- *the runoff from the cul-de-sac associated with Lot 2 will need to be accommodated in a drainage swale designed by the land developers.*

*GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with any of the Assumptions being incorrect.*

*Subject to the paragraphs in this section of the Report, the opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the time of preparation and may be relied on until 6 months, after which time, GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with those opinions, conclusions and any recommendations.*

# Contents

## Table Index



## Figure Index



## Appendices

# Executive Summary

The Wokarena Heights development area is located approximately 8 km north of Geraldton and 1 km inland, adjacent to the North West Coastal Highway. The area is approximately 143 ha in size and will comprise of 215 rural residential lots as well as large regions of public open space.

This Local Water Management Strategy (LWMS) has been prepared in accordance with *Better Urban Water Management* (Western Australian Planning Commission, 2008).

**Principles**

The key principles of integrated urban water management are:

- Minimise total water use in the development area
- Protect infrastructure and assets from inundation and flooding
- Manage groundwater levels to protect infrastructure and assets
- Protect environmental values of receiving water bodies

**Water conservation and efficiency**

To make the Wokarena Heights development a leading example of water efficiency the following measures are recommended:

- Require all new buildings to incorporate certified water efficient appliances, as set out in the Criteria for Waterwise Homes developed by the Water Corporation
- No potable water is to be used outside of homes and buildings
- Public open spaces, including minimal street scaping, should make use of native plants where possible, only be watered during establishment and have watering restricted during the daytime when potential evaporation is at a maximum

**Wastewater management**

The site will not be connected to a centralised sewage treatment plant so the proposed rural residential lots are to be serviced by onsite aerobic treatment units (ATUs) to treat and dispose of all household sewage.

**Stormwater management**

The proposed stormwater management strategy employs the following principles for managing water quantity:

- For the 1 year ARI event lot and road runoff will be infiltrated as close to source as practical using water sensitive urban design (WSUD) measures such as infiltration devices. These include swales and soakwells.
- Events greater than the 5 year ARI event and up to and including the 100 year ARI event will be collected and conveyed via road side swales into drainage basins located throughout the area. These swales and basins have been sized to compensate for major events up to the 100 year ARI event.

Furthermore, the following measures are advised for managing water quality:

- *Structural measures* - Using WSUD and BMPs to ensure that stormwater is infiltrated as close to the source as practical
- *Non-structural measures* - Nutrient control and landscaping, sediment and litter control and construction management, and community awareness and education

**Groundwater management**

To ensure that existing groundwater levels and quality is maintained, the quality of the stormwater infiltration to groundwater will be maximised through:

- Using WSUD and best management practices (BMPs) to ensure that stormwater is infiltrated as close to the source as practical.

# 1. Introduction

GHD Pty Ltd was commissioned by Shire of Chapman Valley to prepare a Local Water Management Strategy (LWMS) for the Wokarena Heights Structure Plan.

The Wokarena Heights study area is located approximately 8 km north of Geraldton, adjacent to the North West Coastal Highway. The site is bounded by the highway to the west, the future highway realignment corridor to the east and existing development to the north and south.

The Wokarena Heights development is approximately 143 ha in size. The current zoning of the site supports the proposed subdivision development.

The aim of this LWMS is to combine present information from a variety of sources and deliver design criteria and precinct water management strategies.

## 1.1 Planning Background

This LWMS has been prepared in accordance with the responsibilities for State Planning Policy 2.9: Water Resources (WAPC 2004), State Water Plan (2007) and Better Urban Water Management (WAPC 2008). The planning framework for land and water planning is illustrated in Figure 1. Better Urban Water Management (WAPC 2008) provides a model for developers to address water related management issues at the various stages of planning and presents interim water related design objectives for water conservation, groundwater and stormwater. The preparation of this LWMS is not supported by a preceding District Water Management Strategy (DWMS) or Regional Water Management Strategy (RWMS).

The strategies presented in this LWMS are consistent with the following documents:

- Geraldton Region Plan Final (WAPC 1999)
- Draft North Geraldton District Structure Plan (WAPC 2006)
- Shire of Chapman Valley Local Planning Strategy (WAPC 2008)
- Land Development Specifications (City of Geraldton-Greenough 2007), which has been adopted by the Shire of Chapman Valley as a Local Planning Policy

## 1.2 Principles and Objectives

Total water cycle management, also referred to as integrated water cycle management, ‘recognises that water supply, stormwater and sewage services are interrelated components of catchment systems and therefore must be dealt with using a holistic water management approach that reflects the principles of ecological sustainability’ (DoW 2004-07 Stormwater management manual for Western Australia). This LWMS is a key component to water cycle management and considers the integration of water supply, sewerage and stormwater while incorporating water-sensitive urban design principles.

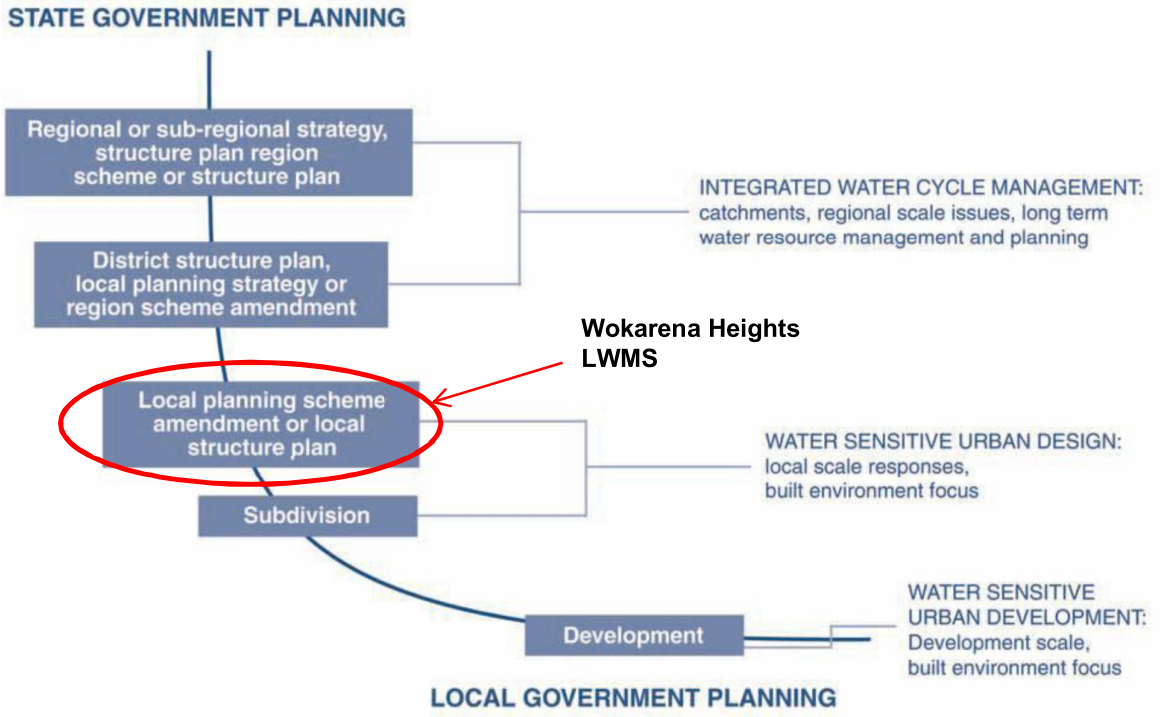



**Figure 1:** Framework for integrating drainage with land planning

Source: *Better Urban Water Management* (WAPC, 2008)

# 2. Proposed Development

The Wokarena Heights study area is located approximately 8 km north of Geraldton, adjacent to the North West Coastal Highway. The site is bounded by the highway to the west, the future highway realignment corridor to the east and existing development to the north and south.

The Wokarena Heights development is approximately 143 ha in size.

### 2.1.1 Proposed land use

The proposed development will be dominated by low density rural residential R2.5 lots sized between 4000 $m^2$ and 6000 $m^2$. Road reserves will be either 15.4 m wide, for access streets, or 19.4 m wide, for neighbourhood connector roads. Table 1 shows the approximate area occupied by each land use.

**Table 1: Wokarena Heights development land use**

| Land use | Area (ha) |
|---|---|
| Low density residential | 111 |
| Public open space | 14 |
| Road reserve | 18 |
| **TOTAL** | **143** |

### 2.1.2 Public open space landscape

Current remnant bushland in the south west of the site will be retained as public open space (POS). The POS will contribute to the site's drainage requirements, by accommodating the 100 year ARI event in one sub-catchment (discussed further in Section 6).

### 2.1.3 Previous land use

The site currently consists of primarily rural uses, including orchard, cleared areas, existing houses and remnant bushland.

# 3. Design Criteria

The design criteria adopted for this LWMS have been based on the design objectives outlined in Better Urban Water Management (WAPC 2008). This criteria is outlined below:

## 3.1 Water conservation and efficiency

Water management is to be sustainable and water use is to be efficient across the entire development. To achieve this principle, the following criteria will be applied:

- Ensure that potable water use is as efficient as possible and therefore minimise total water use. The State water planning framework sets a target of reducing unrestricted annual water consumption to 100 kL/person, including not more than 40 – 60 kL/person scheme water.
- Substitute drinking quality water with fit-for-purpose water for nondrinking water uses. The development aims to reduce the use of scheme water by providing an alternative fit for purpose water supply for nondrinking use.

## 3.2 Stormwater management

***Water quantity***

The post development annual discharge volumes and peak flows are to be maintained relative to pre-development conditions. To achieve this principle, the following criteria will be applied:

- To manage flows for ecological protection and manage the serviceability of roads and other infrastructure, lot and road runoff for minor rainfall events will be either captured in rainwater tanks or infiltrated as close to the source as practical.
- The post-development area should retain all catchment runoff exceeding the pre-development level, up to and including the 100 year ARI event, while protecting infrastructure and assets from flooding.

***Water quality***

The post-development water quality is to be maintained at pre-development levels (winter concentrations) and if possible, the quality of water leaving the development area is to be improved to maintain and restore ecological systems. To achieve this principle, the following criteria will be applied:

- Ensure that all surface and groundwater contained in the drainage infrastructure network receives treatment prior to discharge to receiving environment consistent with the Stormwater Management Manual (DoW 2007).

***Disease vector management***

To reduce health risks from mosquitoes, retention and detention treatments should be designed to ensure that between the months of November and May stationary stormwater is fully infiltrated in less than three days. Detention and infiltration areas should be free of depressions and potholes to avoid immobile water. To achieve this principle, the following criteria will be applied:

- No permanent water bodies will be constructed on site.

## 3.3 Commitment to best management practice

In order to meet the design criteria outlined above, the following best practice hierarchy of principles will be employed:

1. Implement controls at or near the source to prevent pollutants entering the system and/or treat stormwater;
2. Install in-transit measures to treat stormwater and mitigate pollutants that have entered the conveyance system;
3. Implement end-of-pipe controls to treat stormwater, addressing any remaining pollutants prior to discharging to receiving environments.

Current best practice water sensitive urban design measures at the different scales include:

- Residential lot scale:
  - Onsite retention
  - Water wise and Nutrient-wise landscaping
  - Porous pavements
  - Amended topsoils
  - Rainwater tanks
  - Raingardens and vegetated soakwells
- Street Scale:

  As for residential and in addition,
  - Landscaped infiltration structures
  - Conveyance biofilter systems

# 4. Pre-development Environment

## 4.1 Study area

The Wokarena Heights development site is located approximately 8 km north of Geraldton (Figure 2). The site is bounded by the North West Coastal Highway to the west, Alexander Drive to the east and existing development to the north and south.

The study area was previously zoned 'General Farming' under the Shire of Chapman Valley Town Planning Scheme No. 1; however this was revised to 'Residential R2.5' in the Local Planning Scheme No. 2 in 2011. The Draft Northern Geraldton District Structure Plan of 2006 classified the study area as 'Future Rural Residential' and the Greater Geraldton Structure Plan of 2011 updated this zoning to 'Future Urban'.

## 4.2 Climate

The site is located in the mid-west of Western Australia, which has a Mediterranean climate consisting of hot, dry summers and cool, wet winters (Figure 3). The closest weather station to the site is located 13 km away at Geraldton Town (Site ID. 008050). Recorded historical climate data is summarised below (Bureau of Meteorology 2012):

- Mean annual maximum temperature range: 29.7 °C (February) to 19.8 °C (July)
- Mean annual minimum temperature range: 18.8 °C (February) to 10.5 °C (July)
- Mean annual rainfall: 453.5 mm/yr
- Mean annual rain days per year: 41.1 days
- Mean annual actual evapotranspiration: 300 - 400 mm/yr
- Mean annual potential evapotranspiration: 1400 - 1500 mm/yr

## 4.3 Topography

The north east corner of the study area is elevated towards the Moresby Ranges, with a maximum elevation between 70 m Australian Height Datum (AHD) and 75 mAHD based on existing LandGate contours. The elevation decreases steadily towards the south west corner of the study area, to a minimum between 20 mAHD and 25 mAHD.


LEGEND

Contours (5m)

Wokarena Heights development site

Cadastre

1:20,000 (at A4)

0.2 0 0.2 0.4 0.6

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 50

N

GHD CLIENTS PEOPLE PERFORMANCE

Shire of Chapman Valley
Wokarena Heights Structure Plan

Job Number | 61-27523
Revision | E
Date | 15 03 2012

Locality plan

Figure 2

G:\61\27523\GIS\Maps\WORS\6127523_G01_Fig2_RevE

239 Adelaide Terrace Perth WA 6004 Australia **T** 61 8 6222 8222 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

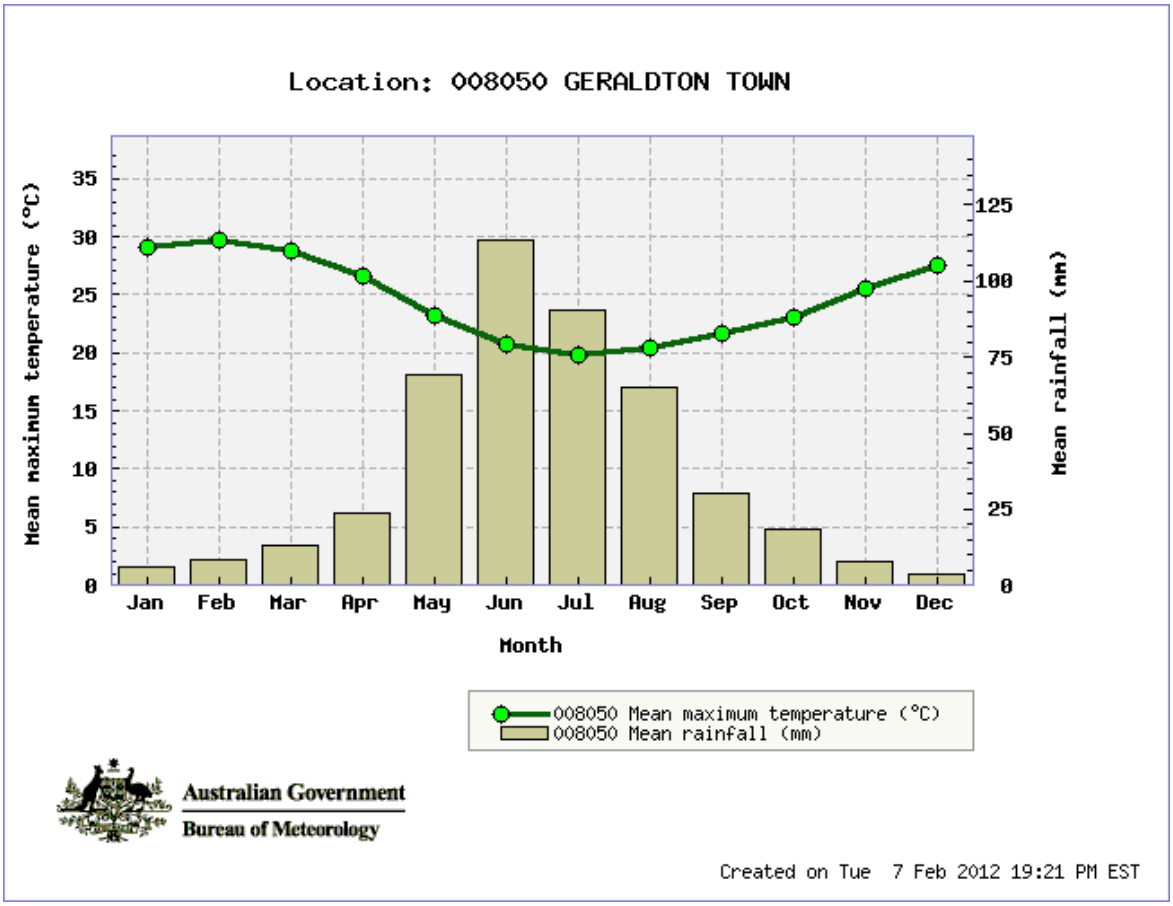



**Figure 3: Climate**

*Source: Bureau of Meteorology (2012)*

## 4.4 Geology and soils

The Wokarena Heights development site is located in the coastal land system (Figure 4). This system consists of two phases of major coastal dunes, the Tamala and the Quindalup. The Tamala dune system comprises of lithified limestone overlain by deep yellow sands and red loams. The younger Quindalup dune system contains white calcareous sands and can be mobile. The dunes are generally stable but are susceptible to erosion. Yellow sands contain some clay and therefore have water retention capacity (WAPC 2008).

There are no known regions of acid sulfate soil risk within the study area (Figure 5). Mapping by Land Gate indicates that there is one area approximately 0.3 km west of the proposed development where there is high to moderate risk of acid sulfate soils occurring within 3 m of the ground surface. This area is approximately 1.48 km long and is 160 m wide at its broadest.

The soil profile on the site should be confirmed prior to the preparation of Urban Water Management Plans to confirm that sandy soil over limestone is present to facilitate infiltration.

## 4.5 Environmental assets and Aboriginal heritage

There are no regions of priority listed flora or threatened fauna and no conservation parks or nature reserves located within the study area (WAPC 2006). There is a region of remnant vegetation in the south west corner of the site, comprising of acacia and banksia shrublands. This remnant vegetation is likely to be significant habitat for a wide range of fauna species. The protection of these species will be addressed through the preservation of the remnant vegetation as public open space under the development proposal.

There is an environmentally sensitive region located approximately 1.5 km northeast of the site which contains Declared Rare Fauna or Priority Listed Significant Flora Populations (Figure 5). An Aboriginal heritage region borders the northern edge of the study area (Figure 5).

## 4.6 Surface water

Surface water flows across the much of the Wokarena Heights development site are generally west towards the coast as a result of the area's topography. Over the southern half of the site the surface water flows are towards the south west. Surface water falling within a small sub-catchment in the northeast corner of the site flows directly north towards a stream. Similarly surface water falling within a small sub-catchment in the southeast corner of the site flows directly south towards a stream.

Currently, very little runoff is generated over the study area due to the low proportion of impermeable surfaces.

There is no surface water bodies (watercourses or wetlands) located on the site. However the site is located within 1 km of the ocean and is 0.5 km northwest of a stream.

## 4.7 Groundwater

There is no groundwater contour data readily available for the Wokarena Heights development area. Groundwater levels for Department of Water bores within 5 km of the site centre were assessed, however none of the bores were within the development area. The subject site experiences a higher elevation than bore locations, and would reasonably achieve a greater distance to groundwater.

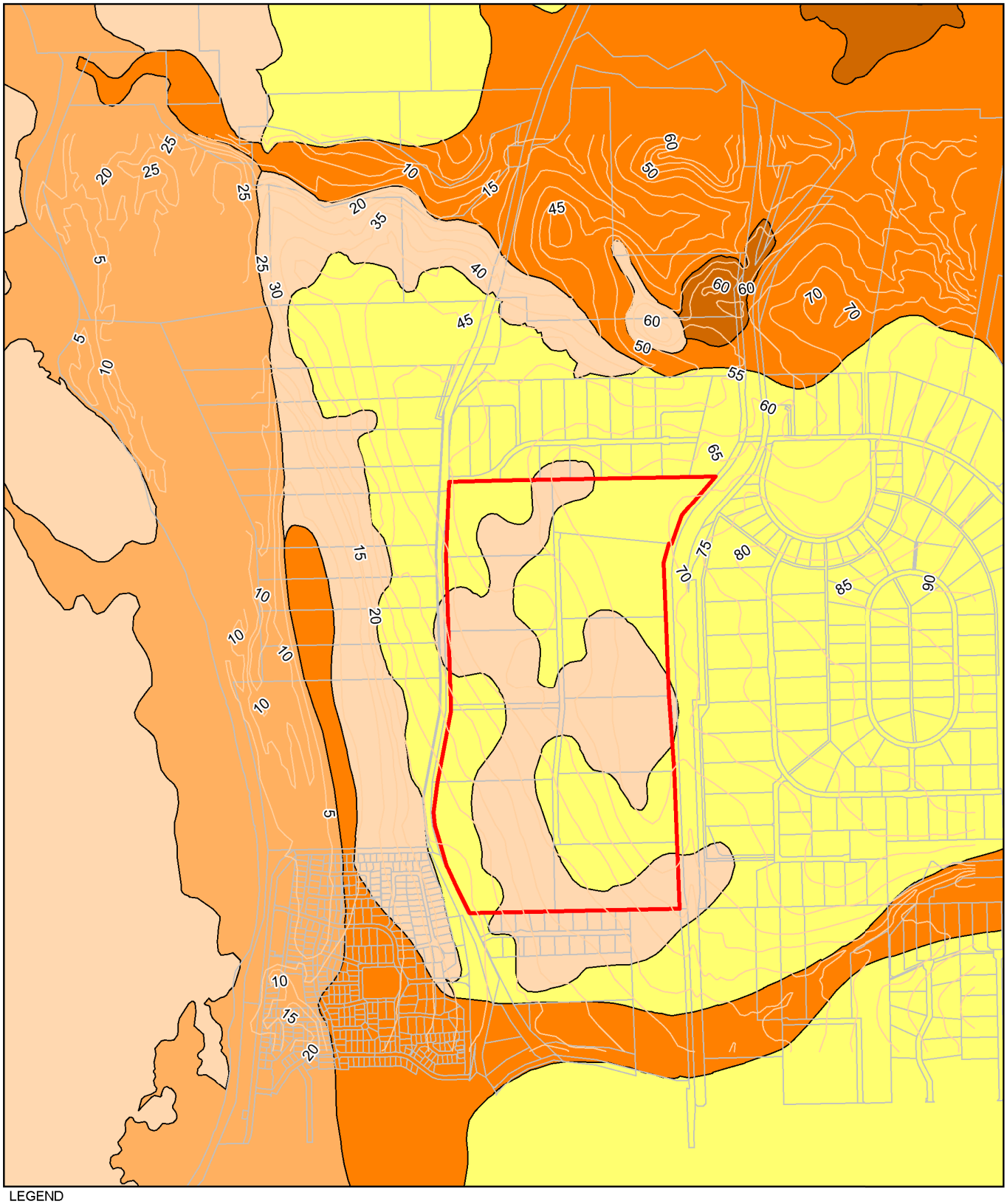
Bores located to the north and south of the area indicated that groundwater level is likely to be deeper than 10 m below ground level (refer Figure 6), and due to the elevation of the site, ranging from 25 up to 70m AHD, it is unlikely depth to groundwater would be less than 5m.

Groundwater monitoring should occur prior to the preparation of Urban Water Management Plans to confirm groundwater levels in the area.

There are no catchment protection zones or sensitive areas within the site.

## 4.8 Existing land use and infrastructure

The site currently consists of primarily rural uses, including orchard, cleared areas, existing houses and remnant bushland. The development site is not currently serviced by sewerage or reticulation mains (WAPC 2006).




1:20,000 (at A4)

0.2 0 0.2 0.4 0.6

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 50

N

CLIENTS PEOPLE PERFORMANCE

Shire of Chapman Valley
Wokarena Heights Structure Plan

Job Number | 61-27523
Revision | E
Date | 15 03 2012

Local geology

Figure 4

G:\61\27523\GIS\Maps\WORS\6127523_G02_Fig4_RevE
239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au



Data source: LGate: Contours (5m), 20111201. Cadastre, 20111201. Geology, 20111201. GHD: Richards Road Development site, 20111201 . Created by: S Glasson


LEGEND

Contours (5m)

Cadastre

Wokarena Heights Development site

Environmentally sensitive area

Aboriginal heritage area

Acid sulfate soils

High to moderate risk

Moderate to low risk

1:20,000 (at A4)

0.2 0 0.2 0.4 0.6

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 50

N

GHD

CLIENTS PEOPLE PERFORMANCE

Shire of Chapman Valley

SLIP ENABLER

Shire of Chapman Valley
Wokarena Heights Structure Plan

Job Number | 61-27523
Revision | E
Date | 15 03 2012

Environmental constraints

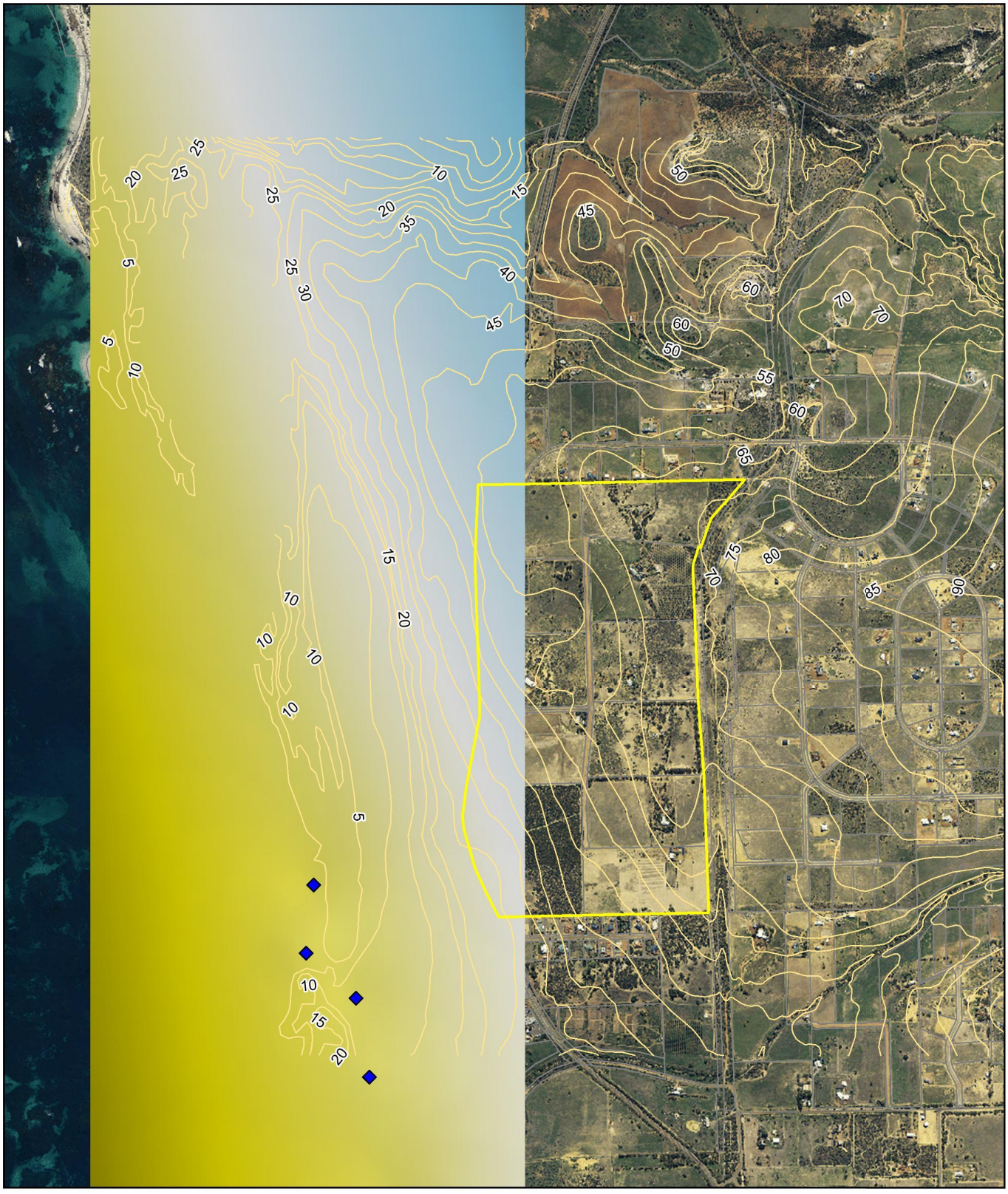
Figure 5

G:\61\27523\GIS\Maps\WORS\6127523__G03_Fig5_RevE

239 Adelaide Terrace Perth WA 6004 Australia **T** 61 8 6222 8222 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au



Data source: LGate: Aerial Image, 20111201. Contours (5m), 20111201. Cadastre, 20111201. Environmentally sensitive area, 20111201. Aboriginal heritage area, 20111201. Acid sulfate soils, 20111201. GHD: Richards Road Development site, 20111201 . Created by: S Glasson




LEGEND

- Groundwater bores
- Contours (5m)
- Cadastre
- Wokarena Heights Development site

Groundwater levels

| | | | |
|---|---|---|---|
| 31 | 20 | 9 | -1 |
| 27 | 17 | 6 | -5 |
| 24 | 13 | 2 | -8 |

1:20,000 (at A4)

0.2 0 0.2 0.4 0.6

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 50

N

GHD

CLIENTS PEOPLE PERFORMANCE

Shire of Chapman Valley

Shire of Chapman Valley
Wokarena Heights Structure Plan

Job Number | 61-27523
Revision | A
Date | 15 03 2012

# Groundwater levels

Figure 6

G:\61\27523\GIS\Maps\WORS\6127523_G04_Fig6_RevA

239 Adelaide Terrace Perth WA 6004 Australia **T** 61 8 6222 8222 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au



Data source: LGate: Aerial image, 20111201, Contours (5m), 20111201, Cadastre, 20111201. DOW: Groundwater bores, 20111201. GHD: Richards Road development site, 20120101. Groundwater levels, 20120301. Created by: S Glasson

# 5. Water Use Strategy

## 5.1 Water conservation and efficiency

The Wokarena Heights development will manage all aspects of the water cycle sustainably and ensure that the use of potable water is as efficient has possible. Water use strategies can be divided into two categories; buildings and public open spaces.

### 5.1.1 Buildings

Water efficiency is part of the Business as Usual approach and is enabled through the use of technology and by changing behaviour to use less water. The Western Australian Government has introduced a range of measures to ensure that new houses built in Western Australia meet minimum standards for energy and water efficiency. The 5 Star Plus building standards introduced in September 2007 are now an addition under the Western Australian Appendix to the Building Code of Australia[1] (BCA) and require:

- All tap fittings must be minimum 4 stars WELS rated;
- All showerheads must be minimum 3 stars WELS rated; and
- All sanitary flushing systems must be a minimum 4 stars WELS rated dual flush.
- Hot water heaters to be located within 5 m of major hot water using points

### 5.1.2 Public open spaces

Public open spaces in the Wokarena Heights development will include some street scaping and an existing region of remnant vegetation. The existing regions of remnant vegetation will not undergo landscaping and will not require irrigation. To conserve water use and maximise efficiency the street scapes should:

- Make use of native plants where possible
- Only be watered during establishment
- Restrict watering during the daytime between 9 am and 6 pm when potential evaporation is at a maximum

## 5.2 Potable water

The potable water for the Wokarena Heights development will be provided by the Water Corporation.

## 5.3 Water supply – fit for purpose strategy

In conjunction with water efficiency measures, supplying fit-for-purpose water can also reduce the demand for potable water. This involves substituting drinking quality water with fit-for-purpose water for nondrinking water uses. Potential non-drinking water uses are:

- In-house non-drinking water: toilets, washing machines
- Irrigation: private (domestic household) and public (public open spaces and road reserves)

- Aquifer recharge

Substituting potable water with an alternative source for non-potable uses can make significant savings in potable water demand and the associated chemical and energy required to treat and deliver water to drinking water standard. Alternative water supply sources include rainwater, groundwater, stormwater and wastewater.

### 5.3.1 Rainwater

Collection and reuse of rainwater at a lot scale using rainwater tank systems is ideal for the Wokarena Heights development due to the large size of lots. Rainwater tanks could effectively supply in-house non-potable water requirements, such as toilets and washing machines.

The major potential risk associated with the use of rainwater tanks is the risk to public health due to poor water quality if the tank system is not maintained and managed appropriately. Rainwater quality is generally considered to be of a high standard if rainwater tanks undergo regular maintenance and appropriate system management is undertaken. The Department of Health (2011) recommends the following:

- Keep gutters and roofs clean and in good repair, each year allow the first good rains to rinse the roof and gutters and run to waste using a first flush diverter
- Screen the inlet and overflow to prevent birds, animals and insects from gaining access
- Use a leaf trap to reduce the amount of organic matter entering the inlet
- Cover and seal the tank to prevent the entry of sunlight, dust, animals, mosquitoes and other insects
- Remove the sludge every two to three years

Rainwater tanks are usually owned and operated by the householder and should be considered at an individual lot level, however they are not mandatory. The use of rainwater tanks at the lot scale is not subject to regulation other than the requirement for an application to Local Government for a Building License. The collection and reuse of rainwater using a rainwater tank system is supported by the Shire of Chapman Valley.

### 5.3.2 Groundwater

Shallow groundwater is considered to be the easiest and usually most cost effective method of providing an alternative to scheme water for irrigation. The use of groundwater presents a small risk in terms of water quality. With respect to irrigation, the presence of significant iron concentrations, hardness, alkalinity, nutrients or salinity can impact upon the receiving vegetation and soils and/or contribute to scaling or scour of irrigation pipework. There is no current information on the quality of the groundwater at the Wokarena Heights development site. The quality of groundwater will need to be investigated prior to the implementation of groundwater for irrigation.

The groundwater level at the site is expected to be deeper than 10 m below ground level. The extraction of shallow groundwater via private bores is supported by the local government but will be at the expense of the landowner.

### 5.3.3 Stormwater

Stormwater runoff increases as a result of land development due to the introduction of impermeable surfaces. At the Wokarena Heights development site the increase in stormwater runoff is expected to be minimal due to the low proportion of impermeable surfaces associated with the proposed rural residential land use. Stormwater can be harvested via infiltration to the superficial aquifer at (or close to) source followed by abstraction from private bores. Collection and storage of stormwater for reuse other than by aquifer storage is impractical due to the small amounts of stormwater expected at the Wokarena Heights development site, and inefficient due to the need to construct large water collection infrastructure.

### 5.3.4 Wastewater

Wastewater includes grey water, wastewater generated from domestic activities such as laundry, dish washing and bathing, and black water, wastewater generated from sewage. While grey water can be reused with little to no treatment, for irrigation, toilet flushing and washing machines, black water must undergo extensive treatment.

The Wokarena Heights development will be unsewered, so landowners will be required to provide onsite effluent disposal systems, such as an aerobic treatment unit (ATU), to treat and dispose of all household wastewater, including grey water and black water.

The Department of Health (2010) requires that in unsewered areas the primary onsite wastewater system should be sized to receive the total wastewater flow in case any additional grey water system fails. Furthermore the removal of grey water from the primary sewage system may adversely impact on the proper operation of that system.

Therefore it is impractical to install an additional grey water system as well as the required effluent disposal system, especially if a rainwater tank is employed.

The National Water Quality Management Strategy: Guidelines for Sewerage Systems - Use of Reclaimed Water (Agriculture and Resource Management Council of Australia 2000) applies to effluent from municipal (ie community) wastewater plants, however it has been adopted by the Department of Health for application to individual household systems, as stated in the Code of Practice for the Design, Manufacture, Installation and Operation of ATUs. The strategy outlines the potential applications for black water and the level of treatment, water quality, monitoring and control requirements.

## 5.4 Wastewater management

The site will not be connected to a centralised sewage treatment plant so the proposed rural residential lots are to be serviced by onsite effluent disposal systems to treat and dispose of all household sewage.

A minimum separation of 1.2 m between an ATU system and the maximum groundwater level is required. In areas of high groundwater, fill is required to ensure adequate separation between an ATU and groundwater. An ATU is required to be at least 6 m away from any well, bore, dam or water course that supplies domestic water or any proclaimed water catchment. An ATU should be situated down slope of the building wherever possible, to remove the need for diversion trenches. Specific requirements can be found in the Department of Health's Code of Practice for the Design, Manufacture, Installation and Operation of Aerobic Treatment Units (2011).

The Shire of Chapman Valley and Department of Health guidelines stipulate each septic tank system is to be assessed individually to determine site specific characteristics and requirements. Builders and

owners of the property will have to design the septic system to suit local conditions and submit an “Application to construct or install an apparatus for the treatment of sewage” to the Shire of Chapman Valley. If the application is approved the effluent disposal system should be installed according to the conditions of approval and must then be inspected by a local government Environmental Health Officer and a Permit to Use issued before the system can be used. Additional applications and approvals are required to reuse treated waste water, for example in irrigation systems or toilets.

# 6. Stormwater Management Strategy

## 6.1 Surface water quantity management

The post development annual discharge volumes and peak flows are to be maintained relative to pre-development conditions. To achieve this principle, the following criteria will be applied:

- To manage flows for ecological protection and manage the serviceability of roads and other infrastructure, lot and road runoff for minor rainfall events will be either captured in rainwater tanks or infiltrated as close to the source as practical.
- The post-development area should retain all catchment runoff exceeding the pre-development level, up to and including the 100 year ARI event, while protecting infrastructure and assets from flooding.

The drainage strategy for Wokarena Heights is shown in Figure 10.

The Wokarena Heights development will comprise of 215 rural residential lots, generally between 4000 $m^2$ and 6000 $m^2$, with two road types. Wokarena Road, Richards Road, Alexander Drive and the northern and southern boundary roads will be "Neighbourhood Connector B (Minor)". All other roads will be "Access Street C, Yield or Give-way Street". All road reserves will incorporate road side swales with a total surface width of 6.7 m. These swales will be grassed to allow infiltration of stormwater runoff. Table 2 gives the dimensions of the two road types. Figure 7 provides typical sections of road reserves within the Wokarena Heights structure plan area, showing the width and conceptual location of the roadside swales. A photograph showing an example roadside swale is shown in Figure 8.

**Table 2: Road types**

| Road type | Width (m) | | | |
|---|---|---|---|---|
| | Road reserve | Road pavement | Footpath | Road side swales |
| Neighbourhood Connector B | 19.4 | 9.1 | 1.5 | 6.7 |
| Access Street C | 15.4 | 7.2 | 1.5 | 6.7 |

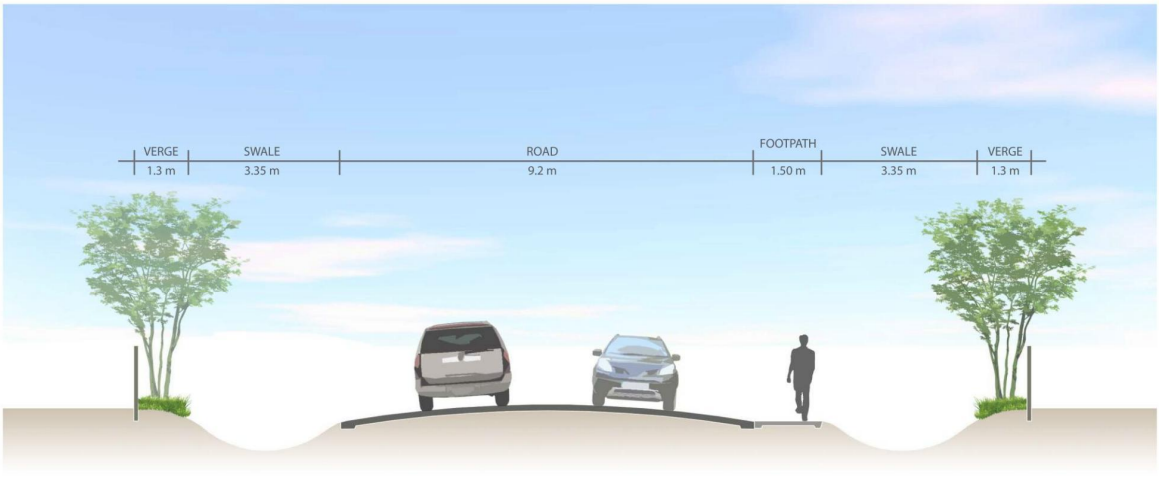



**Figure 7: Road side swales within indicative road cross sections**

**Figure 8: Road side swale in special residential area**

***1 year ARI event***

The typically sandy soil types which are prevalent in the area are ideally suited to the promotion of infiltration at, or close to source. This has the advantage of maintaining recharge into the aquifer as well as minimising the need for drainage infrastructure. As such the most efficient and effective option for managing and reusing stormwater within the Wokarena Heights development is infiltration of stormwater to the aquifer at (or close to) source. Collection and storage of stormwater for reuse other than by aquifer storage is regarded as inefficient due to the need to construct large storages and water collection infrastructure.

Lot and road runoff for minor rainfall events will be either captured in rainwater tanks or infiltrated to the aquifer as close to the source as practical, using water sensitive urban design (WSUD) measures such as soakwells and swales.

Table 3 gives the single lot storage volumes required to retain the 1 year ARI and 5 year ARI events for a range of typical lot sizes. All runoff from the 1 year ARI event is infiltrated within the roadside swales. Roadside swales will be designed to infiltrate the 1 year ARI and convey up to the 10 year ARI in accordance with the engineering requirements of the Shire of Chapman Valley.

**Table 3: Single lot storage volumes ($m^3$)**

| Rainfall event | | 1 year ARI, 1 hour | 5 year ARI, 1 hour |
|---|---|---|---|
| Rainfall intensity (mm/hr) | | 17.4 | 27.8 |
| Lot size ($m^2$) | 4000 | 17.4 | 27.8 |
| | 5000 | 21.75 | 34.75 |
| | 6000 | 26.1 | 41.7 |

***100 year ARI event***

Events greater than the 5 year ARI event and up to and including the 100 year ARI event will be collected and conveyed via road side swales into drainage basins located throughout the structure plan area. These swales and basins have been sized to detain major events up to the 100 year ARI event.

The study area was divided into four sub-catchments based on pre-development water pathways and roads depicted in the Structure Plan, to calculate pre and post development stormwater flows. In the absence of a road grading plan, the sub-catchments were based on the assumption that the roads grade downwards towards the south. The adopted catchments are illustrated in Figure 10. Surface water in sub-catchments A and C travels west towards the ocean. Sub-catchment B directs water north towards a stream. Sub-catchment D includes a large area of POS which will act as a drainage basin. Note that these catchments do not include runoff from upstream catchments outside the Wokarena Heights study area, as this land is already developed and has its own stormwater retention requirements (S Lancaster 2012, pers. comm., 24 Feb).

Table 4 gives the sub-catchment storage volumes required to retain various rainfall events on site. Given the required storage volumes and the direction of surface water flow in each sub-catchment, the recommended drainage basin locations, with indicative flowpaths through the road drainage network, are shown in Figure 10. An indicative example of the proposed basin type is shown in Figure 9.

**Table 4: Sub-catchment storage required to maintain pre-development flows**

| Sub-catchment | Area (ha) | Required storage volume ($m^3$) | | |
|---|---|---|---|---|
| | | 5yr ARI | 10yr ARI | 100yr ARI |
| A | 36 | 1043 | 1447 | 2766 |
| B | 2 | 0 | 0 | 98 |
| C | 41 | 1408 | 2037 | 3240 |
| D | 64 | 1400 | 2007 | 2489 |

Infiltration basins for up to the 100 year event will be large shallow depressions located within public open space, and will be designed to perform two functions: quick infiltration at source, and active and passive public open space consistent with the requirements of Liveable Neighbourhoods.

The basin for sub-catchment D will be located within a POS area identified for conservation. The basin should be located and designed within the southwest corner of the POS area in areas of more degraded vegetation. Design of the basin should be appropriately sized for flood storage, and shaped to minimise impact on quality native vegetation. Basin design should support passive and unstructured active recreational functions.

Public open space areas within subcatchments A and C have been located and sized to facilitate flood storage in accordance with Shire of Chapman Valley engineering requirements. The design of these basins should support passive and unstructured active recreational functions.

All basins within POS are to be designed in accordance with the Shire of Chapman Valley engineering requirements and are to be managed as recreation areas for passive and unstructured active play.

**Figure 9: Swale in public open space**

The swales have the capacity to retain up to the 100 year ARI event runoff from the road reserves. The swales also have the capacity to convey up to the 10 year ARI events to the designated drainage basin locations without overtopping. However peak flows resulting from the 100 year ARI event may result in

slight overtopping of the road side swales. Therefore habitable floors are required to be at least 300 mm above the 100 year ARI flood or storage level at all locations.

## 6.2 Surface water quality management

The post-development water quality is to be maintained at pre-development levels (winter concentrations) and if possible, the quality of water leaving the development area is to be improved to maintain and restore ecological systems. To achieve this principle, the following criteria will be applied:

- Ensure that all surface and groundwater contained in the drainage infrastructure network receives treatment prior to discharge to receiving environment consistent with the Stormwater Management Manual (DoW 2007).

Urban runoff is a significant source of nutrients and other contaminants that are discharged to the shallow aquifer. Runoff water quality from roads and other paved surfaces can be variable and is dependent on local soil types, land use and climate. Maintaining pre-development discharge rates and volumes from developed catchments is expected to prevent the majority of contaminants from reaching the receiving environment by ensuring that the majority of flows from high-frequency events are retained or infiltrated on site.

Provided that the initial flow of more significant events is subject to the same retention and treatment received by high-frequency events, surface runoff that occurs during more significant events represents a lower risk to water quality. This is because nutrients and other contaminants that represent a threat to water quality are typically transported within the 'first flush' of an event.

Managing water quality has been divided into categories: Structural measures and non-structural measures.

### 6.2.1 Structural measures

- Use WSUD elements and best management practices (BMPs) promoting retention, infiltration and treatment of events up to the 1 year ARI events as close to the source as practical, in accordance with the *Stormwater Management Manual for Western Australia* (Department of Water, 2004- 2007).

The key WSUD element to be incorporated into the design of the development area is grassed swales, with infiltration as close to source as possible.

### 6.2.2 Non-structural measures

***Nutrient control and landscaping***

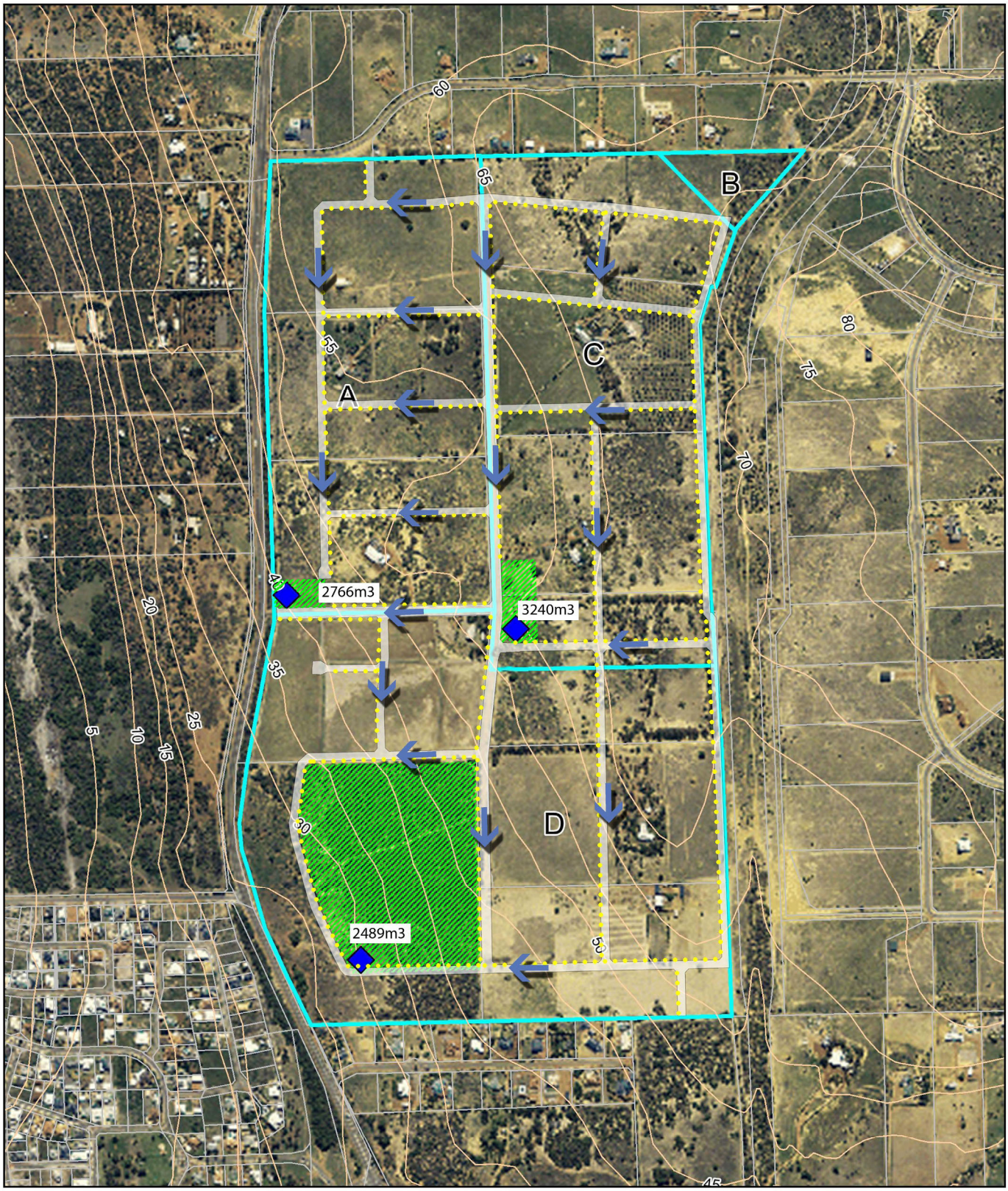
- Implement the swales relatively early to avoid temporary facilities and allow new vegetation to establish before housing construction of the developed lots is completed.

***Sediment and litter control and construction management***

- Provide an effective waste management plan for the area to ensure that litter and other waste does not collect in the compensating basins and drainage system.
- Require all development construction projects, including road and infrastructure construction, to implement sediment and erosion control measures.

- Provide suitable protection during construction to bioretention systems and other stormwater BMPs. Such measures could include the Shire imposing the requirement for silt fences to be installed around the lot and verge frontage as part of the building licence application for each individual home building. Other measures may include the use of filter barriers to drainage inlet structures, and regular sweeping of the roads.
- Ensure that drainage basins area cleared biannually to ensure functionality

There are no registered contaminated sites and no evidence of other pollutants from previous land use that need to be considered. There are no existing or proposed surface waterways or water bodies within the study area that require specific water quality management. All stormwater runoff generated over the site should be retained within the site boundaries, therefore there should be no impact on the ocean or the nearby streams.




LEGEND

Recommended Drainage Basin

Cadastre

Sub-catchments

Roadside swales

Contours (5m)

Public open space

Indicative flow

1:10,000 (at A4)

0.1 0 0.1 0.2 0.3

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 50

N

GHD

CLIENTS PEOPLE PERFORMANCE

SLIP ENABLER

Shire of Chapman Valley
Wokarena Heights Structure Plan

Job Number | 61-27523
Revision | E
Date | 15 03 2012

Recommended drainage plan

Figure10

G:\61\27523\GIS\Maps\WORS\6127523_G05_Fig9_RevE

239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au



Data source: LGate: Aerial Image, 20111201. Contours (5m), 20111201. Cadastre, 20111201. GHD: Sub-catchments, 20120301. Public open space, 20120301. Recommended drainage, 20120301

Created by: S Glasson

# 7. Groundwater Management Strategy

## 7.1 Groundwater levels

To ensure that existing groundwater levels are maintained, stormwater runoff will be infiltrated as close to the source as practical using WSUD and BMPs

The groundwater level at the site is expected to be deeper than 10 m below ground level, based on extrapolation of Department of Water data from bores located to the north and south of the site.

Groundwater monitoring should occur prior to the preparation of Urban Water Management Plans to confirm groundwater levels in the area.

## 7.2 Groundwater quality

The post-development groundwater quality is to be maintained at pre-development levels (winter concentrations) and if possible, the quality of water leaving the development area is to be improved to maintain and restore ecological systems.

To ensure that existing groundwater quality is maintained, the quality of the stormwater infiltration to groundwater will be maximised through:

- Using WSUD and BMPs to ensure that stormwater is infiltrated as close to the source as practical.

The groundwater level at the site is expected to be deeper than 10 m below ground level. Therefore the operation of ATUs and the disposal of treated wastewater on site should not adversely affect groundwater quality. Furthermore, it is unlikely that any decrease in stormwater quality will adversely affect the local superficial aquifer.

There are no mapped groundwater dependent ecosystems in the development area.

# 8. Implementation Framework

## 8.1 Monitoring plan

There are no existing or proposed waterways or water bodies onsite and all stormwater runoff generated on site is to be retained within the site boundaries. Therefore surface water monitoring is not required. If stormwater runoff is not retained on site then post development surface water monitoring of the streams to the south east and north may be required to ensure no adverse impacts.

Baseline groundwater levels and quality have been determined from existing data, the depth to groundwater is likely to be greater than 10 m, so it is unlikely that either on site wastewater disposal or stormwater infiltration will affect the local aquifer. However, groundwater monitoring should occur prior to the preparation of Urban Water Management Plans to confirm depth to groundwater in the area.

## 8.2 Next steps

The next stage of subdivision planning may require the development of Urban Water Management Plans. This will include progressing conceptual designs to detailed designs, specifically the following issues will need to be addressed within the urban water management plan:

- Demonstration that the urban water management plan will meet the objectives and criteria stated in this LWMS;
- Confirmation of groundwater levels and soil profile;
- Demonstration of compliance with regulatory requirements, including required licences and approvals;
- Determining the infrastructure requirements and land required to fit the infrastructure for detailed design, including drainage and development requirements for stormwater and shallow groundwater management;
- Detailed designs for the major/minor stormwater management system, including BMPs to achieve the water quality and quantity objectives given in this LWMS;
- Identifying floor level heights;
- Operational and maintenance responsibilities and liabilities;

It should also be noted that staging of infrastructure will be required during the development phase. Measures will need to be put in place to manage stormwater while road side swales, drainage basins and drainage channels are being constructed. These measures may include temporary sumps.

## 8.3 Roles and Responsibilities

Table 5 sets out the roles and responsibilities for the actions outlined in the LWMS for the Wokarena Heights development.

**Table 5: Roles and Responsibilities**

| Role | Responsibility | Requirement and Period |
|---|---|---|
| Urban Water Management Plan | Developer/landowner | At subdivision application. |
| Design and Construction of Drainage System | Developer | Maintain infrastructure for a minimum of 2 years after practical completion, until successful handover to Shire of Chapman Valley. |
| Non-Structural Controls:<br>*Public awareness campaigns* | Shire of Chapman Valley | Sustainability information packs, including educational information regarding non-structural control measures, such as fertiliser application, native gardens, herbicide use, weed control and waste management, to be provided at settlement. |
| Structural Control Compliance | Shire of Chapman Valley after Practical Completion | Drainage structures to be cleared biannually for a period of two years from practical completion and monitored to ensure functionality. |
| Swale and basin vegetation | Developer | Hand over to Shire Chapman Valley at Practical Completion. |
| ATUs, rainwater tanks | Shire of Chapman Valley | Ensure lots meet requirements relating to ATUs and rainwater tanks. |

# 9. References


Agriculture and Resource Management Council of Australia 2000. *National Water Quality Management Strategy – "Guidelines for Sewerage Systems – Use of Reclaimed Water, November 2000",* Canberra.

City of Geraldton-Greenough 2007. *Land Development Specifications,* Geraldton.

Department of Health 2011. *Code of Practice for the Design, Manufacture, Installation and Operation of Aerobic Treatment Units (ATUs),* Perth.

Department of Health 2011. *Country rainwater collection*, Perth.

Department of Health 2010. *Code of Practice for the Reuse of Greywater in Western Australia 2010*, Perth.

Department of Water 2007. *Stormwater Management Manual for Western Australia,* Perth.

Government of Western Australia 2007. *State Water Plan,* Perth.

Western Australian Planning Commission 1999. *Geraldton Region Plan Final*, Perth.

Western Australian Planning Commission 2004. *Statement of Planning Policy No 2.9: Water Resources Policy,* Perth.

Western Australian Planning Commission 2006. *Draft Northern Geraldton District Structure Plan*, Perth.

Western Australian Planning Commission 2008. *Better Urban Water Management,* Perth.

Western Australian Planning Commission 2008. *Shire of Chapman Valley Local Planning Strategy*, Perth (unpublished).

Western Australian Planning Commission 2011. *Greater Geraldton Structure Plan,* Perth.

Appendix A

# Local structure plan


LEGEND:

- RESIDENTIAL (R2.5)
- ROAD RESERVE (FUTURE HIGHWAY)
- PUBLIC OPEN SPACE
- LOCAL STRUCTURE PLAN AREA
- FUTURE ROAD CONNECTION
- TEMPORARY ACCESS WAY
- SUBJECT TO FUTURE DETAILED AREA PLAN (REFER TO FIGURE 13)
- (1) ROAD CONNECTION ONLY TO BE PROVIDED IF DETERMINED NECESSARY FOR VEHICLE ACCESS AT TIME OF SUBDIVISION. IF NOT REQUIRED FOR VEHICULAR PURPOSES TO BE RETAINED AS PEDESTRIAN ACCESS WAY / SERVICE ALIGNMENT.

0 60 120 180m
SCALE 1:6000 AT ORIGINAL SIZE

N

GHD
CLIENTS | PEOPLE | PERFORMANCE

Shire of Chapman Valley
Wokarena Heights Structure Plan

Local Structure Plan

Job Number 71-11105
Revision A
Date June 2012

Plan 01

11/F Alphaland Southgate Tower 2258 Chino Roces Ave corner EDSA Makati City Philippines T 63 2 479 5600 F 63 2 479 5601 E mnlmail@ghd.com W www.ghd.com

Plot Date: 26 March 2012 - 3:39 PM Plotted by: Arianne Marisse G Manandic/Manila/GHD/AU Cad File No: G:\71\11105\CADD\Drawings\Richards Road Residential\71-11105_FIG1.dwg

**GHD**

GHD House, 239 Adelaide Tce. Perth, WA 6004
P.O. Box 3106, Perth WA 6832
T: 61 8 6222 8222 F: 61 8 6222 8555 E: permail@ghd.com.au



**Document Status**

| Rev No. | Author | Reviewer | | Approved for Issue | | |
|---|---|---|---|---|---|---|
| | | Name | Signature | Name | Signature | Date |
| A | S Glasson | A Fell | On file | N Deeks | On file | |
| B | S Glasson | C Murphy | On file | N Deeks | On file | |
| 0 | S Glasson | C Murphy | | A Fell | | 9/8/12 |
| | | | | | | |

# Appendix B

## Frequently Asked Questions

**What is a structure plan?**

A structure plan is a document (incorporating reports and plans) that nominates land uses, transport and road networks, open space areas, utility networks, urban water management land requirements and development standards over an area of land.

Structure plans focus on the neighbourhood scale and provide a comprehensive land use framework for subdivision and development applications. Structure plans will show all land uses (as per the zones in the local planning scheme), residential density ranges and the neighbourhood street network. They can be prepared by local government, a landowner or landowner representative.

Structure plans are statutory documents prepared and approved under the provisions of a local planning scheme. The Wokarena Heights Structure Plan is a statutory structure plan.

**What is the purpose of a structure plan?**

A structure plan provides a guiding framework for subdivision and development. It serves to coordinate the provision of land use, community facilities (such as schools, parks and roads), services and infrastructure. Structure plans are particularly important in areas that have fragmented or multiple ownership.

A structure plan provides a comprehensive framework for land use to facilitate future subdivision and development of an area. Structure plans coordinate the provision and planning for local infrastructure and facilities and provide the general basis for subdivision which will comprise a more detailed level of planning.

**What is the structure of the Wokarena Heights Structure Plan?**

The Wokarena Heights Structure Plan includes 3 main components:

– Part One - Statutory Section,
– Part Two - Explanatory Section, and
– Appendices.

Part One sets out statutory provisions that apply to all subdivision and development within the structure plan area, and includes the structure plan map. This is the only statutory component of the structure plan.

Part Two is non-statutory. This section elaborates on the intent of Part One, and provides additional guidance and examples for the future development of Wokarena Heights.

Appendix A includes a Local Water Management Strategy for Wokarena Heights, which explains how water and stormwater is to be managed in a coordinated way. The Local Water Management Strategy provides a basis for the development of more detailed Urban Water Management Plans to be prepared by developers at the time of subdivision.

**Do I have to subdivide?**

No.

The structure plan provides the general coordinated layout for subdivision when a landowner chooses to subdivide. The structure plan does not require that the land be subdivided, but only facilitates subdivision if that is the action a landowner wishes to take.

**Can I continue running my business from my property?**

Yes.

The structure plan does not require that landowners subdivide now, in the future, or at all. Any existing and authorised business operations may continue until such time as the owner wishes to subdivide.

**Can I subdivide in stages?**

Yes.

The structure plan does not require that any lot is completely subdivided at once. Figure 22 in the structure plan document shows an example of how a lot might subdivide partially, whilst keeping a larger lot with the current dwelling and business retained. So long as a proposed subdivision generally supports the road network shown on

the plan and does not prejudice future subdivision in accordance with the structure plan, staged subdivision can be supported.

**Can I develop larger lots than the structure plan specifies, or subdivide off a portion of my lot for a family member?**

Yes.

The Structure Plan allows for any number of lots larger than 4000m2 to be subdivided, providing they are in accordance with the overall layout i.e. they do not conflict with the intended road layouts. This includes subdividing off a single larger lot for various purposes.

**What if I want to subdivide in a manner different to shown on the Structure Plan?**

The structure plan sets the framework for the coordinated subdivision of the entire Wokarena Heights area. The most important elements to ensure coordinated subdivision are road connections into neighbouring lots, the location and size of public open space, and the area of road and its impact on stormwater management (which impacts on the size of drainage basins in public open space).

Part One of the structure plan includes Figure 1 which shows these road connections and public open space areas, and subdivision should generally accord with that plan. Subdivision layouts that propose minor changes to road layouts and do not compromise road connections, public open space or impact on stormwater management could be supported. This includes adjusting road layouts to retain houses, or to increase potential lot yield.

The indicative lot layout plan included as Figure 9 in Part Two of the structure plan is not statutory and provides an example of one way that lots could be subdivided under the requirements of the structure plan. Subdivision plans do not have to present the same lot layout as presented in that plan.

Major changes that would impact on neighbouring lots, affect the distribution of public open space, or create additional stormwater runoff are unlikely to be supported as they would not be consistent with the requirements of the structure plan.

**Why do I have to provide public open space (POS)?**

State planning policy requires that subdivision of residential land in WA provides 10 percent of the subdivisional area being ceded as public open space ('POS').

**What happens if the structure plan requires me to provide more than ten percent POS? What is a POS contribution and how is it calculated?**

In the case of the Wokarena Heights Structure Plan, rather than 11 landowners providing 11 parcels of land, the 10 percent POS land allocation has been distributed on a more coordinated basis. The coordinated allocation of POS avoids 11 smaller parks of lesser future community value and meets with drainage requirements and the Department of Water and Environmental Regulation requirements pertaining to the protection of remnant vegetation upon Lot 1.

The coordinated allocation of POS throughout the Wokarena Heights area results in some landowners not having any POS identified on their lots, and other landowners being required to cede a greater area than 10 percent.

All landowners in Wokarena Road are required to contribute their equivalent 10 percent, either through land or cash-in-lieu contributions.

Landowners not ceding any land for POS, or ceding less than 10 percent of their subdivisional area, for POS are required to pay a 'cash-in-lieu' contribution for any under provision of POS.

Landowners required to cede more than 10 percent land for POS will be compensated through a cash payment at the time of subdivision for any excess area of land ceded.

The monetary contribution is based upon the unimproved valuation of the land prior to subdivision. This method for determining the value of land in cash contributions is set out in the *Planning and Development Act 2005*. Cash-in-lieu contributions are paid to the local government at the time of subdivision and held in trust for the acquisition of excess POS from other landowners in Wokarena Heights.

For example, the structure plan shows 5,200m2 of POS on Lot 3, which has a total area of 11.6123 hectares. The POS area to be ceded comprises 4.48 percent of the subdivisible area. Therefore, if the owner of Lot 3 were to

subdivide, the 10 percent POS contribution would comprise 4.48 percent land and 5.52 percent cash-in-lieu contribution.

**Why do I have to contribute to road upgrades?**

It is considered reasonable that the cost of the Richards Road upgrade and Highway intersection upgrade would be proportionately borne by subdividers as it is the act of subdivision that will generate the additional lots and with it the additional residences and vehicle trips that will impact upon Richards Road and the Highway intersection, and it is the subdivider who will financially benefit from the subdivision.

The expectation and precedent for subdividers to pay for infrastructure, where the demand and/or need is generated by subdivision, is set out in state planning policy.

**Do I have to pay POS or road contributions if I do not subdivide?**

No. Should you have no interest in subdivision then you would not make payment of a POS contribution or road upgrade contribution as they are payable only at time of subdivision.

**How are the road contributions calculated?**

Road contributions are shared across all subdividers, based on the proportionate demand/need for the infrastructure generated by the subdivision of each lot in the Wokarena Heights structure plan area.

The proportion of infrastructure costs for each lot in the Wokarena Heights Structure Plan area has been determined to exclude areas including:

– Public open space
– Subdivisional road reserves
– Land ceded for other purposes, e.g. future road reserve

In this way, the contribution is only paid for land that a subdivider can sell, therefore only that land that creates the need for the infrastructure. Figure 21 in Part Two of the Structure Plan illustrates these areas.

For example, under the structure plan, Lot 9 will generate approximately 9.9 hectares of sellable residential land (excluding area of POS and road reserves). This represents 8.9 percent of the total residential land yielded in the structure plan area. Therefore, it is expected that the subdivision of Lot 9 will result in 8.9 percent of future demand for road infrastructure upgrades, therefore the subdivider of Lot 9 will be responsible for contributing to 8.9 percent of the cost to undertake road upgrade works.

Council will obtain and publish a design for road upgrades and a cost estimate for the works to inform developers of the likely costs associated with this development item.

**Do I have to pay road contribution if I only subdivide one larger lot (e.g. 1 – 2 hectares)?**

No. Road contributions are only payable for residential subdivisions that generate the need for the road upgrades.

If only one lot is subdivided, then internal subdivision roads would not be required to be created, and service authority fees such as power connection and water connection/headworks charges would be based on creation of one additional lot (and the remaining balance lot that contains the residence would already have these services). Other fees incurred would be the costs of surveying and settlement but again these would be linked to the creation of one lot only.

**Do I have to pay road contribution if I only subdivide a smaller stage?**

Yes, however you would only pay the contribution associated with the area of land you are subdividing at that time.

**Do I have to give money to other developers if they subdivide before I do?**

No.

Developer contributions are only paid when the land is subdivided. A developer will pay their contribution to the Council as a condition of subdivision. No landowner is expected to pay any money to any other developer at any time, irrespective of when subdivision occurs (For example, road contribution would not be required for the larger ‘balance’ lot).

# Appendix C

## Bushfire Management Plan

# Bushfire management plan / statement addressing the bushfire protection criteria coversheet

Site address: Wokarena Heights, Buller

Site visit: Yes ☑ No ☐

Date of site visit (if applicable): Day 3 Month February Year 2025

Report author or reviewer: Linden Wears

WA BPAD accreditation level (please circle):

Not accredited ☐ Level 1 BAL assessor ☐ Level 2 practitioner ☐ Level 3 practitioner ☑

If accredited please provide the following.

BPAD accreditation number: 19809 Accreditation expiry: Month June Year 2026

Bushfire management plan version number: Rev 0

Bushfire management plan date: Day 22 Month August Year 2025

| If one or more of the following are selected, then these should be automatically referred to DFES | YES | NO |
|---|---|---|
| Strategic planning is required to address SPP 3.7 and the Guidelines | ☑ | ☐ |
| The application is a vulnerable land use | ☐ | ☑ |

None of the Above ☐

| If one or more of the following are selected, and the decision-maker requires input form DFES, then the application can be referred. | YES | NO |
|---|---|---|
| The BAL rating has been calculated by a method other than Method 1 as prescribed by AS 3959 | ☐ | ☑ |
| An outcomes-based approach has been submitted to demonstrate compliance with the bushfire protection criteria | ☐ | ☑ |

None of the Above ☑

**Note:** If a subdivision or development application meets all the acceptable solutions and does not otherwise trigger a referral as listed above, seeking advice from DFES on SPP 3.7 or other matters is at the discretion of the decision-maker.

The information provided within this bushfire management plan to the best of my knowledge is true and correct:

Signature of report author or reviewer 

Date 22 August 2025

# Report

## Bushfire Management Plan

LOCATION: WOKARENA HEIGHTS, BULLER, WA

CLIENT: GHD PTY LTD

Project Ref 244026/ N250079 Issue A2

20 August 2025

# DOCUMENT ISSUE APPROVAL

| | |
|---|---|
| **Project Title:** | Bushfire Management Plan |
| **Project Location:** | Wokarena Heights Structure Plan |
| **Project Address:** | Various Lots, Buller, Shire of Chapman |
| **Client:** | GHD Pty Ltd |
| **Project No:** | 244026 |
| **Report No:** | N25-0079 |
| **Issue:** | A2 |
| **Date:** | 20 August 2025 |
| | |
| **Distribution:** | Client |
| | Covey Associates |
| | |



Author:

Linden Wears
Senior Bushfire Engineer

BSc, GradDip (Fire Safety Eng.), GradDip (Bushfire Protection)
BPAD Level 3 Accredited Bushfire Practitioner

Reviewed:

Marzia Coslan
Senior Bushfire Consultant/Team Lead

BSc(Hons) of Science, Masters by Research

## *Abbreviations Used in Report*

| Abbreviation | Full Meaning |
|---|---|
| AS 3959 | AS 3959:2018 'Construction of buildings in bushfire-prone areas' |
| BAL | Bushfire Attack Level |
| BMP | Bushfire Management Plan |
| BPC | Bushfire Protection Criterion/a |
| BRMP | Bushfire Risk Management Plan |
| FFDI | Forest Fire Danger Index |
| NCC | National Construction Code (Building Code of Australia) |
| PBG | WA 'Planning for Bushfire Guidelines 2024' |
| POS | Public Open Space |
| RHF | Radiant Heat Flux |
| SCV | Shire of Chapman Valley |
| SPP | State Planning Policy |
| WAPC | Western Australia Planning Commission |

| **Supporting Documentation** | |
|---|---|
| **Document** | **Prepared by** |
| *Wokarena Heights Structure Plan Map, Project No. 12655722, Rev 0, Buller, WA (19 August 2025)* | *GHF Pty Ltd* |

# Contents

# Figures



# Tables

# 1 Introduction

## 1.1 Proposed Development

The Shire of Chapman Valley (SCV) is seeking approval for the extension of the existing Wokarena Heights Structure Plan (SP), which is set to expire in October 2025. GHD Pty Ltd previously prepared the SP which was approved in 2013, however this requires review and updating, in order to enable the application of extension of time from the Western Australia Planning Commission (WAPC).

The original SP extended over 10 existing freehold predominantly cleared rural-residential lots and one lot with remnant bushland in Buller (the project area), which is located in the Shire of Chapman Valley. The current SP (Figure 1-1) proposes the following:

- Primarily residential development (anticipates R2.5 lots);
- Several Public Open Space (POS) areas:
  - POS 1 is currently proposed as a small entrance statement to the estate off North West Coastal Highway (0.52 ha);
  - POS 2 is slightly larger area located at the intersection of Wokarena Road and Richards Road (1.06 ha); and
  - POS 3 is a large area of retained vegetation in the south-west of the Structure Plan, that will be surrounded by future residential development (12.29 ha); and
- Internal public road network.

It is noted that the SP has been partially implemented, namely with subdivision works on Lots 2 and 10, which is more clearly depicted on Figure 1-2.

## 1.2 Site description

The project area is approximately 142.8 ha in area, and is mostly cleared of vegetation, other than the remnant vegetation within the bushland lot in the south-west. As mentioned above, residential subdivision has been implemented in two lots, with the remaining lots appearing unchanged from the original SP submission.

Within the project area, there is several existing public roads, namely Wokarena Road, Richards Road, Hilltop Loop, Dune Vista, Elevation Rise, Coastal Crest and Skyline Ridge. Reticulated water supply has been extended to the subdivided lots which also have street hydrants installed.

The project area is surrounded by (see Figure 1-2):

- North West Coastal Highway to the west, with a combination of residential development, caravan park, rural residential development, and remnant vegetation further to the west;
- Eliza Shaw Drive and rural residential lots to the north;
- Unconstructed road reserve and former rail alignment to the east, with rural residential lots further to the east; and
- Primarily rural residential lots and Glassford Vista to the south with some remnant vegetation to the south-east.

Existing public road access to the project area is currently via a single connection to North West Coastal Highway to the west.

The existing town main water supply currently provided to the site extends from water supply pipework along both North West Coastal Highway and Eliza Shaw Drive.

## 1.3 Purpose

Portions of the project area are designated as bushfire prone on the *Map of Bush Fire Prone Areas* (DFES 2025; see Figure 1-3), and as such, the proposal is required to demonstrate compliance with *State Planning Policy 3.7: Bushfire* (SPP 3.7; WAPC 2024) and the *for Planning for Bushfire Guidelines* (PBG; WAPC 2024). The original SP was submitted prior to ratification of SPP 3.7 and PBG in late 2015, thus has not been previously assessed against this bushfire policy.

While the SP presents an indicative internal road and lot layout, there is flexibility for adjustment according to the development aspirations of subdividers; on this basis the proposal is required to be assessed against Bushfire Protection Criterion (BPC) 4 (Strategic Planning) of PBG. This Bushfire Management Plan (BMP) has been prepared to address requirements under Policy Measure 7(ii) of SPP 3.7 and Sections 2.2 and 4.4 of PBG including:

- An assessment of the broader landscape;
- The identification of any environmental, biodiversity or conservation values on the subject site(s):
    - Where relevant, details on how the clearing of native vegetation specifically for bushfire mitigation to achieve the bushfire protection measures, can be avoided through the use of siting and design measures; and
    - Where the clearing of native vegetation cannot be avoided, details on how the proposal will minimise the clearing are to be provided;
- A pre-development BHL assessment that demonstrates a BHL of predominantly moderate or low:
    - Where the pre-development BHL assessment results in areas with a predominantly extreme BHL, further detail should be provided on the level of native vegetation clearing that will be necessary to reduce the BHL to moderate or low;
- The identification of any bushfire hazard issues arising from the assessment; and
- Assessment against the bushfire protection criteria within BPC 4: Strategic Planning, demonstrating compliance via either the acceptable solutions, or through an outcomes-based approach.

## 1.4 Other plans/reports

There was no bushfire assessment or reporting required at the time of the SP lodgement in 2013, and as such, there was no BMP produced to accompany the SP application.

Covey are aware of a BMP that accompanied the approved Lot 10 Richard Road subdivision application, prepared by Bushfire Safety Consulting in 2023.

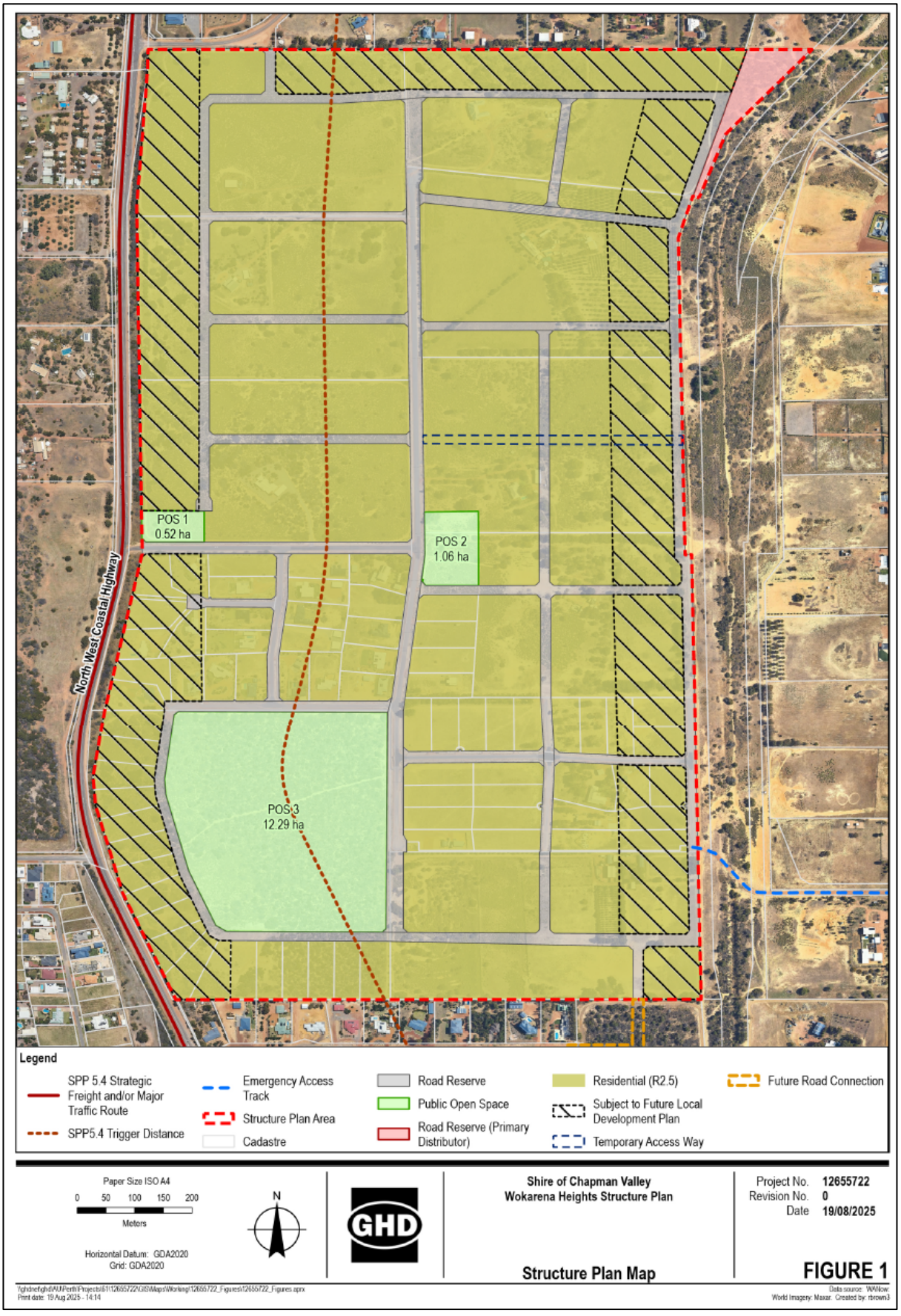



***Figure 1-1. Structure Plan***

## Figure 1-2: Site Overview

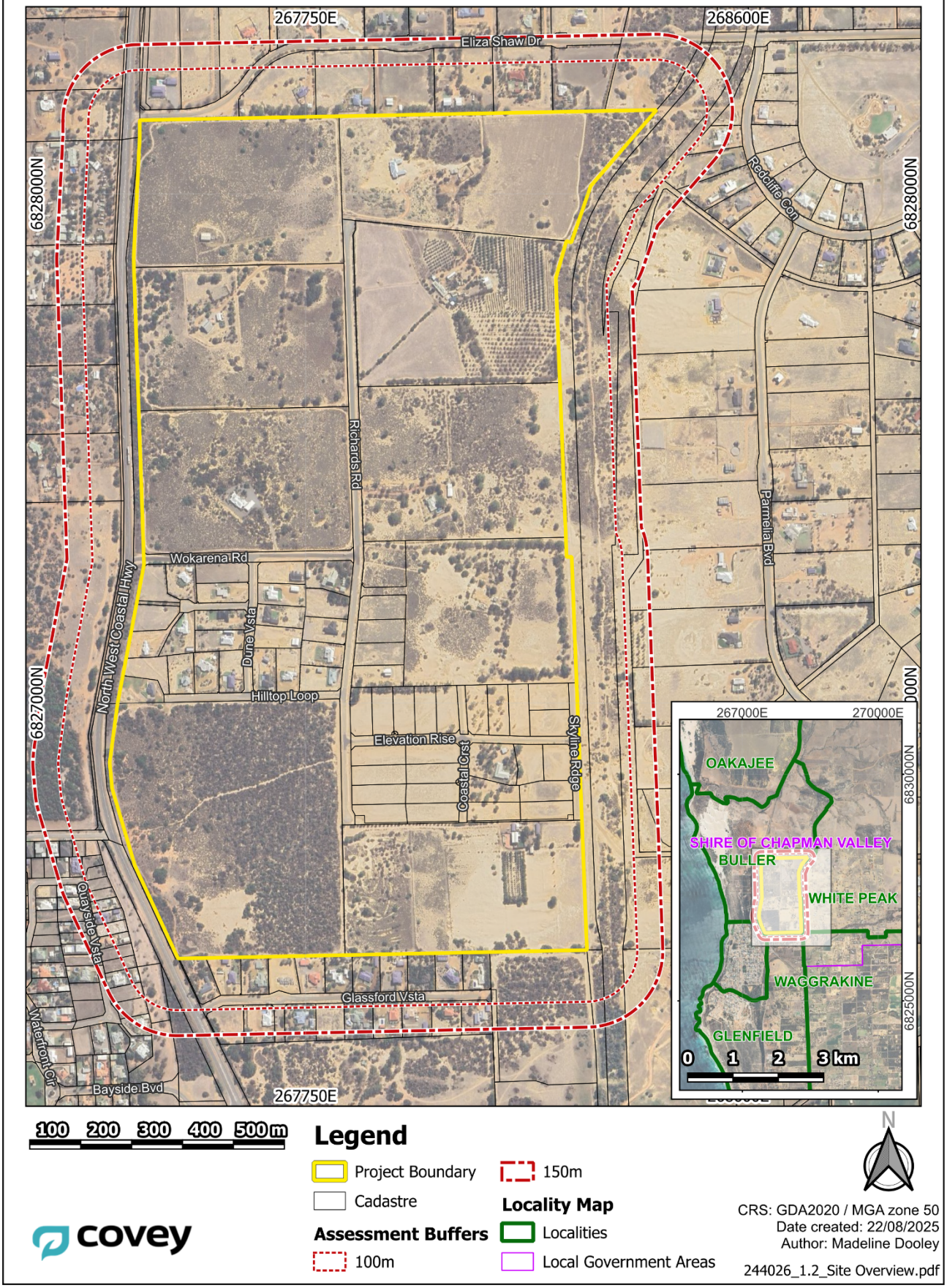
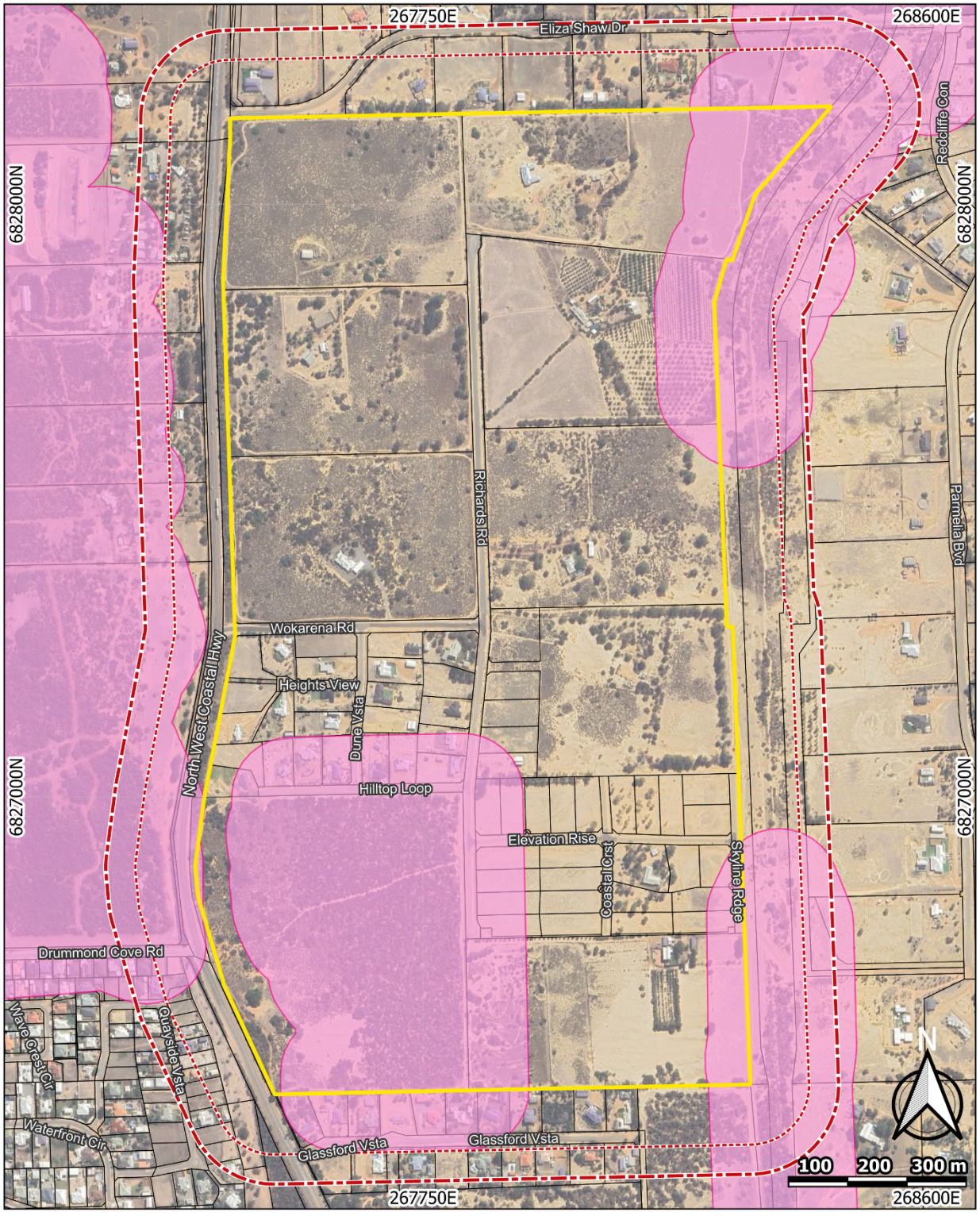



*Figure 1-2. Site overview*

## Figure 1-3: Designated Bushfire Prone Areas




**Legend**

- Bushfire Prone Area 2
- Project Boundary
- Cadastre

**Assessment Buffers**

- 100m
- 150m

CRS: GDA2020 / MGA zone 50
Date created: 22/08/2025
Author: Madeline Dooley

244026_1.3_Designated Bushfire Prone Areas.pdf

*Figure 1-3. Map of designated Bushfire Prone Areas*

# 2 Environmental Considerations

## 2.1 Native vegetation - modification and clearing

The project area has been cleared of most native vegetation for previous land uses, however it is expected that the site will require further clearing to accommodate development as part of future planning applications. Table 1 provides a summary of a search of publicly available environmental data.

Covey assumes that all relevant environmental and aboriginal heritage studies will be undertaken to support the project, and if any State and Federal environmental referrals and approvals are required, they will be sought prior to commencing on-site vegetation modification or clearing required to construct the development.

***Table 1: Summary of environmental values***

| Environmental value | Not mapped within/ adjacent to the project area | Mapped as occurring within or adjacent to the project area | | Description |
|---|---|---|---|---|
| | | Within | Adjacent | |
| Environmentally Sensitive Area | ✓ | | | No part of project area/adjacent land identified as being an Environmentally Sensitive Area. |
| Swan Bioplan Regionally Significant Natural Area | ✓ | | | No Regionally Significant Natural Areas were identified. |
| Ecological linkages | ✓(?) | | | This information is unavailable as the time of this BMP however Covey are not aware of any ecological linkages being identified. |
| Wetlands | ✓ | | | No wetlands are mapped as occurring within or adjacent to the project area |
| Waterways | ✓ | | | No waterways are mapped within the project area or in adjacent land. |
| Threatened Ecological Communities listed under the EPBC Act | | ✓(?) | ✓(?) | This layer is currently publicly available at a very coarse level and while no Threatened Ecological Communities are mapped in or near the project area, there are Priority Ecological Communities are mapped within and adjacent to project area. |
| Threatened and priority flora | | X | ✓(?) | This layer is currently publicly available at a very coarse level, and while no Threatened and Priority Flora are mapped as occurring within the project area, they are mapped close to the eastern boundary. |
| Fauna habitat listed under the EPBC Act | ✓ | | | No fauna habitat was mapped as occurring within or adjacent to the project area |

| Environmental value | Not mapped within/ adjacent to the project area | Mapped as occurring within or adjacent to the project area | | Description |
|---|---|---|---|---|
| | | Within | Adjacent | |
| Threatened and priority fauna | ✓ | | | This layer is currently publicly available at a very coarse level, and there are no Threatened and Priority Fauna are mapped as occurring within or adjacent to the project area, with the nearest being approximately 2 km to the south-east. |
| Bush Forever Site | ✓ | | | No Bush Forever Area is mapped as occurring within or adjacent to the project area. |
| DBCA managed lands and waters (includes legislated lands and waters and lands of interest) | ✓ | | | No DBCA managed lands and waters is mapped as occurring within or adjacent to the project area, with the nearest being Wokatherra Nature Reserve approximately 1.2 km to the north-east. |
| Conservation covenants | ✓ | | | No information has been provided by the client regarding Conservation Covenants. |
| Crown Reserves | | ✓ | ✓ | Crown Reserve 53711 ('Richard Pym Park' – a vacant, cleared 0.8 ha lot under SCV management/identified for future recreational development) is mapped as occurring within the project area.<br>Crown Reserve R27663 (former rail alignment removed in 1957) is mapped immediately east of the site with the interest holder being Main Roads WA, likely for future road. |
| Aboriginal Heritage | | X | ✓ | No Aboriginal Heritage Places mapped as occurring within the project area but Heritage Places are identified to the north-east of the site. |

## 2.2 Revegetation / Landscape Plans

No revegetation is currently being proposed within the project area however it is noted that this is not yet finalised.

Although the project area is currently mostly cleared of native vegetation, almost all remaining vegetation is expected to be cleared as part of future development, other than within POS 3 in the south-west. Any required Asset Protection Zones (APZs) are to be either non-vegetated elements or landscaped in accordance with APZ Standards of PBG (refer to Appendix A). All other future onsite landscaping is to comply with the requirements of Australian Standards (AS) 3959:2018 'Construction of buildings in bushfire prone areas' (AS 3959; Standards Australia 2018) Clause 2.2.3.2 (e) and (f) (refer to Appendix B) and align with the principles of APZ Standards.

# 3 Bushfire assessment

For strategic planning where the lot layout is still to be finalised, the following bushfire assessment tools are required to be utilised:

1. ***Broader Landscape Assessment (BLA)*** – given the project area within an area designated as Area 2 on the Map of Bushfire Prone Areas (see Section 1.3), it will require an assessment of the broader landscape to demonstrate compliance with Element 1: Location; and
2. ***Bushfire Hazard Level (BHL)*** Map - is required in accordance with Appendix A.2 of PBG.

## 3.1 Broader Landscape Assessment

As Element 1 has not been approved at previous planning stages under SPP 3.7 and PBG and given portions of the project area are designated as Area 2, the proposal requires an assessment of the broader landscape.

The intent of the Broader Landscape Assessment (BLA) is to examine the landscape external to the planning proposal, to develop an understanding of the wider bushfire hazards and potential for landscape-scale bushfire behaviour, in addition to the broader road network, and proximity to townsites, urban areas and suitable destinations. Examination of the broader landscape provides important contextual information when considering whether a site is suitable for intensification of land use or development.

The outputs of the BLA are used to demonstrate compliance with Element 1: Location of Bushfire Protection Criteria 4 (BPC4).

### 3.1.1 Broader Landscape Assessment area

The BLA area extends to 2 km from the project area boundary, as required by PBG.

An overview of the BLA assessment area is depicted on Figure 3-1, in addition to the broader vehicular access network and extent of designated bushfire prone land, to serve as a wider context plan. Figure 3-1 is useful for identifying suitable destinations that could be used in a bushfire emergency, with the closest ones to the project area being:

- Drummond Cove and Glenfield residential areas (approximately 4 km south);
- Geraldton townsite and residential areas (approximately 10 km south); and
- Northampton townsite (approximately 37 km north) – not shown on Figure 3-1.

### 3.1.2 Assessment of the Broader Landscape

#### *3.1.2.1 Vegetation types*

A desktop assessment has been undertaken within the BLA area to distinguish between different vegetation types, which is depicted on Figure 3-2. The vegetation types have been divided into three broad categories:

- ***Low threat vegetation and non-vegetated areas*** (in accordance with exclusions under Clause 2.2.3.2 of AS 3959) including:
  - Existing residential and commercial land uses;
  - Existing developed portions of rural residential lots;
  - Existing roads; and
  - Non-vegetated beaches, ocean and waterways

- ***Unmanaged grassland*** (Class G Grassland); and
- ***All other types of classified vegetation*** (as a single category) primarily including shrubland, scrub and woodland vegetation within lots not previously cleared and used for agricultural or grazing purposes.

In addition to the vegetation mapping, Figure 3-2 has been overlain with four map aspects (north-east, south-east, north-west and south-west) which are used to quantify the bushfire hazards present within the BLA area. Mapping of the quadrants will assist in determining whether the bushfire hazards in a particular direction have potential to exhibit landscape-scale bushfire behaviour and impact life, property and infrastructure assets.

#### *3.1.2.2 Predominant vegetation patterns*

The predominant vegetation patterns have been identified within the BLA area based on the vegetation types assigned above. The following vegetation patterns have been identified:

- ***Cleared vegetation*** (e.g. residential or urban zoned and developed land), including:
  - Non-vegetated areas and low threat vegetation in residential or commercial lots, and on the developed portions of rural residential lots; and
  - Non-vegetated beaches, ocean and waterways;
- ***A mosaic pattern of vegetation*** (including Class G Grassland, and vegetation within rural living precincts) including:
  - The 'unmanaged grassland' extent depicted on the vegetation hazard mapping; and
  - Areas of other classified vegetation on the undeveloped portions of rural residential lots; and
- ***Large tracts of classified vegetation*** (e.g. contiguous vegetation within reserves or national parks) including:
  - Proposed POS 3 area in south-west of project area;
  - Continuous vegetation to the west of North West Coastal Highway; and
  - Isolated larger plots on the perimeter of the 2 km assessment area to the south, south-east, north-east and north-west of the site.

The predominant vegetation pattern mapping is depicted on Figure 3-3.

#### *3.1.2.3 Road patterns and suitable destinations*

The road hierarchy and road patterns is depicted on Figure 3-4, which also notes the proximity of suitable destinations to the project area (which is also visible on Figure 3-1).

#### *3.1.2.4 Summary of the Broader Landscape Assessment*

Table 2 provides a summary of the BLA for each of the four identified map aspects.

### 3.1.3 Determination of the Broader Landscape Type

The broader landscape type (BLT) is determined using the points-based system detailed in Table 3. With an assessed total of 8 points, the BLT applicable to the proposed development is **BLT A**.

***Table 2: Broader Landscape Assessment Table***

| Quadrant | North-west | North-east | South-east | South-west |
|---|---|---|---|---|
| Vegetation Type | • Combination of grassland and all other vegetation types<br>• Substantial non-vegetated areas formed by ocean and sand blowout | • Primarily combination of non-vegetated/low threat and grassland within rural residential lots near the project area<br>• Areas of all other vegetation types mostly on perimeter of assessment area. | • Primarily combination of non-vegetated/low threat and grassland within rural residential lots near the project area<br>• Areas of all other vegetation types mostly toward the perimeter of assessment area, with some isolated plots within unconstructed road reserve on western SP boundary, and along waterway 500 m from SP. | • Primarily non-vegetated land within existing residential development, and the ocean.<br>• A significant area of all other vegetation types within south-west corner of SP site, with another area west of North West Coastal Highway. |
| Vegetation Pattern | • Existing plot of classified vegetation west of North West Coastal Highway capable of fire runs up to 700 m long through low scrub vegetation.<br>• Only other large tracts of classified vegetation occur 1.5 km from the site.<br>• Remainder of land in this direction is either cleared (ocean, sand blowout or existing development) or mosaic vegetation within rural residential lots or fragmented non-grassland vegetation | • Almost all land in this direction is either cleared (existing development) or mosaic vegetation within rural residential lots or fragmented non-grassland vegetation<br>• There are two plots of other classified vegetation further from the SP site; one to the north about 700 m away and one to the north-east about 1.3 km away. | • Almost all land in this direction is either cleared (existing development) or mosaic vegetation within rural residential lots or fragmented non-grassland vegetation<br>• Plots of other classified vegetation occur further from the SP site, between 1 km to 1.3 km away. | • Primarily cleared land<br>• Plot of classified vegetation to be retained within POS 3, which has moderate fire runs of up to 600 m through scrub vegetation<br>• Existing plot of classified vegetation west of North West Coastal Highway capable of fire runs up to 600 m long through scrub vegetation.<br>• Only other large tracts of classified vegetation occur 1 km from the site. |
| Landscape-scale bushfire risk | • Limited risk<br>• While there is some exposure to large tracts of classified vegetation from this direction, especially from west, the fire runs are constrained by the ocean and sand blowout, and the vegetation is low scrub vegetation. | • Limited risk<br>• Given the large tracts of classified vegetation are some distance from the SP site, it is most likely that fire impact on the project area would be from fully developed grassfire. | • Limited risk<br>• Given the large tracts of classified vegetation are some distance from the SP site, it is most likely that fire impact on the project area would be from fully developed grassfire. | • Limited risk<br>• While there is some exposure to large tracts of classified vegetation from this direction, especially from POS 3 in the south-west, the fire runs are constrained by existing residential development, and the vegetation is low scrub vegetation. It is also noted that the SP will eventually create a ring road around POS 3, which will disconnect and isolated it from the surrounding landscape. |
| Road Network/Access to Suitable Destination | • A bushfire from the north-west would likely result in residents evacuating south to Drummond Cove/Glenfield residential area, or further south to Geraldton townsite<br>• Access and egress via North West Coastal Highway would be used to travel to these suitable destinations. | • A bushfire from the north-east would likely result in residents evacuating south to Drummond Cove/Glenfield residential area, or further south to Geraldton townsite<br>• Access and egress via North West Coastal Highway would be used to travel to these suitable destinations. | • A bushfire from the south-east would likely result in residents evacuating south to Drummond Cove/Glenfield residential area, or further south to Geraldton townsite. If this was unsafe to conduct, northerly travel to Northampton could be undertaken<br>• Access and egress via North West Coastal Highway would be used to travel to these suitable destinations. | • In the unlikely scenario a bushfire approached from the south-west, northerly evacuation to Northampton could be undertaken.<br>• Access and egress via North West Coastal Highway would be used to travel to that suitable destination. |

***Table 3: Broader Landscape Type determination table***

| BLA Criteria | 5 points | 2 points | 1 point | Assessed Points | Comments |
|---|---|---|---|---|---|
| Proximity of the planning proposal to a suitable destination is: | >10 km | 1 – 10 km | <1 km | **2 points** | Suitable destinations would be available at either Drummond Cove/Glenfield residential area, or further south to Geraldton townsite.<br>Distance from the SP area for both destinations is 1-10k m. |
| The road pattern from the planning proposal to a suitable destination is: | Complex and indirect (cul-de-sacs, and/or multiple intersections) | Mixed road patterns | Simple and/or direct (limited intersections) | **2 points** | While there are some cul-de-sacs and several intersections, the overall road pattern is mostly simple and once at North West Coastal Highway, travel is via Primary Regional Road to the suitable destinations, with travel to the south also noted to be predominantly through residential land.<br>Given the above, the roads are assessed as a mixed road pattern, although this is considered conservative. |
| The predominant vegetation pattern is: | Large tracts of vegetation (contiguous vegetation) | A mosaic pattern of vegetation (e.g. vegetation within rural living precincts) | Cleared vegetation (e.g. clearing for residential zoned urban lots) | **2 points** | The site is largely surrounded by residential and rural residential land uses, where the vegetation is mostly Class G grassland within rural residential lots. There are plots of shrubland/scrub (not Class G) especially to west of North West Coastal Highway, and larger plots o non-grassland to the north. Overall, the predominant vegetation pattern is assessed as mosaic. |
| Exposure of the planning proposal to an identified external bushfire hazard (excluding Class G Grassland) is from: | Three or four aspects | Two aspects | From nil or one aspect only | **2 points** | The exposure of the project area to external bushfire hazard (capable of landscape-scale bushfire), is considered relatively limited, however there is continuous vegetation to the west of North West Coastal Highway that could produce elevated bushfire behaviour. Generally, the predominant vegetation is Class G grassland interfaces to the north and east, with a mixture of grass/shrubland/scrub to the south, with shrubland/scrub vegetation to the west.<br>Given the above, the exposure to bushfire hazard is conservatively assessed as two aspects, noting that this is conservative as there is limited risk of landscape-scale bushfire in this location. |
| **Total Points** | | | | **8 points** | |
| **Broader Landscape Type (Type A is <12 points; Type B is >12 points)** | | | | **BLT A** | |

## Figure 3-1: BLA Context Plan

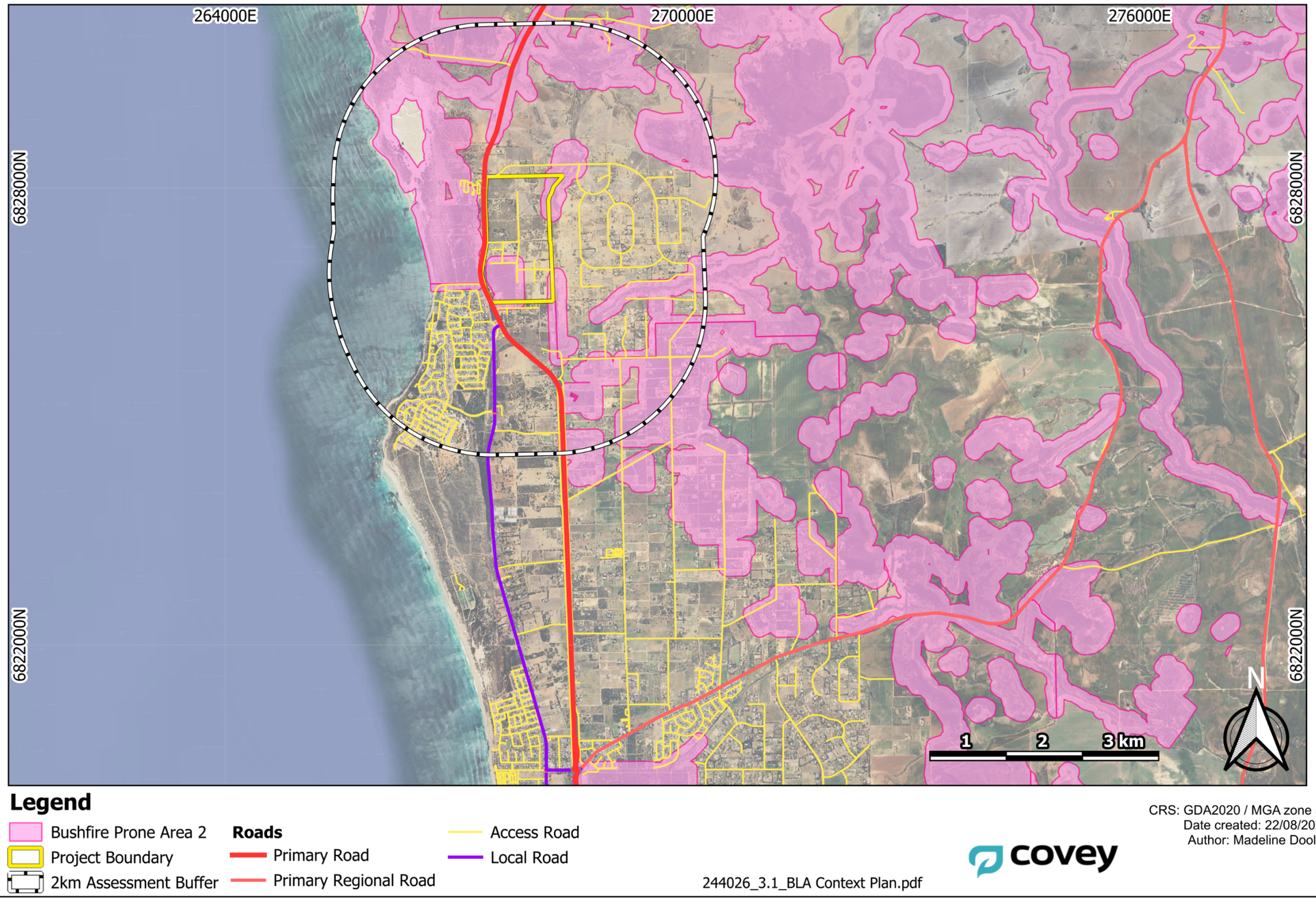



***Figure 3-1. BLA context map***

## Figure 3-2: BLA Vegetation Type and Aspect Assessment

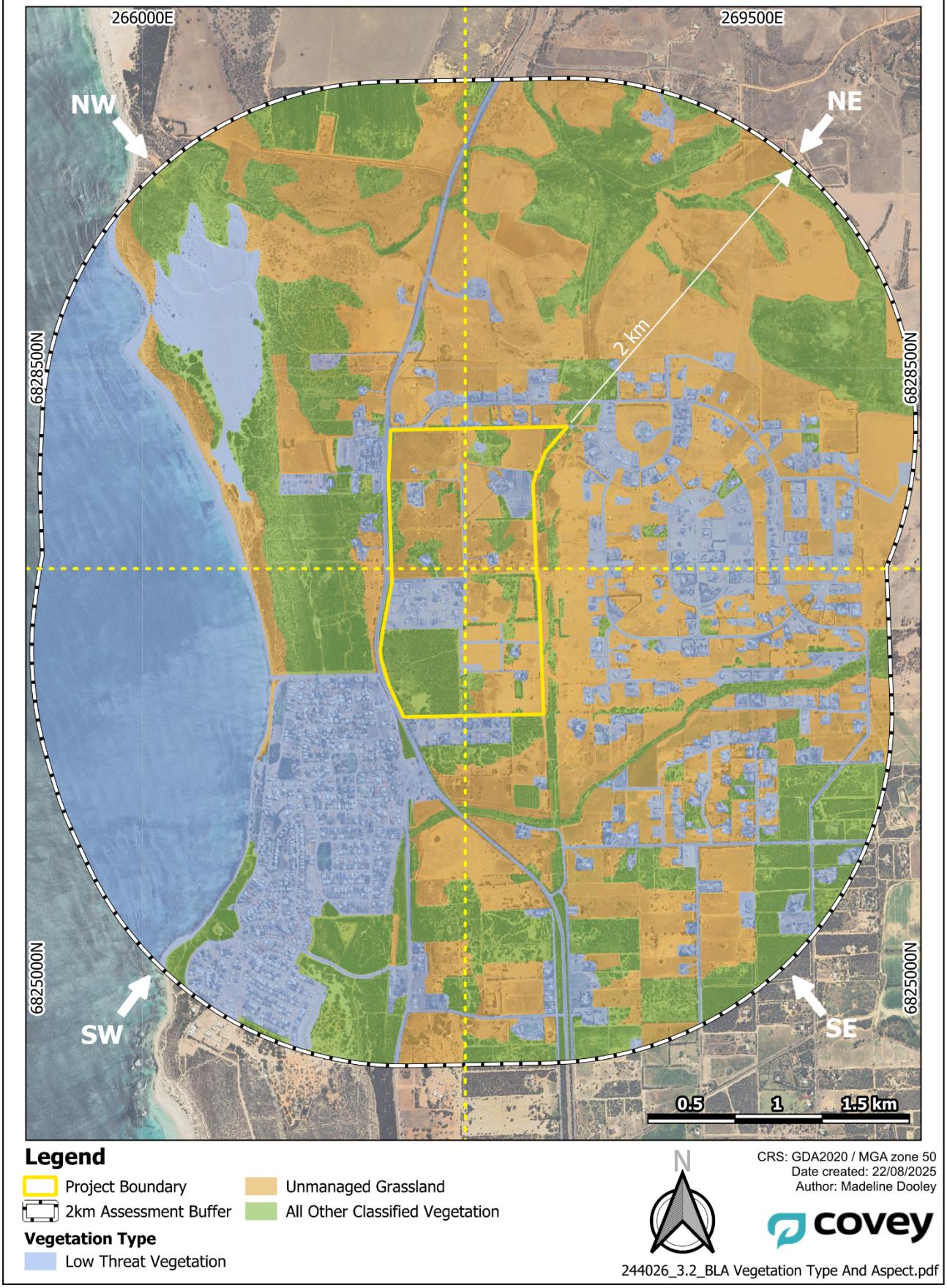



*Figure 3-2. BLA vegetation type and aspect assessment*

## Figure 3-3: BLA Predominant Vegetation Pattern

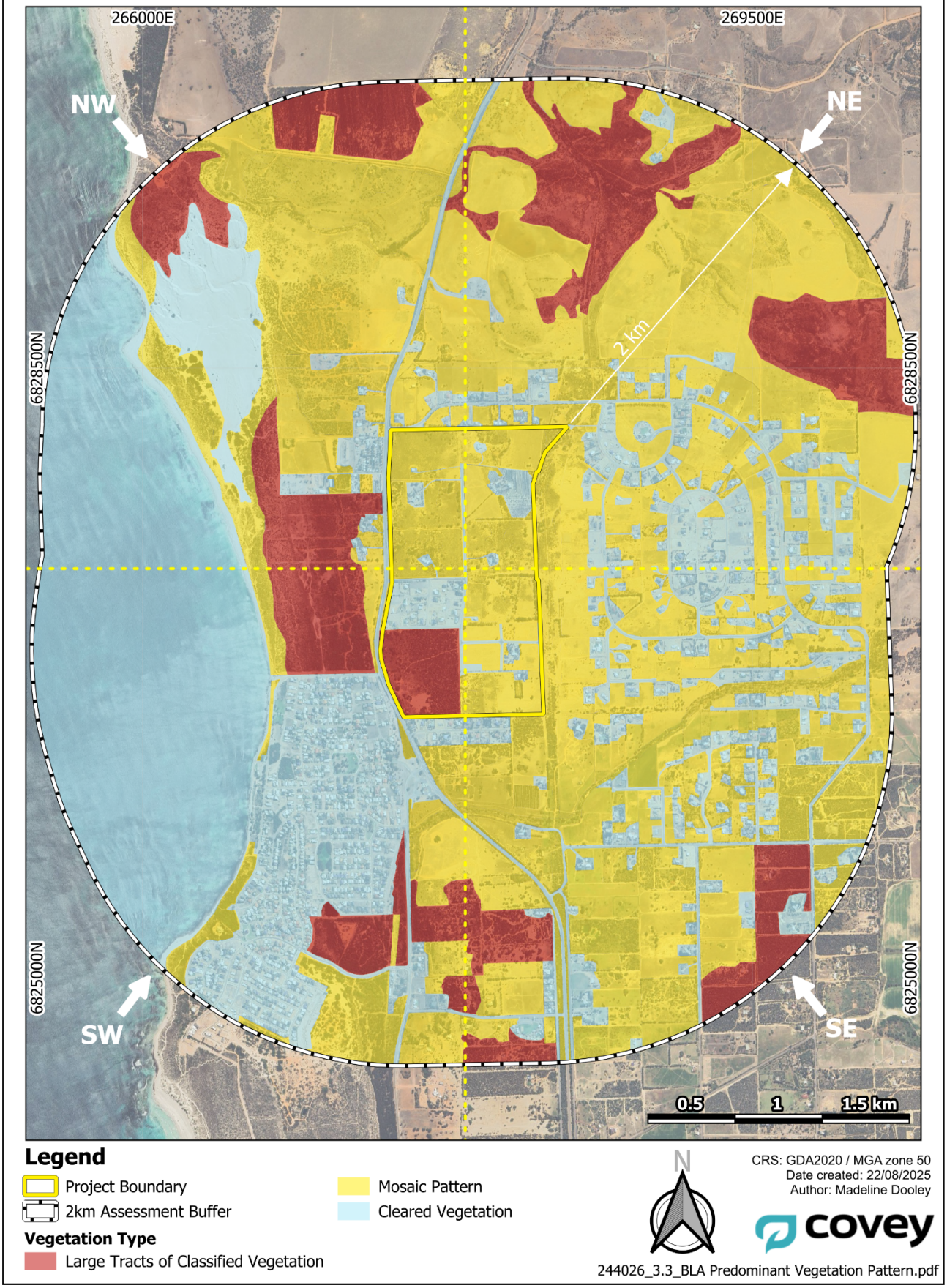



***Figure 3-3. BLA predominant vegetation pattern***

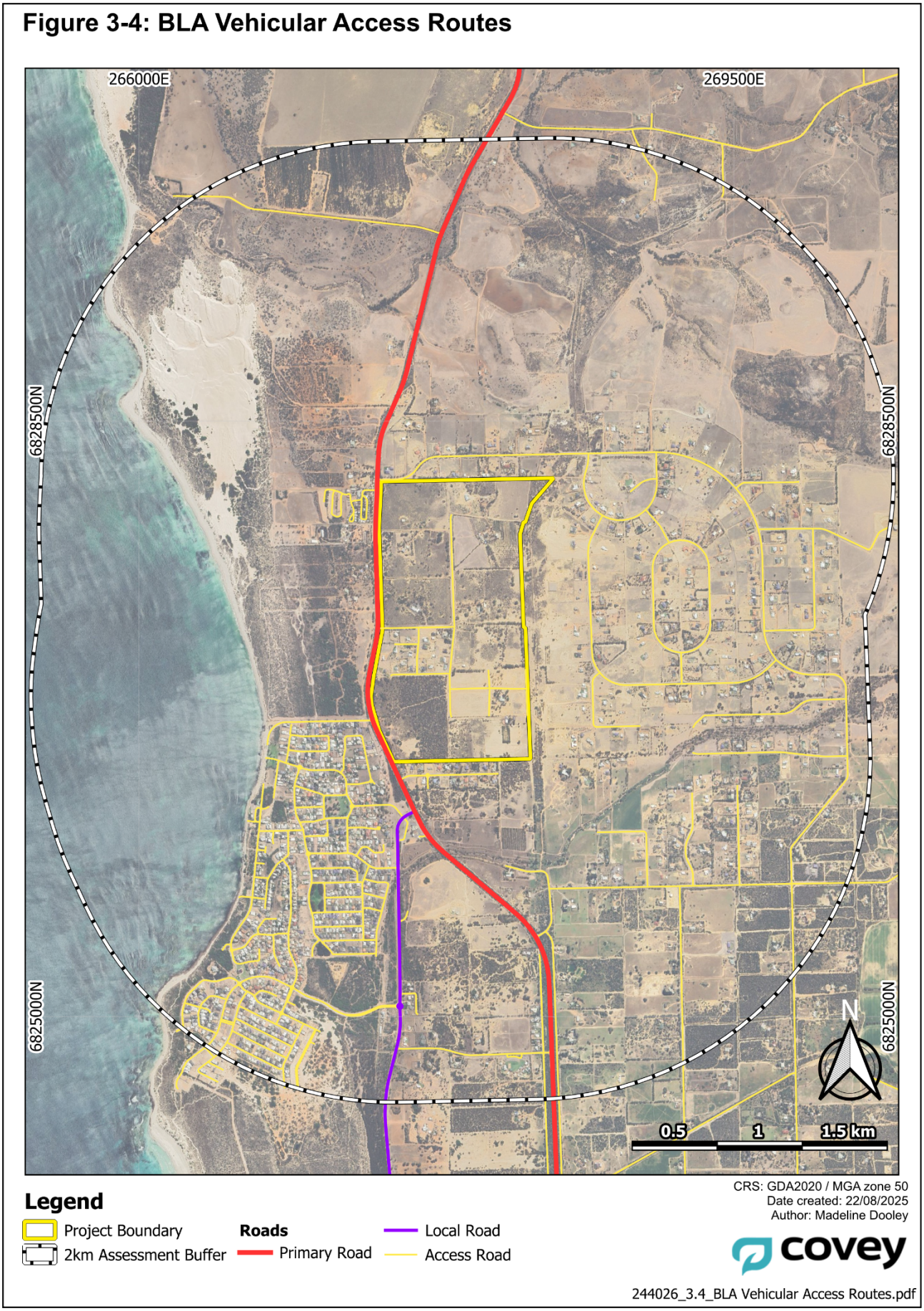



*Figure 3-4. BLA Vehicular access routes*

## 3.2 Bushfire Hazard Level Assessment

### 3.2.1 Vegetation classification

Covey assessed classified vegetation and exclusions within 150 m of the subject site through on-ground verification, conducted on 3 February 2025 in accordance with AS 3959 and the 'Visual Guide for Bushfire Risk Assessment in Western Australia' (WA Department of Planning 2016).

Georeferenced site photos and a description of the vegetation classifications and exclusions are contained in Appendix C and:

- Pre-development vegetation is summarised on Table 4 and depicted on Figure 3-5l and
- Post-development vegetation is summarised on Table 5 and depicted on Figure 3-6.

The assessed classified vegetation types that are expected to remain following development works are as follows:

- Glass G Grassland;
- Class C Shrubland;
- Class D Scrub; and
- Class B Woodland.

A summary of the assessed exclusions is as follows:

- Clause 2.2.3.2 (a) plots of unmanaged vegetation further than 100 m from the project area;
- Clause 2.2.3.2 (e) areas of non-vegetated land such as land cleared for existing and proposed roads, infrastructure and buildings; and
- Clause 2.2.3.2 (f) land managed in a minimal fuel low threat condition, such as road verges, managed gardens and lawns including the managed POS areas.

Other exclusions that may be relevant for future development are as follows:

- Clause 2.2.3.2 (c) isolated plots of unmanaged vegetation, that will be less than 0.25 ha and will be located so it is further than 20 m from any proposed lots or any other classified vegetation; and
- Clause 2.2.3.2 (d) isolated plots of unmanaged vegetation, that will be less than 20 m wide and will be located so it is further than 20 m from any proposed lots or any other classified vegetation

Exclusions under Clauses 2.2.3.2 (e) and (f) used for all non-vegetated elements and managed vegetation proposed as part of the development, with Clauses 2.2.3.2 (c) and (d) potentially used to exclude vegetation associated with small plots of unmanaged vegetation such as future drainage areas, if possible.

### 3.2.2 Effective Slope

Covey assessed effective slope under classified vegetation through on-ground verification on 3 February 2025 in accordance with AS 3959. Results were cross-referenced with Landgate 5 m contour data depicted on Figure 3-5 and Figure 3-6 and are summarised in Table 4 and Table 5.

Site observations indicate that land is elevated to the east and descends through the subject site to the west closer to the coast, resulting in classified vegetation having an assessed effective slope of downslope 0° – 5°.

### 3.2.3 Pre-Development BHL Assessment Inputs

A summary of the assessed pre-development classified vegetation, exclusions and effective slope within the project area and the adjacent 150 m, as it currently presents, are listed in Table 4 and illustrated in Figure 3-5.

***Table 4: Pre-development vegetation classifications/exclusions and effective slope***

| Plot | Vegetation classification | Effective slope | Comments |
|---|---|---|---|
| 1 | Class G Grassland | Downslope >0–5° | Unmanaged grass >100 mm high within the project area, occasionally with scattered shrubs or trees. |
| 2 | Class C Shrubland | Downslope >0–5° | Shrub vegetation (<2 m high) within the project area. |
| 3 | Class D Scrub | Downslope >0–5° | Scrub vegetation that is >2 m but <6 m high within the project area. |
| 4 | Class B Woodland | Downslope >0–5° | Mature trees with minimal understorey, within the project area. |
| 5 | Class G Grassland | Downslope >0–5° | Unmanaged grass >100 mm high outside the project area, occasionally with scattered shrubs or trees. |
| 6 | Class D Scrub | Downslope >0–5° | Scrub vegetation that is >2 m but <6 m high outside the project area. |
| 7 | Class B Woodland | Downslope >0–5° | Mature trees with minimal understorey, outside the project area. |
| 8 | Excluded – Clause 2.2.3.2 [a] | N/A | Classified vegetation further than 100 m from the project area. |
| 9 | Excluded – Non-vegetated (Clause 2.2.3.2 [e]) | N/A | Non-vegetated firebreak around large plot of scrub vegetation, in the south-west corner of the project area. |
| 10 | Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f]) | N/A | Existing non-vegetated elements (roads, paths, buildings) and low threat vegetation (managed gardens, maintained lawn) within the project area. |
| 11 | Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f]) | N/A | Existing non-vegetated elements (roads, paths, buildings) and low threat vegetation (managed gardens, maintained lawn) outside the project area |

### 3.2.4 Post-Development BHL Assessment Inputs

A summary of the potential post-development classified vegetation, exclusions and effective slope within the project area, and the adjacent 150 m, is contained in Table 5 and illustrated on Figure 3-6.

The post-development vegetation classifications for all land external to the project area has remained the same as for the pre-development classifications. If external vegetation is altered prior to future planning stages, the change in vegetation condition is to be captured through a future BHL assessment or BAL contour map assessment.

Within the project area, the BMP assumes that there will be no onsite vegetation retention following construction of future development, internal roads and infrastructure, other than POS 3. Should any vegetation retention or revegetation be proposed as part of future development or should proposed drainage swales or basins be unable to be excluded from classification, it is expected that sufficient separation will need to be provided as part of future planning so that any BAL impact on habitable buildings is limited to BAL-29 or lower and captured through a future BHL assessment or BAL contour map assessment.

***Table 5: Post-development vegetation classifications/exclusions and effective slope***

| Vegetation plot | Vegetation classification | Effective slope | Comments |
|---|---|---|---|
| 1 | Class G Grassland | Downslope >0–5° | Assumed to be modified to Plot 12 as part of future development. |
| 2 | Class C Shrubland | Downslope >0–5° | Assumed to be modified to Plot 12 as part of future development. |
| 3 | Class D Scrub | Downslope >0–5° | Scrub vegetation that is >2 m but <6 m high within the project area.<br>Most is assumed to be modified to Plot 12, other than large plot within proposed POS in the south-west of the project area. |
| 4 | Class B Woodland | Downslope >0–5° | Assumed to be modified to Plot 12 as part of future development. |
| 5 | Class G Grassland | Downslope >0–5° | Unmanaged grass >100 mm high outside the project area, occasionally with scattered shrubs or trees. |
| 6 | Class D Scrub | Downslope >0–5° | Scrub vegetation that is >2 m but <6 m high outside the project area. |
| 7 | Class B Woodland | Downslope >0–5° | Mature trees with minimal understorey, outside the project area. |
| 8 | Excluded – Clause 2.2.3.2 [a] | N/A | Classified vegetation further than 100 m from the project area. |
| 9 | Excluded – Non-vegetated (Clause 2.2.3.2 [e]) | N/A | Non-vegetated firebreak around large plot of scrub vegetation, in the south-west corner of the project area. |
| 10 | Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f]) | N/A | Existing non-vegetated elements (roads, paths, buildings) and low threat vegetation (managed gardens, maintained lawn) within the project area. |
| 11 | Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f]) | N/A | Existing non-vegetated elements (roads, paths, buildings) and low threat vegetation (managed gardens, maintained lawn) outside the project area |
| 12 | Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f]) | N/A | Land to be modified to non-vegetated elements and low threat vegetation (managed gardens, maintained lawn, managed POS) as part of future development. |

### 3.2.5 BHL Assessment Methodology

Pre- and post-development vegetation extents have been assigned a bushfire hazard level in accordance with the methodology detailed in Appendix Two of PBG, which is reproduced below in Table 6.

***Table 6: Bushfire hazard levels and characteristics***

| Bushfire hazard level | Characteristics* |
|---|---|
| Extreme | • Class A Forest<br>• Class B Woodland<br>• Class D Scrub<br>• Any classified vegetation with a greater than 10° slope. |
| Moderate | • Class C Shrubland<br>• Class E Mallee/Mulga<br>• Class G Grassland, including sown pasture and crops<br>• Vegetation that has a low hazard level but is within 100 metres of vegetation classified as a moderate or extreme hazard, is to adopt a moderate hazard level. |
| Low | • Low threat vegetation, which may include mangroves and other saline wetlands, areas of maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks.<br>• Managed grassland in a minimal fuel condition, meaning there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example, short-cropped grass to a nominal height of 100 millimetres.<br>• Non-vegetated areas, waterways, exposed beaches, roads, footpaths, buildings or rock outcrops. |
| **Vegetation classifications from AS 3959* | |

#### *3.2.5.1 Pre-development BHL assessment*

Covey has mapped the pre-development bushfire hazard levels within the project area and adjacent 150 m wide assessment area. The bushfire hazard levels have been assessed on the basis of the vegetation discussed in Section 3.2.3 (i.e. the current pre-development extent of vegetation within, and surrounding, the project area).

The pre-development BHL assessment (see Figure 3-7) show that based on the existing vegetation, the project area contains land with ***Low, Moderate and Extreme*** bushfire hazard levels.

#### *3.2.5.2 Post-development BHL assessment*

Covey has mapped the potential post-development bushfire hazard levels to demonstrate that the future bushfire hazard levels will be acceptable for future development to occur within the project area. The bushfire hazard levels have been assigned on the basis of the vegetation discussed in Section 0 and the future expected vegetation extent within and surrounding the project area.

The post-development BHL assessment (see Figure 3-8) demonstrate that all future habitable development (i.e. land likely to contain habitable buildings) will be located on land with ***Low and Moderate*** bushfire hazard levels.

It is also noted that construction of a road alignment along Crown Reserve 27663 (which runs along the eastern boundary of the SP area) would further mitigate bushfire hazard levels in that area.

## Figure 3-5: Pre-development Vegetation and Effective Slope

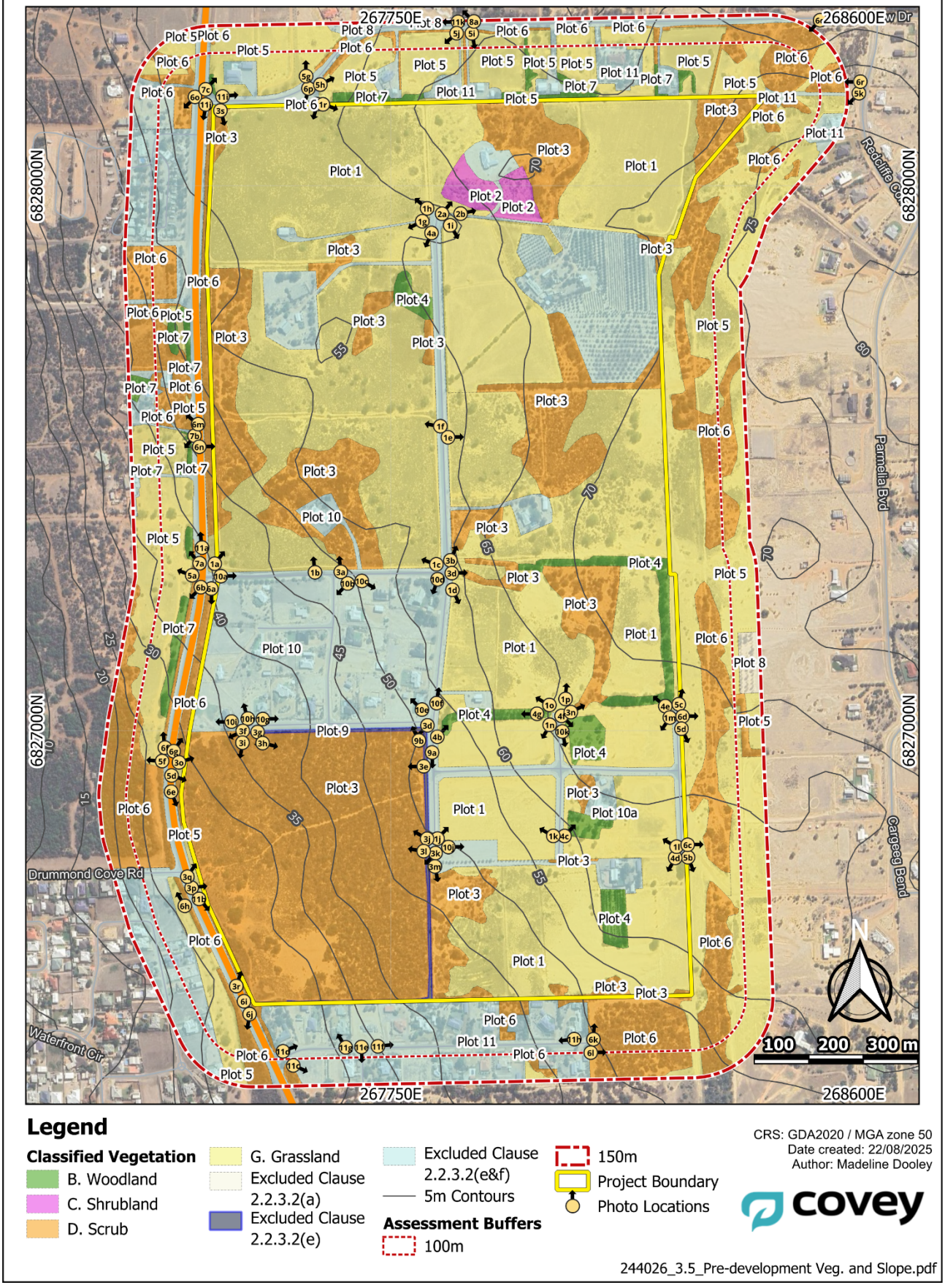



***Figure 3-5. Pre-development vegetation and effective slope***

## Figure 3-6: Post-development Vegetation and Effective Slope

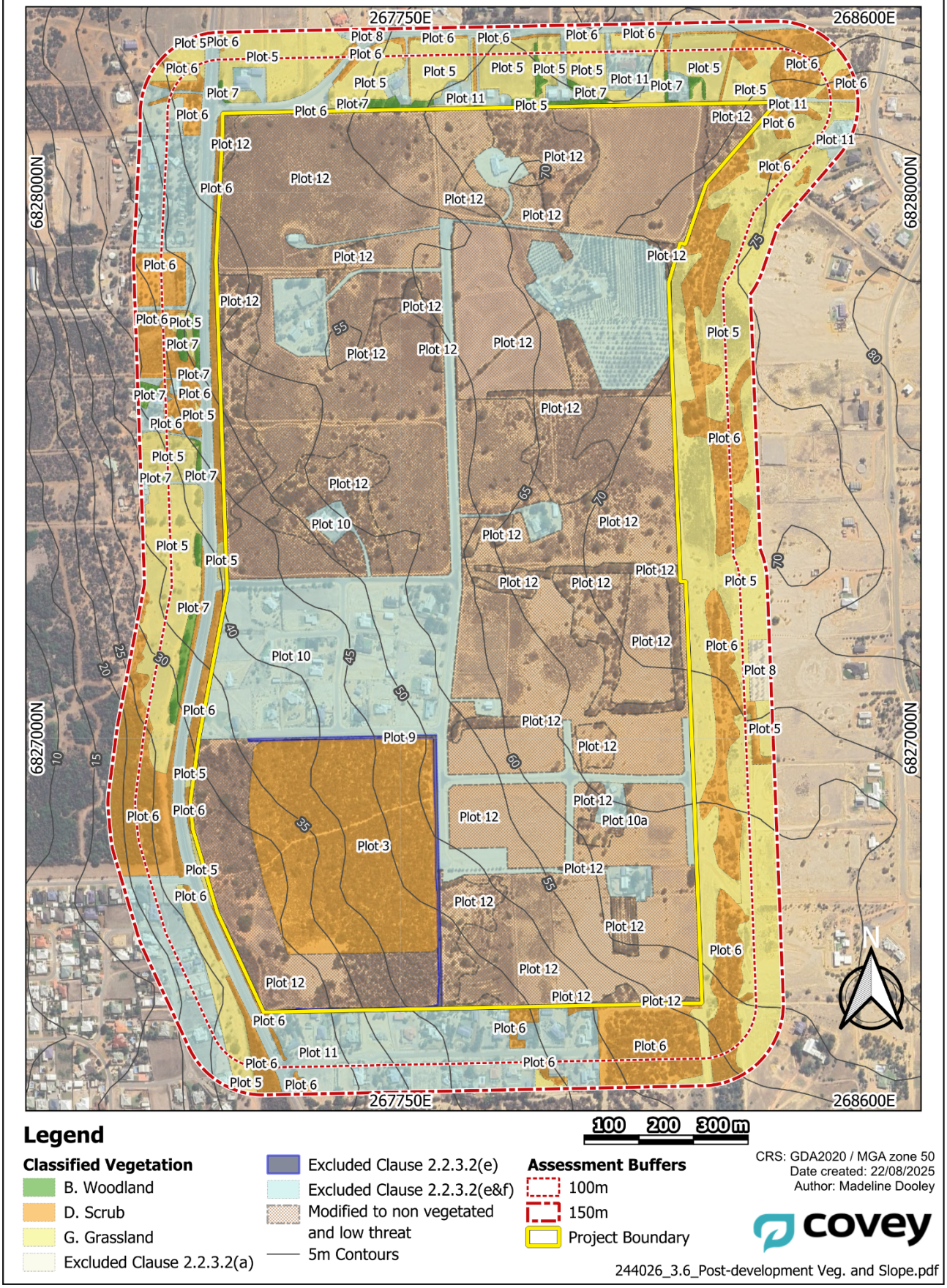



***Figure 3-6. Post-development vegetation and effective slope***

## Figure 3-7: Pre-development Bushfire Hazard Level Assessment

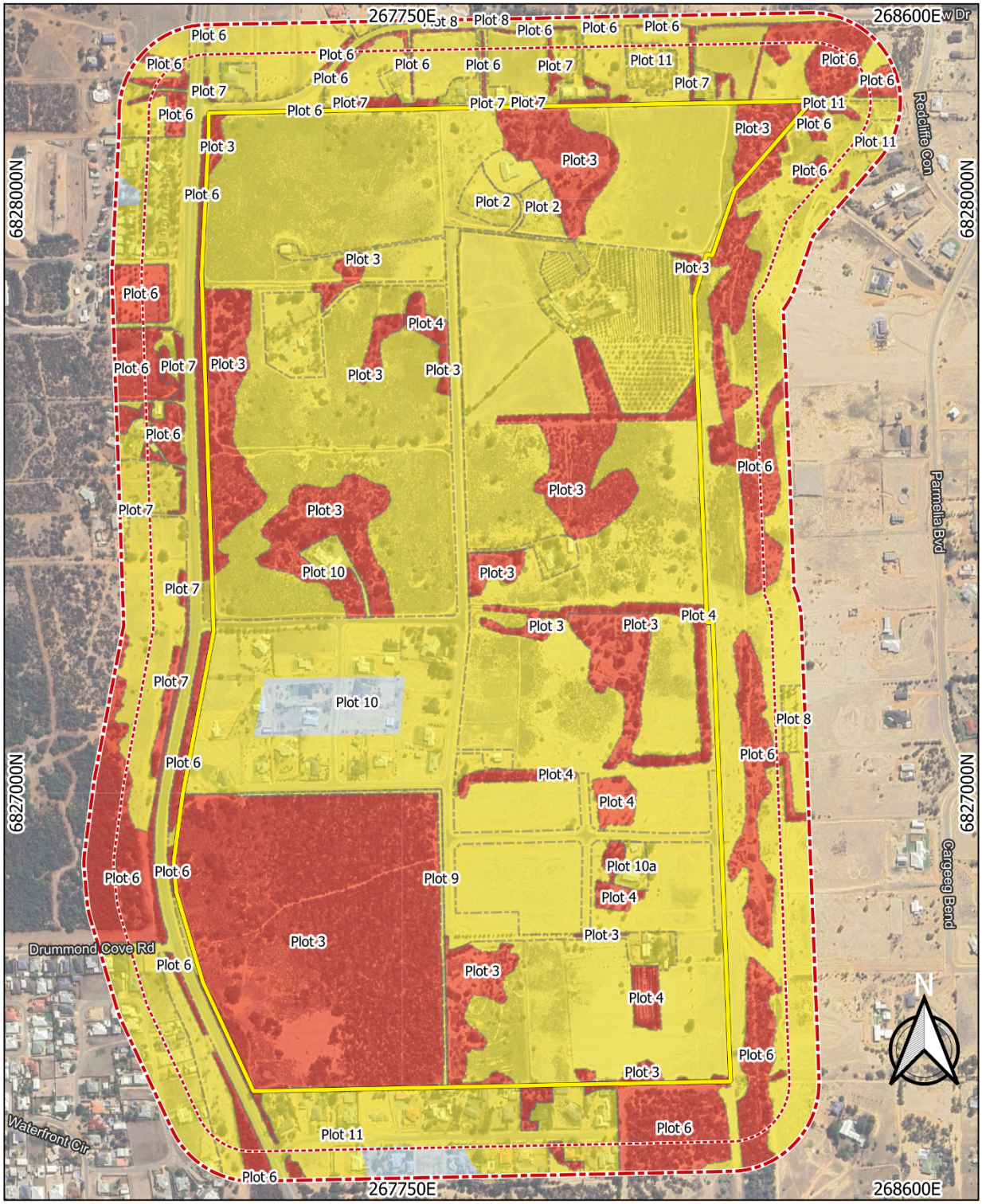



*Figure 3-7. Pre-development Bushfire Hazard Level assessment*

## Figure 3-8: Post-development Bushfire Hazard Level Assessment

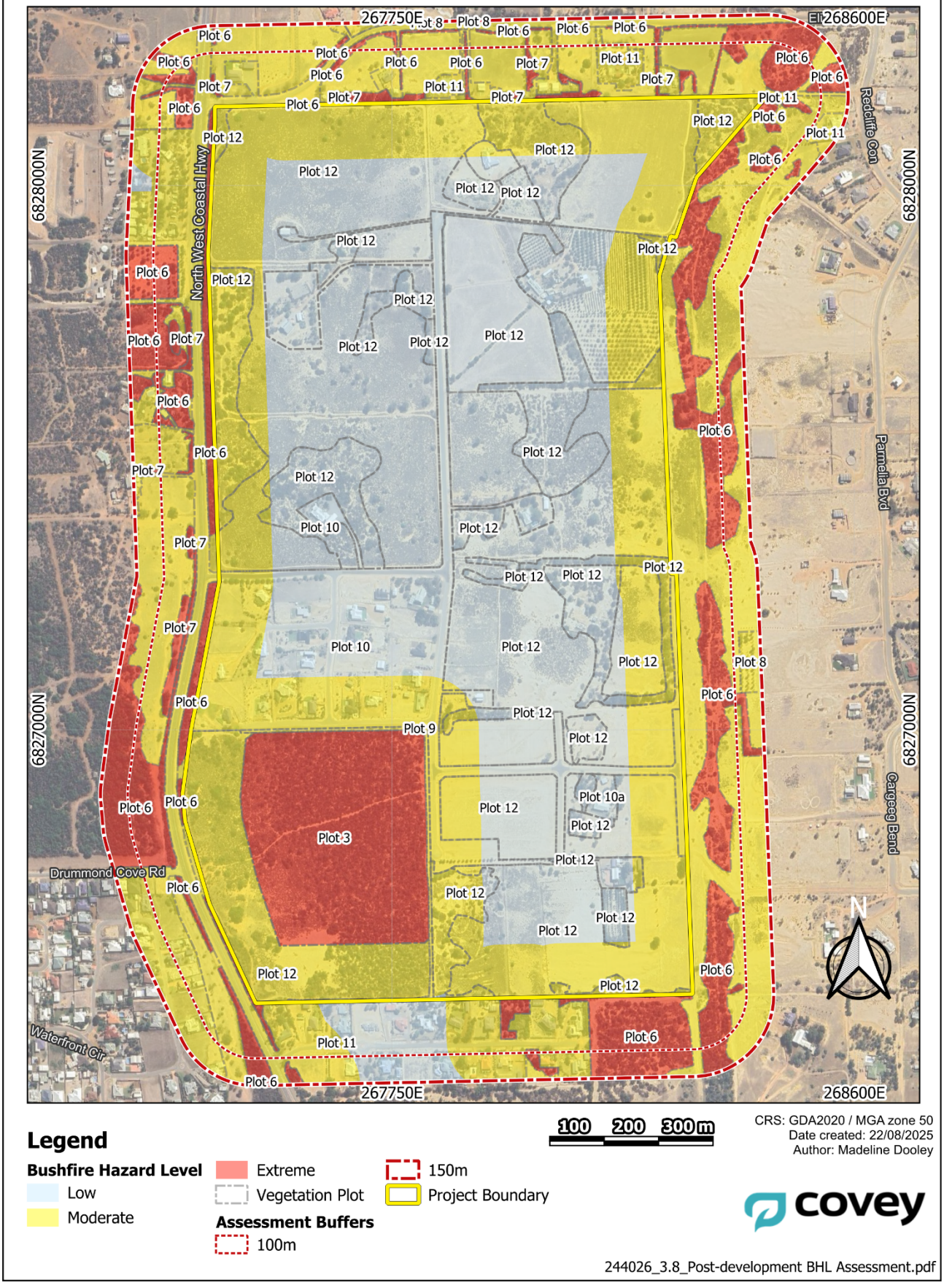



*Figure 3-8. Post-development Bushfire Hazard Level assessment*

# 4 Identification of bushfire hazard issues

## 4.1 Bushfire context

The external bushfire threat to the proposed future development has been assessed through the BLA documented in Section 3.1. It is noted there is some continuous vegetation west of North West Coast Highway which could support elevated bushfire behaviour, however the bushfire risk to the site is primarily through fragmented fuels within rural residential development in all other directions.

Notwithstanding, any fire approaching the development, would represent a threat to the proposed buildings and future residents, if not appropriately managed.

## 4.2 Bushfire hazard issues

Examination of strategic development design in accordance with the concept plan and pre- and post-development bushfire hazards has identified the following bushfire hazard issues to be considered at future planning stages:

1. Based on the existing extent of vegetation within and outside the project area, parts of the proposed development would be subject to an initial BAL of BAL-FZ, if unmanaged. In order for the development to achieve a compliant rating of BAL-29 or less, sufficient separation need to be provided between habitable development and classifiable, unmanaged vegetation. Similarly, sufficient separation will also be required from any classifiable onsite vegetation, if any, to achieve BAL-29 or less;
2. Provision of a coherent internal vehicular access network to ensure occupants are able to egress away from bushfire, and fire brigade has appropriate and flexible access to habitable development and direct interfaces with unmanaged vegetation;
3. Provision of a secure water supply for bushfire fighting activities; and
4. Ensure the bushfire risk to any future vulnerable land uses (if proposed as part of future applications) is appropriately considered and mitigated.

## 4.3 Bushfire safety strategy

The following bushfire safety strategy is proposed to demonstrate compliance with the Bushfire Protection Criteria of PBG at future planning stages, in order to address the bushfire hazards identified above:

1. Create sufficient separation between future habitable buildings and post-development classified vegetation, both within and outside the project area, to achieve BAL-29 or lower in accordance with AS 3959. Other than POS 3 (and potentially small portions of POS 1 and 2), it is noted that upon completion all other land within the project area is expected to be either non-vegetated or low threat landscaping, however internal APZ setbacks may be required within some lots to prevent development in areas of BAL-40/FZ;
2. Ensure vehicular access to and from the proposed development complies with the technical specifications of PBG;
3. Ensure a secure bushfire fighting water supply, most likely through use reticulated water supply and street hydrants; and
4. If proposed as part of future planning applications, ensure a Bushfire Emergency Evacuation Plan accompanies the BMP for any future vulnerable land uses.

Based on the above, Covey considers the bushfire hazards within and adjacent to project area and the associated bushfire risks are manageable through standard management responses outlined in PBG and AS 3959. These responses will be factored into proposed development as early as possible at all stages of the planning process to ensure a suitable, compliant and effective bushfire management outcome is achieved for protection of future life, property and environmental assets.

## 5 Assessment against the Bushfire Protection Criteria

An acceptable solutions assessment against Bushfire Protection Criteria 4 (Strategic Planning) of PBG, has been provided in Table 7.

***Table 7: Compliance with the Bushfire Protection Criteria 4 (Strategic Planning) of PBG***

| Bushfire protection criteria | | Development response | |
|---|---|---|---|
| Outcomes | Acceptable Solutions | Method of compliance | Proposed bushfire management measures |
| **Element 1: Location** | | | |
| Outcome O1<br>Avoid broader landscapes that present an unacceptable risk to life, property and infrastructure. | **Area 1 (Urban)**: Does not require assessment of Element 1: Location<br>**Area 2**: Determine the Broader Landscape Type in accordance with Appendix A.1 and proceed with the following Acceptable Solutions<br>A1.1 Location<br>*A1.1a Broader Landscape Type A*<br>The subject site is located in an area that is a Broader Landscape Type A. This location satisfies the policy outcome for Element 1:Location and no additional consideration is required.<br>A1.1b Broader Landscape Type B<br>The subject site is located in an area that is a Broader Landscape Type B which presents an unacceptable bushfire risk of a landscape scale bushfire resulting in impacts to people, property and infrastructure. This location does not satisfy the policy outcome for Element 1: Location.<br>Where the practitioner considers that further analysis could demonstrate to the decision-maker that the risks can be appropriately managed, and/or mitigated, an outcomes-based approach should be prepared in accordance with policy measure 7.5 of SPP 3.7.<br>Further explanatory notes are provided in Appendix B.1 of PBG. | **Acceptable Solution** | Portions of the project area is sited in Area 2 designated bushfire prone area.<br>A Broader Landscape Assessment has been conducted as detailed in Section 3.1.<br>***The determined Broader Landscape Type for the project area, is BLT A.***<br>On this basis, compliance is achieved with A1.1, with no additional consideration required. |
| **Element 2: Siting and Design** | | | |
| Outcome O2<br>Ensure siting and design solutions:<br>• manage or mitigate the bushfire risk to people, property and infrastructure; and<br>• avoid, or where unavoidable, minimises the clearing of native vegetation | **Area 1 (Urban)**: Does not require assessment of Element 2: Siting and Design<br>**Area 2**: Proceed with the following Acceptable Solutions<br>A2.1 Siting and Design<br>The areas of the subject site(s) identified for intensification and/or the future development site(s) achieve a pre- or post-development bushfire hazard level of moderate or low | **Acceptable Solution** | The pre- and post-development BHL assessment has been undertaken (see Figure 3-7 and Figure 3-8), which identifies that all developable land is capable of achieving either a Low or Moderate bushfire hazard level, upon completion of development (i.e. post-development BHL).<br>Based on the above, compliance is achieved with A2.1. |
| | A2.2 Clearing of native vegetation<br>The strategic planning proposal avoids, or where unavoidable, minimises the clearing of native vegetation. | **Acceptable Solution** | The majority of the project area has been cleared as part of previous development, and there appears to be limited remnant native vegetation remaining other than the scrub vegetation within the south-west corner of the site which is to be mostly retained within POS 3. While it is expected that most vegetation will require clearing for future development, it is unlikely there is any significant native vegetation within the project area.<br>Notwithstanding, Covey assumes that all relevant environmental studies will be undertaken to support the project, and if any State and Federal environmental referrals and approvals are required, they will be sought prior to commencing on-site vegetation modification or clearing required to construct the development. |

| Bushfire protection criteria | | Development response | |
|---|---|---|---|
| Outcomes | Acceptable Solutions | Method of compliance | Proposed bushfire management measures |
| **Element 3: Vehicular access** | | | |
| Outcome O3<br>Ensure the design and capacity of vehicular access and egress provide:<br>• for efficient and effective evacuation to a suitable destination(s) and/or<br>• as a contingency measure for vulnerable land uses, an on-site shelter, where demonstrated appropriate, as a last resort option. | **Area 1 (Urban)**: Does not require assessment of Element 3: Vehicular Access<br>**Area 2**: Proceed with the following Acceptable Solutions<br>A3.1 Public Roads<br>Public roads, including perimeter roads should meet the technical requirements in Appendix B.3, Table 10 | **Acceptable Solution** | The existing public roads outside the project area, namely North West Coastal Highway, Eliza Shaw Drive and Glassford Vista, are sealed two-way roads that appear to be compliant with PBG and are sufficient for occupant egress and emergency services access.<br>Additionally, the existing public roads within the project area, all appear compliant with PBG, generally presenting as sealed, 6 m wide roads.<br>The concept plan provided on depicts additional future public roads within the project area as part of future development. All future public roads will be required to comply with the relevant technical requirements of PBG for public roads (see Appendix D). |
| | A3.2 Access Routes<br>Public road access should be provided in two different directions, to two different suitable destinations; and with an all-weather surface. | **Acceptable Solution** | The public road network outside the project area is currently as follows:<br>• North West Coastal Highway to the west, allows for travel north and south;<br>• Eliza Shaw Drive to the north, allows for travel west to North West Coastal Highway or east; and<br>• Glassford Vista to the south is currently an overlength 575m long no-through road, that connects to North West Coastal Highway;<br>Within the project area, the existing public road network is as follows:<br>• Wokarena Road is a 440 m long road extending from North West Coastal Highway to Richards Road in the east;<br>• Richards Road is a 1.18 km north-south dead end road, with cul-de-sac heads at either end;<br>• Hilltop Loop and Dune Vista form a loop road between Wokarena Road and Richards Road, with Hilltop Loop also having a 150 m no-through road as it extends west past Dune Vista;<br>• Heights View is a 130 m long no-through road from Dune Vista;<br>• Elevation Rise is a 450 m long road extending from Richards Road in the west to Skyline Ridge in the east;<br>• Coastal Crest is a 270 m long road running north to south; and<br>• Skyline Ridge is a 270 m long road running north to south along the eastern edge of the SP area.<br>The SP proposes two potential additional public road connections as follows:<br>• Future public road connection to Glassford Vista to the south<br>• Potential public road connection to Eliz Shaw Drive to the north, otherwise this is to be retained as pedestrian access way.<br>The constructed public road network is currently non-compliant with A3.2, as it is only served by the single public road connection to the greater public road network, namely North West Coastal Highway, and essentially forms a large no-through road.<br>This can be addressed by utilising either or both of the other proposed connections to the greater public road network (i.e. to Eliza Shaw Drive and Glassford Vista), either as public roads, or Emergency Access Ways.<br>It is also noted that a constructed 2WD gravel standard emergency access vehicle alignment links Skyline Ridge to Cargeeg Bend providing a 390 m long secondary access/egress to the south-east.<br>In this regard, the proposed development can be provided with at least two access routes which meets the requirements of Acceptable Solution A3.2. |

| Bushfire protection criteria | | Development response | |
|---|---|---|---|
| Outcomes | Acceptable Solutions | Method of compliance | Proposed bushfire management measures |
| | A3.3a No-through Roads<br>If the public road access to the subject site is via a no-through road which cannot be avoided due to demonstrated site constraints, the public road access is to be a maximum of 200 m from the subject site boundary to an intersection where two-way access is provided.<br>The no-through road may exceed 200 metres if it is demonstrated that an alternative access, including an emergency access way, cannot be provided due to site constraints, and the following requirements are met<br>• the no-through road travels towards a suitable destination; and<br>• the balance of the no-through road that is greater than 200 metres from the subject site, is wholly within BAL-LOW, or is within a residential built-out area, or is within Area 1 (Figure 29).<br><br>A3.3b No-through Road Requirements<br>A no-through road is to meet all the following requirements:<br>• requirements of a public road (Appendix B.3, Table 10, Column 2); and<br>• turn-around area/head (Figure 30). | **Acceptable Solution** | The SP currently depicts two potential no-through roads on either side of Wokarena Road as follows.<br>• A no-through road on the southern side of Wokarena Road (which is the currently constructed Height View Road), which is less than 200m long and has a compliant turning head at the termination.<br>• The proposed no-through road north of Wokarena Road that is not yet constructed, but appears will also be less than 200 m long and should be able to achieve a 18 m wide turning head at the termination.<br>All future public roads within the project area will be required to comply with the relevant technical requirements of PBG for public roads (see Appendix D), and any no-through roads, are to comply with the requirements of A3.3a including:<br>• being no greater than 200 m long to a point of choice (unless justification can be provided as per A3.3a)<br>• having a compliant turnaround head or hammerhead arrangement. |
| **Element 4: Water** | | | |
| Outcome O4<br>Ensure that sufficient water is available to enable people, property and infrastructure to be defended from bushfire. | **Area 1 (Urban)**: Does not require assessment of Element 4: Water<br>**Area 2**: Proceed with the following Acceptable Solutions<br>A4.1 Water Supply<br>Evidence that a sufficient and accessible reticulated or non-reticulated water supply for bushfire firefighting can be provided at the subdivision and/or development application stage, in accordance with the specifications of the relevant water supply authority or the requirements in Appendix B4: Water Supply dedicated for bushfire firefighting | **Acceptable Solution** | The existing development within the project area is connected to reticulated water supply with existing street hydrants within the site as depicted on Plate 1. There is also existing reticulated water supply and street hydrants along public roads outside the project area, including North West Coastal Highway, Eliza Shaw Drive and Glassford Vista.<br>Given the proximity to existing reticulated water supply, it is expected that the proposed future development will also be connected to reticulated water supply in accordance with the relevant Water Corporations design standards (refer to Appendix E). Should future public roads be constructed as part of future development, it is expected that additional street hydrants would be installed in accordance with relevant Water Corporation design standards. |

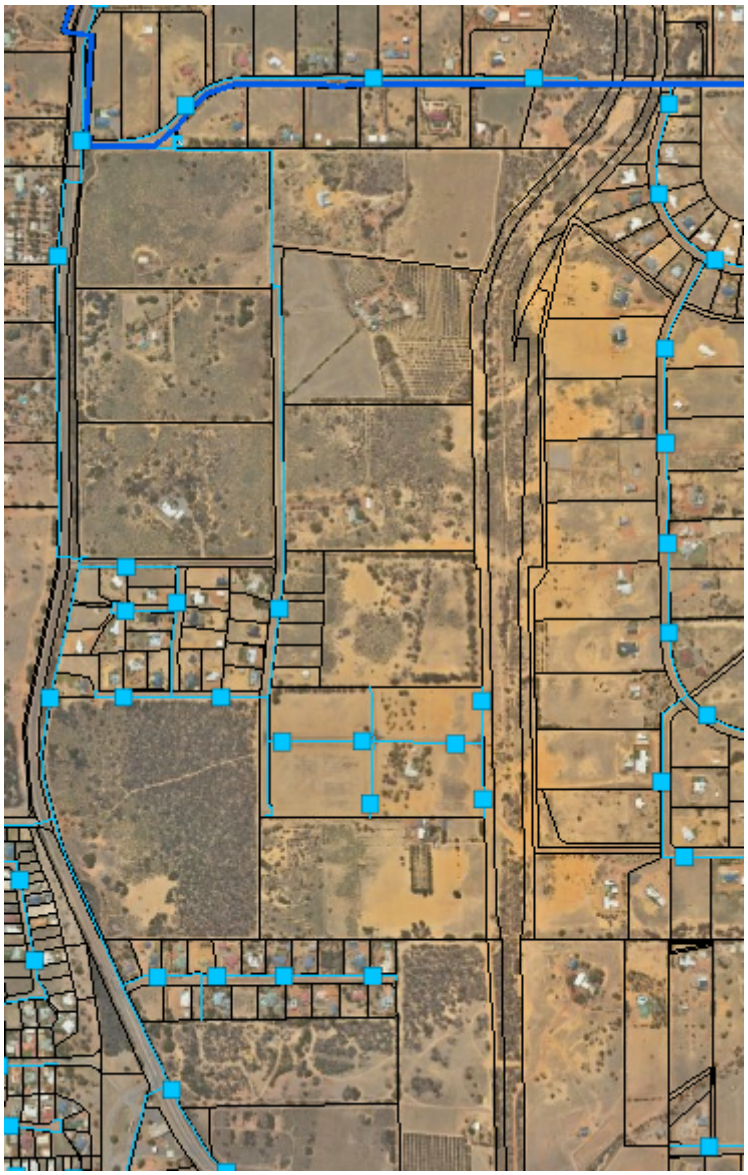


***Plate 1: Existing Water Corporation pipe and hydrants***

# 6 Responsibilities for implementation and management of the bushfire measures

This BMP has been prepared as a strategic guide to demonstrate how development compliance will be delivered at future planning stages in accordance with PBG. Aside from the preparation of future BMPs to accompany future subdivision and development applications where appropriate, there are no further items to implement, enforce or review at this strategic stage of the planning process.

Future BMPs prepared for subsequent subdivision and development applications are to meet the relevant commitments outlined in this strategic level BMP, address the relevant requirements of SPP 3.7 (i.e. Policy Measure 7.1 (ii)) and demonstrate in detail how the proposed development will incorporate the relevant acceptable solutions or meet the performance requirements of PBG. Future BMPs are to include the following detailed information:

- Proposed development layout, including any lots, roads, POS/drainage areas etc;
- Detailed landscape plans for all POS, drainage and areas of revegetation or retention, to confirm the final extent of classified vegetation (retained or revegetated) and exclusions (non-vegetated areas and low threat vegetation);
- Final determination of post development classified vegetation extent, exclusions and effective slope;
- Final BAL contour map demonstrating that proposed development areas will achieve BAL–29 or lower (may require designation of building envelopes);
- Width and alignment of compliant APZs/setbacks;
- Confirmation of how bushfire management will be addressed during development staging including consideration of low threat staging buffers and vehicular access (temporary no-through roads/EAWs);
- Proposed approach to fuel management throughout POS, vacant land, staging buffers, adjacent properties and road verges; or application of AS 3959 in response to classified vegetation;
- Vehicular access provisions, including demonstration that a minimum of two access routes will be achieved for each stage of development (as required);
- Water supply provisions with regards to reticulated water supply provisions (including network of street hydrants), or static firewater tanks if required;
- Demonstration of compliance with the relevant Bushfire Protection Criteria of PBG;
- Requirements for any proposed vulnerable land uses including provision of a BMP and Bushfire Emergency Evacuation Plan to accompany the development application;
- Requirements for BMP compliance reports as a condition of subdivision;
- Provisions for notification on Title for any future lots with a rating of BAL–12.5 or greater as a condition of subdivision;
- Compliance requirements with the current local government annual firebreak notice, as amended or varied (most recent as per Appendix F);
- Construction of Class 1, 2, 3 or associated 10a buildings/decks, in accordance with National Construction Code to the assessed BAL rating;
- Construction ’certain Class 9‘ buildings, in accordance with the requirements of the National Construction Code; and
- Proposed implementation and audit program outlining all measures requiring implementation and the appropriate timing and responsibilities for implementation.

On the basis of the information contained in this BMP, Covey considers the bushfire hazards within and adjacent to the project area and the associated bushfire risks are manageable through standard management responses outlined in PBG and AS 3959. Covey considers that on implementation of the proposed management measures, the project area will be able to be developed with a manageable level of bushfire risk whilst maintaining full compliance with PBG and AS 3959.

# 7 References

Department of Fire and Emergency Services (DFES) 2025, *Map of Bush Fire Prone Areas*, [Online], Government of Western Australia, available from: https://maps.slip.wa.gov.au/landgate/bushfireprone/,

Standards Australia (SA) 2018, Australian Standard *AS 3959:2018 Construction of buildings in bushfire-prone areas*. SAI Global, Sydney.

Western Australian Department of Planning (DoP) 2016, *Visual guide for bushfire risk assessment in Western Australia.* Department of Planning, Perth.

Western Australian Planning Commission (WAPC) 2024, *State Planning Policy 3.7: Bushfire*, November 2024. Western Australian Planning Commission, Perth.

Western Australian Planning Commission (WAPC) 2024, *Planning for Bushfire Guidelines*, November 2024. Western Australian Planning Commission, Perth.

# Appendix A

## APZ Standards from PBG

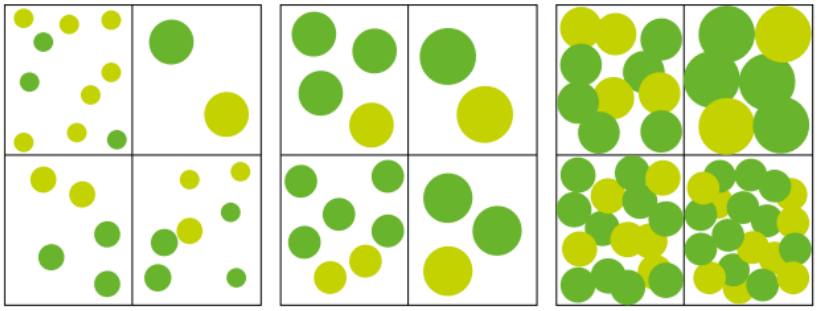
An APZ is a low fuel area maintained around a habitable building to increase the likelihood that it will survive a bushfire, by providing a defendable space and reducing the potential for direct flame contact, radiant heat exposure and ember attack. The APZ allows emergency services access and provides an area for firefighters and home-owners to defend their property.

An APZ should not be seen as an area entirely cleared of vegetation, but as a strategically designed space that considers how existing and future mature vegetation, and combustible and non-combustible features interact with and affect the building's resilience to bushfire.

Vegetation management within an APZ should provide defendable space and be maintained to a low threat state, in perpetuity, in accordance with the requirements outlined below.

**Table 9: Asset Protection Zone Technical Requirements**

- **Trees* (> 6 metres in height)**
  - Trunks at maturity should be a minimum distance of six metres from all elevations of the building.
  - Branches at maturity should not touch or overhang a building or powerline.
  - Lower branches and loose bark should be removed to a height of two metres above the ground and/or surface vegetation.
  - Canopy cover within the APZ should be <15 per cent of the total APZ area.
  - Tree canopies at maturity should be at least 5 metres apart to avoid forming a continuous canopy. Stands of existing mature trees with interlocking canopies may be treated as an individual canopy provided that the total canopy cover within the APZ will not exceed 15 per cent and are not connected to the tree canopy outside the APZ.




- **Shrub* and Scrub* (0.5 metres to 6 metres in height)**
  - Should not be located under trees or within three metres of buildings.
  - Should not be planted in clumps >5 square metres in area.
  - Clumps should be separated from each other and any exposed window or door by at least 10 metres.
  - Shrub and scrub >6 metres in height are to be treated as trees.
- **Ground covers (<0.5 metres in height)**
  - Can be planted under trees but must be maintained to remove dead plant material, as prescribed in 'Fine fuel load'.
  - Can be located within two metres of a structure, but three metres from windows or doors if >100 millimetres in height.
  - Ground covers >0.5 metres in height are to be treated as shrubs
- **Grass**
  - Grass should be maintained at a height of 100 millimetres or less, at all times.

**Table 9: Asset Protection Zone Technical Requirements**

- Wherever possible, perennial grasses should be used and well-hydrated with regular application of wetting agents and efficient irrigation.

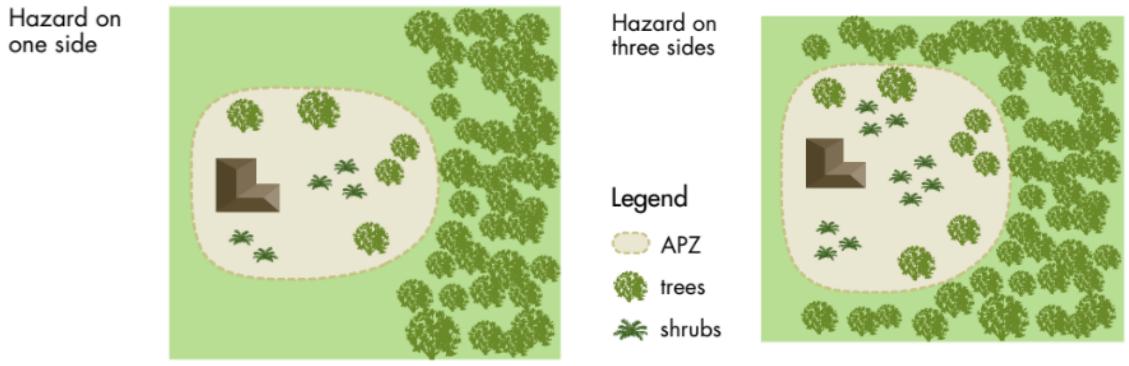
- **Fine Fuel load (combustible dead vegetation mater <6 mm in thickness)****
  - Should be managed and removed on a regular basis to be maintained as low threat vegetation.
  - Should be maintained at <2 tonnes per hectare (on average).
  - Mulches should be non-combustible such as stone, gravel, shells, rock or crushed mineral earth or wood mulch >5 millimetres in thickness.
- **Defendable Space**
  - Within three metres of each wall or supporting post of a habitable building, the area is kept free from vegetation, but can include ground covers, grass and non-combustible mulches as prescribed above.
- **Fences within the APZ**
  - Should be constructed from non-combustible materials (for example, iron, brick, limestone, metal post and wire, or bushfire-resisting timber referenced in Appendix F of AS 3959)
- **LPG Cylinders**
  - Should be located on the side of a building furthest from the likely direction of a bushfire or on the side of a building where surrounding classified vegetation is upslope, at least one metre from vulnerable parts of a building.
  - The pressure relief valve should point away from the house.
  - No flammable material within six metres from the front of the valve.
  - Must sit on a firm, level and non-combustible base and be secured to a solid structure.

** Plant flammability, landscaping design and maintenance should be considered – refer to explanatory notes*

*** Fine fuel load:*

- *is the combustible, dead or dry vegetation matter on the ground, near ground, or elevated. Fine fuel includes grass, leaves, bark and twigs less than six millimetres in diameter that ignite readily and are burnt rapidly when dry.*
- *Fine fuel should be maintained at less than 2t/ha (100gm/m2 equates to 1t/ha).*
  - *To estimate a fuel load (in t/ha), collect the dry fine fuel from a representative one square meter and weigh (in grams using kitchen scales) and multiply the weight by 0.01.*

Figure 25: Design of an Asset Protection Zone



### B.2.2 Designing an Asset Protection Zone

An APZ should not be seen as an area entirely cleared of vegetation, but as a strategically designed space that considers how existing and future mature vegetation, and combustible and non-combustible features interact with and affect the building's resilience to bushfire.

An APZ should provide the greatest level of vegetation management within at least three metres of a habitable building, to ensure adequate unobstructed defendable space for emergency services to operate. This area should contain minimal vegetation and be free of combustible materials and obstructions. Within the remainder of the APZ, planting of vegetation can increase as you move farther away from the building.

The placement of plants within an APZ is a key design technique. Separation of garden beds with areas of low fuel or non-combustible material will break up fuel continuity and reduce the likelihood of vegetation within an APZ supporting a bushfire. It is important to consider the plant density and final structure and form of plants in their mature state.

Strategic landscaping measures can be applied, such as replacing weeds with low flammability vegetation to create horizontal and vertical separations between the retained vegetation.

Mulches used within the APZ should be non-combustible. The use of stone, gravel, shells, rock and crushed mineral earth is encouraged. Very fine or light mulch (such as shredded pine bark, pine needles, or poplar woodchips) less than five millimeters in diameter should be avoided. It is recommended that wood mulch is used in garden beds or areas where the moisture level is higher by regular irrigation, and these areas are separated with non-combustible elements, such as pathways and open spaces.

Incorporation of landscaping features, such as masonry feature walls, can provide habitable buildings with barriers to wind, radiant heat and embers. These features can include noise walls or wind breaks. Use of Appendix F of AS 3959 for bushfire resistant timber selection or the use of non-combustible fencing materials such as iron, brick, limestone, metal post and wire is encouraged within an APZ

### B2.3 Management of an Asset Protection Zone

Ongoing maintenance of an APZ is usually enforced through a condition of a development approval, which should refer to Table 9 APZ technical requirements within this Appendix.

In addition to regular maintenance of an APZ, further bushfire protection can be provided by:

- ensuring gutters are free from vegetation
- installing gutter guards or plugs
- regular cleaning of underfloor spaces, or enclosing them to prevent gaps
- trimming and removing dead plants or leaf litter
- pruning climbing vegetation (such as vines) on a trellis, to ensure it does not connect to a building, particularly near windows and doors
- removing vegetation in close proximity to a water tank to ensure it is not touching the sides of a tank
- following the requirements of the relevant local government firebreak notice, which may include additional provisions such as locating wood piles more than 10 metres from a building.

Preparation of a property prior to the bushfire season and/or in anticipation of a bushfire is beneficial even if your plan is to evacuate. Embers can travel up to several kilometres from a bushfire and fall into small spaces and crevices or land against the external walls of a building.

Best practice recommends objects within the APZ are moved away from the building prior to any bushfire event.

Objects may include, but are not limited to:

- door mats
- outdoor furniture
- potted plants
- shade sails or umbrellas
- plastic garbage bins
- firewood stacks
- flammable sculptures
- playground equipment and children's toys.

**B2.4 Plant Flammability**

There are certain plant characteristics that are known to influence flammability, such as moisture or oil content and the presence and type of bark. Plants with lower flammability properties may still burn during a bushfire event, but may be more resistant to burning and some may regenerate faster post-bushfire.

There are many terms for plant flammability that should not be confused, including:

- **Fire resistant** – plant species that survive being burnt and will regrow after a bushfire and therefore may be highly flammable and inappropriate for a garden in areas of high bushfire risk.
- **Fire-retardant** – plants that can absorb more of the heat of the approaching bushfire without burning, compared to more flammable plants.
- **Fire wise** – plants that have been identified and selected based on their low flammability properties and linked to maintenance advice and planting location within a garden.

Although not a requirement of these Guidelines, local governments may develop their own list of fire wise or fire-retardant plant species that suit the environmental characteristics of an area.

When developing a recommended plant species list, local governments should consult with ecologists, land care officers or environmental authorities to ensure the plants do not present a risk to endangered ecological communities, threatened, or endangered species or their habitat.

When selecting plants, private landholders and developers should aim for plants within the APZ that have the following characteristics:

- grow in a predicted structure, shape and height;
- are open and loose branching with leaves that are thinly spread;
- have a coarse texture and low surface-area-to-volume ratio;
- will not drop large amounts of leaves or limbs, that require regular maintenance;
- have wide, flat, and thick or succulent leaves;
- trees that have bark attached tightly to their trunk or have smooth bark;

- have low amounts of oils, waxes, and resins (which will often have a strong scent when crushed);
- do not produce or hold large amounts of fine dead material in their crowns; and/or
- will not become a weed in the area.

# Appendix B

## AS 3959 Clause 2.2.3.2 (e) and (f) – Low threat Vegetation and Non-Vegetated Areas

**2.2.3.2** *Exclusions—Low threat vegetation and non-vegetated areas*

The following vegetation shall be excluded from a BAL assessment:

(a) Vegetation of any type that is more than 100 m from the site.

(b) Single areas of vegetation less than 1 ha in area and not within 100 m of other areas of vegetation being classified vegetation.

(c) Multiple areas of vegetation less than 0.25 ha in area and not within 20 m of the site, or each other or of other areas of vegetation being classified vegetation.

(d) Strips of vegetation less than 20 m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 m of the site or each other, or other areas of vegetation being classified vegetation.

(e) Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings and rocky outcrops.

(f) Vegetation regarded as low threat due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a minimal fuel condition, mangroves and other saline wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks.

NOTES:

1 Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack (recognizable as short-cropped grass for example, to a nominal height of 100 mm).

2 A windbreak is considered a single row of trees used as a screen or to reduce the effect of wind on the leeward side of the trees.

# Appendix C

## Vegetation plot photos and description


Photo ID: 1a


Photo ID: 1b


Photo ID: 1c


Photo ID: 1d


Photo ID: 1e


Photo ID: 1f

| | |
|---|---|
| Plot number | Plot 1 |
| Vegetation classification | Class G Grassland |
| Description / justification | Grassland greater than 100 mm in height |


Photo ID: 1g


Photo ID: 1h


Photo ID: 1i


Photo ID: 1j


Photo ID: 1k


Photo ID: 1l

| | |
|---|---|
| Plot number | Plot 1 |
| Vegetation classification | Class G Grassland |
| Description / justification | Grassland greater than 100 mm in height |


Photo ID: 1m


Photo ID: 1n


Photo ID: 1o

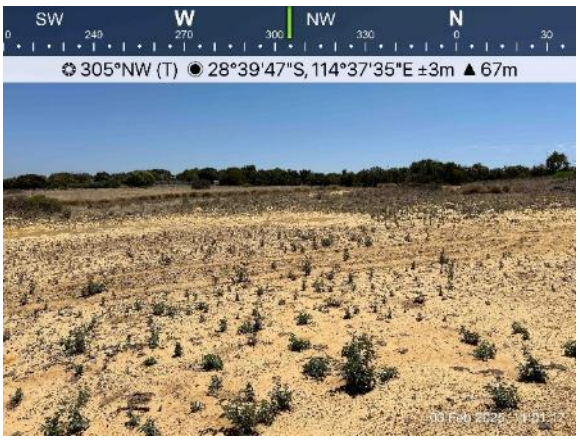



Photo ID: 1p


Photo ID: 1q


Photo ID: 1r

| | |
|---|---|
| Plot number | Plot 1 |
| Vegetation classification | Class G Grassland |
| Description / justification | Grassland greater than 100 mm in height |


Photo ID: 2a


Photo ID: 2b

| | |
|---|---|
| Plot number | Plot 2 |
| Vegetation classification | Class C Shrubland |
| Description / justification | Shrub vegetation less than 2 m high at maturity |


Photo ID: 3a


Photo ID: 3b


Photo ID: 3c


Photo ID: 3d


Photo ID: 3e


Photo ID: 3f

| | |
|---|---|
| Plot number | Plot 3 |
| Vegetation classification | Class D Scrub |
| Description / justification | Vegetation with a continuous horizontal and vertical structure, greater than 2 m high at maturity |


Photo ID: 3g


Photo ID: 3h

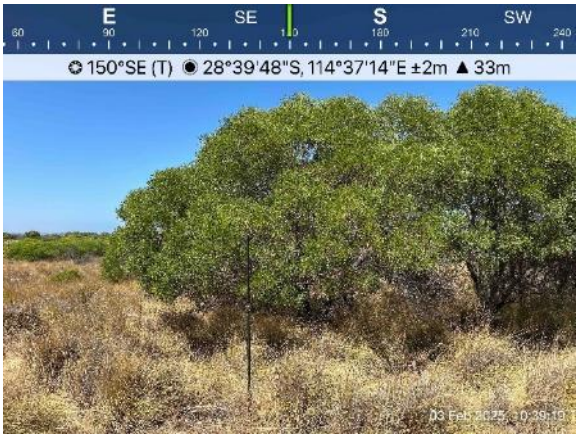



Photo ID: 3i

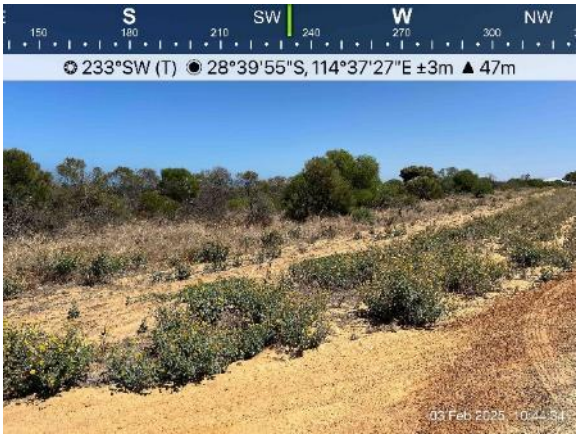



Photo ID: 3j


Photo ID: 3k


Photo ID: 3l

| | |
|---|---|
| Plot number | Plot 3 |
| Vegetation classification | Class D Scrub |
| Description / justification | Vegetation with a continuous horizontal and vertical structure, greater than 2 m high at maturity |


Photo ID: 3m


Photo ID: 3n


Photo ID: 3o


Photo ID: 3p


Photo ID: 3q


Photo ID: 3r

| | |
|---|---|
| Plot number | Plot 3 |
| Vegetation classification | Class D Scrub |
| Description / justification | Vegetation with a continuous horizontal and vertical structure, greater than 2 m high at maturity |


Photo ID: 3s

| | |
|---|---|
| Plot number | Plot 3 |
| Vegetation classification | Class D Scrub |
| Description / justification | Vegetation with a continuous horizontal and vertical structure, greater than 2 m high at maturity |


Photo ID: 4a


Photo ID: 4b


Photo ID: 4c


Photo ID: 4d


Photo ID: 4e

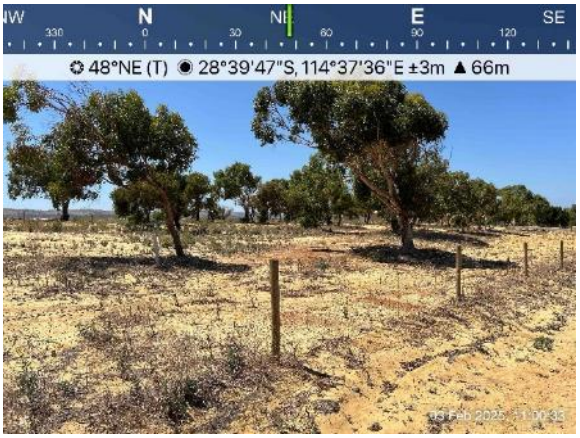



Photo ID: 4f

| | |
|---|---|
| Plot number | Plot 4 |
| Vegetation classification | Class B Woodland |
| Description / justification | Trees 2-30 m at maturity, dominated by trees with a grassy understorey (lacks shrubby middle layer and deep surface litter) |

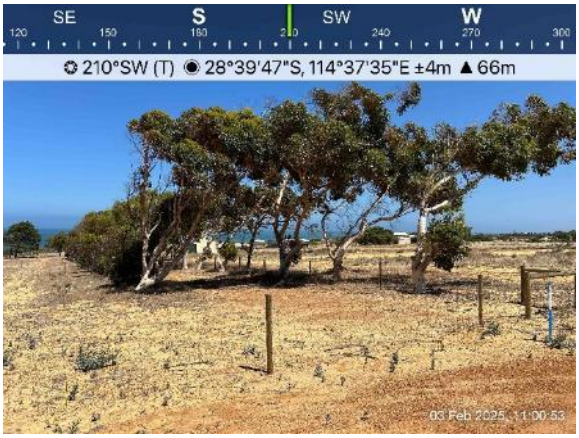



Photo ID: 4g

| | |
|---|---|
| Plot number | Plot 4 |
| Vegetation classification | Class B Woodland |
| Description / justification | Trees 2-30 m at maturity, dominated by trees with a grassy understorey (lacks shrubby middle layer and deep surface litter) |


Photo ID: 5a


Photo ID: 5b


Photo ID: 5c


Photo ID: 5d


Photo ID: 5e


Photo ID: 5f

| | |
|---|---|
| Plot number | Plot 5 |
| Vegetation classification | Class G Grassland |
| Description / justification | Grassland at maturity, greater than 100 mm in height |


Photo ID: 5g


Photo ID: 5h


Photo ID: 5i


Photo ID: 5j


Photo ID: 5k

| | |
|---|---|
| Plot number | Plot 5 |
| Vegetation classification | Class G Grassland |
| Description / justification | Grassland at maturity, greater than 100 mm in height |


Photo ID: 6a

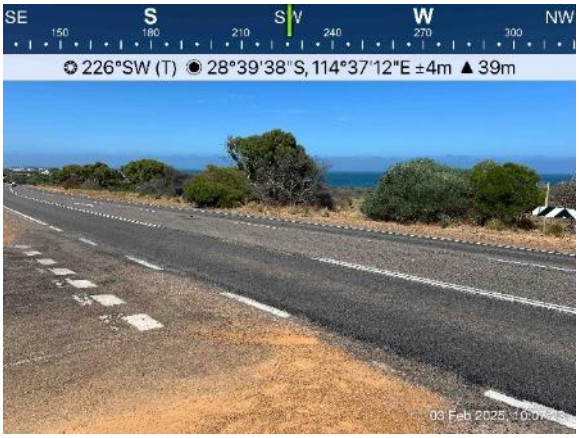



Photo ID: 6b


Photo ID: 6c


Photo ID: 6d


Photo ID: 6e


Photo ID: 6f

| | |
|---|---|
| Plot number | Plot 6 |
| Vegetation classification | Class D Scrub |
| Description / justification | Vegetation with a continuous horizontal and vertical structure, greater than 2 m high at maturity |


Photo ID: 6g


Photo ID: 6h


Photo ID: 6i


Photo ID: 6j


Photo ID: 6k


Photo ID: 6l

| | |
|---|---|
| Plot number | Plot 6 |
| Vegetation classification | Class D Scrub |
| Description / justification | Vegetation with a continuous horizontal and vertical structure, greater than 2 m high at maturity |


Photo ID: 6m


Photo ID: 6n


Photo ID: 6o


Photo ID: 6p


Photo ID: 6q


Photo ID: 6r

| | |
|---|---|
| Plot number | Plot 6 |
| Vegetation classification | Class D Scrub |
| Description / justification | Vegetation with a continuous horizontal and vertical structure, greater than 2 m high at maturity |


Photo ID: 7a


Photo ID: 7b


Photo ID: 7c

| | |
|---|---|
| Plot number | Plot 7 |
| Vegetation classification | Class B Woodland |
| Description / justification | Trees 2-30 m at maturity, dominated by trees with a grassy understorey (lacks shrubby middle layer and deep surface litter) |


Photo ID: 8a

| | |
|---|---|
| Plot number | Plot 8 |
| Vegetation classification | Excluded – Clause 2.2.3.2 [a] |
| Description / justification | Classified vegetation >100m from site |


Photo ID: 9a


Photo ID: 9b

| | |
|---|---|
| Plot number | Plot 9 |
| Vegetation classification | Excluded – Non-vegetated (Clause 2.2.3.2 [e]) |
| Description / justification | Non-vegetated firebreak |


Photo ID: 10a


Photo ID: 10b


Photo ID: 10c


Photo ID: 10d


Photo ID: 10e


Photo ID: 10f

| | |
|---|---|
| Plot number | Plot 10 |
| Vegetation classification | Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f]) |
| Description / justification | Low threat cultivated gardens and maintained lawns within surrounding properties and non-vegetated areas including roads, footpaths, driveways and building footprints |


Photo ID: 10g


Photo ID: 10h


Photo ID: 10i


Photo ID: 10j


Photo ID: 10k

| | |
|---|---|
| Plot number | Plot 10 |
| Vegetation classification | Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f]) |
| Description / justification | Low threat cultivated gardens and maintained lawns within surrounding properties and non-vegetated areas including roads, footpaths, driveways and building footprints |


Photo ID: 11a


Photo ID: 11b


Photo ID: 11c


Photo ID: 11d


Photo ID: 11e


Photo ID: 11f

| | |
|---|---|
| Plot number | Plot 11 |
| Vegetation classification | Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f]) |
| Description / justification | Low threat cultivated gardens and maintained lawns within surrounding properties and non-vegetated areas including roads, footpaths, driveways and building footprints |


Photo ID: 11g


Photo ID: 11h


Photo ID: 11i

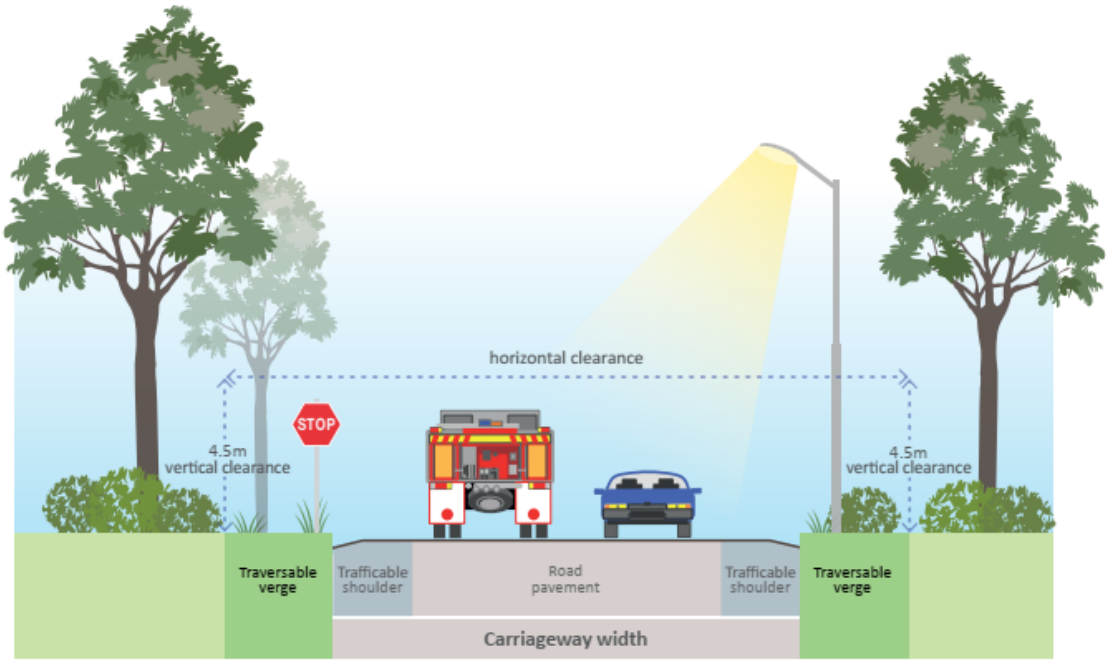

Photo ID: 11j


Photo ID: 11k

| | |
|---|---|
| Plot number | Plot 11 |
| Vegetation classification | Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f]) |
| Description / justification | Low threat cultivated gardens and maintained lawns within surrounding properties and non-vegetated areas including roads, footpaths, driveways and building footprints |

# Appendix D

## Vehicular Access Technical Standards of the PBG

| **Public Roads** |
|---|
| **Acceptable Solution A3.1** |
| Public roads, including perimeter roads should meet the technical requirements in Appendix B.3, Table 10 |
| **Appendix B.3.1** |
| The Guidelines do not prescribe values for the carriageway width or the horizontal clearance for public roads (except for perimeter roads). Public roads should be in accordance with the class of road as specified in the Public Works Engineering Australasia (IPWEA) subdivision guidelines, Liveable Neighbourhoods, Austroads Standards, any applicable or relevant Main Roads standards, supplements, policies and any applicable or relevant local government standards or policies.<br>However, it is important that public roads (and other forms of access) in bushfire prone areas, allow for emergency services vehicles to stop and operate on the side of the public road, specifically where the public road traverses large areas of classified vegetation.<br>It is, therefore, recommended that public roads achieve a minimum six metres horizontal clearance. Perimeter roads require additional width.<br>Where local or state government roads are proposed to be widened or modified by the proponent, as part of the structure planning process or at the subdivision stage, approval is required from the relevant government authority.<br>Figure 26: Area encompassing horizontal clearance and vertical clearance<br>  <br><br>**Horizontal clearance:** The carriageway width (including the road pavement and trafficable shoulder) and traversable verge that provides for the movement and parking of vehicles and area required by emergency services to operate. Infrastructure and vegetation within the traversable verge should be frangible, however, non-frangible items can occur providing they do not restrict vehicular movement in the event of an emergency. |

## No-Through Roads

### Acceptable Solution A3.3

A3.3a No-through Roads

If the public road access to the subject site is via a no-through road which cannot be avoided due to demonstrated site constraints, the public road access is to be a maximum of 200 m from the subject site boundary to an intersection where two-way access is provided.

The no-through road may exceed 200 metres if it is demonstrated that an alternative access, including an emergency access way, cannot be provided due to site constraints, and the following requirements are met

- the no-through road travels towards a suitable destination; and
- the balance of the no-through road that is greater than 200 metres from the subject site, is wholly within BAL-LOW, or is within a residential built-out area, or is within Area 1 (Figure 29).

A3.3b No-through Road Requirements

A no-through road is to meet all the following requirements:

- requirements of a public road (Appendix B.3, Table 10, Column 2); and
- turn-around area/head (Figure 30).

### Appendix B.3.3

No-through roads reduce the legibility of a road network and options available for access and egress in the event of a bushfire emergency. The inclusion of new no-through roads within subdivision or structure plan designs, in the first instance, should be avoided in bushfire prone areas.

However, where it is demonstrated, to the satisfaction of the decision-maker that a no-through road cannot be avoided due to site or design characteristics, the inclusion of a new no-through road is to be treated as an acceptable solution, if it satisfies the prescribed maximum road length. Where this is not demonstrated, a decision-maker is able to request a redesign to remove the no-through road.

The acceptable solution for no-through roads in areas shown as Area 2 on the Map of Bush Fire Prone Areas includes a maximum of 200 metres from the lot(s) boundary to an intersection where two-way access is provided (Figure 28). There is no prescribed maximum length for no-through roads in areas shown as Area 1 (Urban) on the Map of Bush Fire Prone Areas.

Figure 28: Demonstration of a lot achieving two-way access within 200 metres

## No-Through Roads

Figure 29: Example of a site on a no-through road greater than 200 metres but within 200 metres of BAL-LOW

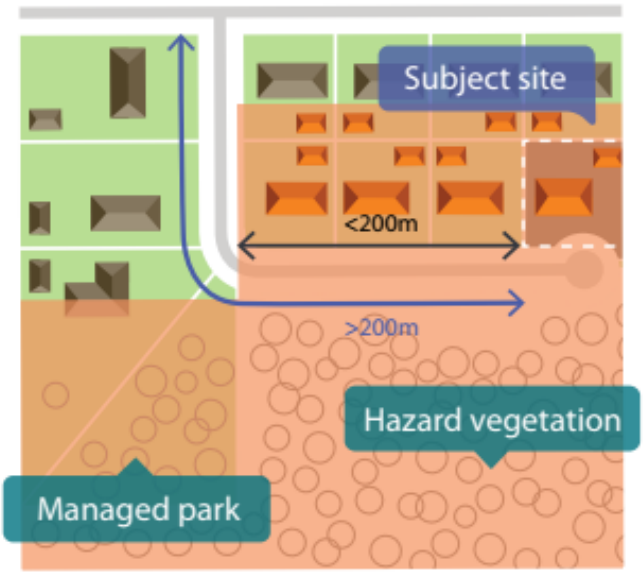



Figure 30: Design requirements for a turn-around area

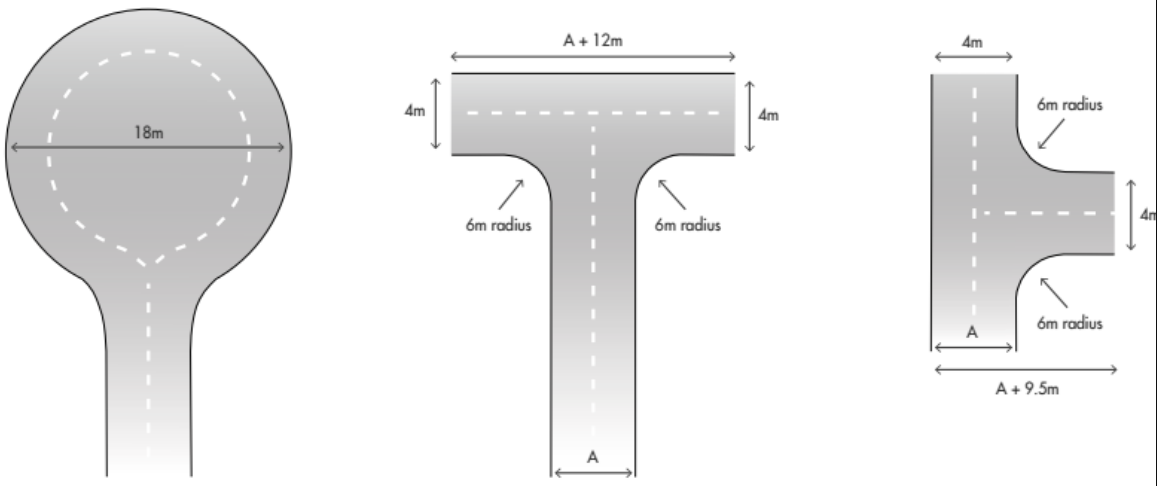


Table 10: Vehicular access technical requirements

| | 1 | | 2 | | 3 | | 4 | | 5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **TECHNICAL REQUIREMENTS** | **PERIMETER ROADS** | | **PUBLIC ROADS** | | **EMERGENCY ACCESS WAY[3]** | | **FIRE SERVICE ACCESS ROUTE[3]** | | **BATTLE-AXE & PRIVATE DRIVEWAYS[1]** | |
| **MAP OF BUSH FIRE PRONE AREAS DESIGNATION** | **Area 2** | **Area 1** | **Area 2** | **Area 1** | **Area 2** | **Area 1** | **Area 2** | **Area 1** | **Area 2** | **Area 1** |
| Minimum horizontal clearance (metres) | 12 | 8 | See note 5 | | 10 | 6 | 10 | 6 | 6 | |
| Minimum vertical clearance (metres) | 4.5 | | | | | | | | | |
| Minimum weight capacity (tonnes) | 15 | | | | | | | | | |
| Maximum grade unsealed road[2] | See note 5 | | See note 5 | | 1:10 (10% or 6°) | | | | | |
| Maximum grade sealed road[2,4] | | | | | 1:7 (14.3% or 8°) | | | | | |
| Maximum average grade sealed road | | | | | 1:10 (10% or 6°) | | | | | |
| Minimum inner radius of road curves (metres) | | | | | 8.5 | | | | | |

Notes:

[1] Driveways and battle-axe legs to comply with the Residential Design Codes and Development Control Policy 2.2 Residential Subdivision where not required to comply with the widths in this Appendix or the Guidelines.

[2] Dips must have no more than a 1 in 8 (12.5% - 7.1 degrees) entry and exit angle.

[3] To have crossfalls between 3 per cent and 6 per cent.

[4] For sealed roads only the maximum grade of no more than 1 in 5 (20 per cent) (11.3 degrees) for no more than 50 metres is permissible, except for short constrictions to 3.5 metres for no more than 30 metres in length where an obstruction cannot be reasonably avoided or removed.

[5] As outlined in the Institute of **Public Works Engineering Australasia (IPWEA) subdivision guidelines, Liveable Neighbourhoods, Austroads Standards** Main Roads standard, supplement, policy or guideline and/or any applicable or relevant local government standard or policy.

# Appendix E

## Water Technical Standards of PBG

| Appendix B.4 – Water Supply |
|---|
| **B4.1 Construction and Design Technical requirements** |
| • An above-ground tank and associated stand should be constructed of non-combustible material.<br>• Below-ground tanks should have a 200 millimetres diameter access hole to allow tankers or emergency services vehicles to refill direct from the tank, with the outlet location clearly marked on the surface.<br>• Above and below ground tanks may need to comply with AS/NZS 3500.1:2018.<br>• An inspection opening may double as the access hole provided that the inspection opening meets the requirements of AS/NZS 3500.1:2018.<br>• Where an outlet for an emergency services vehicle is provided, then an unobstructed, hardened ground surface is to be supplied within four metres of any water supply.<br>B4.1.1 Pipes and Fittings<br>• All above-ground, exposed water supply pipes and fittings should be metal.<br>• Fittings should be located away from the source of bushfire hazard and be in accordance with the applicable section below, unless otherwise specified by the local government.<br>B4.1.2 Fittings for above-ground water tanks<br>• Commercial land uses: 125mm Storz fitting; or<br>• Strategic water tanks: 50mm or 100mm (where applicable and adapters are available) male camlock coupling with full flow valve; or<br>• Standalone water tanks: 50mm male camlock coupling with full flow valve; or<br>• Combined water tanks: 50mm male camlock coupling with full flow valve or a domestic fitting, being a standard household tap that enables an occupant to access the water supply with domestic hoses or buckets for extinguishing minor fires.<br>B4.1.3 Remote outlets<br>• In certain circumstances, it may be beneficial to have the outlet located away from the water supply. In instances in which a remote outlet is to be used, the applicant should consult the local government and DFES on their proposal. |
| **B4.2 Use of Water Supply** |
| • The combination of drinking water and water for firefighting purposes is not recommended, as stagnant water may alter the quality of the drinking water and the emergency services, by law, may not be able to take water from the water supply to suppress a bushfire.<br>• Combining drinking water and water for firefighting purposes is contrary to provisions within clause 4.2.3 of AS/ NZS 3500.1:2021 |
| **B4.3 Independent Water and Power Supply** |
| • Water tank/s are to be provided in accordance with Table 11, Water supply dedicated for bushfire firefighting purposes. |
| **B4.5 Location of Water Tanks and Hydrants** |

## Appendix B.4 – Water Supply

Figure 39: A good and bad example of landscaping around a water tank

Table 11: Water supply dedicated for bushfire firefighting purposes

| SECTIONS FROM THE PLANNING FOR BUSHFIRE GUIDELINES | | | | | |
|---|---|---|---|---|---|
| **SECTION 5[2] STRUCTURE PLANS AND SUBDIVISION APPLICATIONS** | | **SECTION 6[2] DEVELOPMENT – RESIDENTIAL** | **SECTION 7[2] DEVELOPMENT – COMMERCIAL & INDUSTRIAL** | **SECTION 8[2] – DEVELOPMENT – VULNERABLE LAND USES** | |
| One additional lot | 10,000 litre water tank per lot | 10,000 litre water tank per habitable building | For each habitable building - 10,000 litre per 1,500 m² of floor space up to 50,000 litre. Provided in a water tank | Camping ground | At the discretion of the local government |
| Three to 24 lots | 10,000 litre water tank per lot[1] **or** 50,000 litre strategic water tank | | | | |
| 25 lots or more | 50,000 litre per 25 lots or part thereof, provided as a strategic water tank(s) **and/or** 10,000 litre water tank per lot | | | Other vulnerable land uses | For each habitable building - 10,000 litre per 500 m² of floor space up to 50,000 litre. Provided in a water tank |

Notes:

[1] Evidence that the identified water supply amounts in either column denoted is to be provided at the relevant planning stage.

[2] where more than one habitable building is proposed, strategic water tanks are to be provided in accordance with Section 5 requirements and at the discretion of the Local Government.

# Appendix F

## Shire of Chapman Firebreak Notice

# BUSH FIRES ACT 1954 AS AMENDED

Notice is hereby given to all land owners in areas requiring compulsory firebreaks that these must be installed by 15 October and maintained free of flammable material as required under the Bush Fire Act 1954 and in accordance with this Notice, approved fire management plans or approved variations to this Notice.

## HARVESTING OPERATIONS

1. No harvesting operations are permitted on **Christmas Day**, **Boxing Day** and **New Years Day**. A separate fire fighting fire appliance is required to be present in any paddock being harvested, chaining, raking stubble, straw baling and associated allied activities during restricted and prohibited periods. The fire fighting unit must be in a state of readiness and have a minimum capacity of 400L of water, a powered pump and hose. The farm fire fighting unit should be parked on bare ground in or near the harvesting or working area.
2. A Harvesting and Movement Ban and Use of Internal Combustion Engines (except for the watering and movement of stock) will be imposed when the actual weather conditions reach a Fire Danger rating of thirty five (35) on the maximum wind speed at the weather stations of two (2) bush fire brigades. All such bans are at the discretion of the Chief Bush Fire Control Officer or a duly appointed person.

If a ban has been imposed, all persons registered will be sent a text message advising of details. All bans will still be broadcast on radio:

**ABC State wide AM**
**98.1 FM & 96.5 FM**

**NOTE:** Attention of landowners is drawn to the fact that this order allows for provision of firebreaks in situations other than immediately with property boundaries subject to approval. The Chief Bush Fire Control Officer and appointed Fire Control Officers have been authorised to act for Council in this matter.

**FAILURE TO INSTALL AND MAINTAIN FIREBREAKS IN ACCORDANCE WITH THIS NOTICE MAY RESULT IN A $5,000 PENALTY**

## PROPERTIES WILL BE INSPECTED TO ENSURE COMPLIANCE WITH COUNCILS REQUIREMENTS

### SMALL LOTS RESIDENTIAL & SPECIAL RURAL / RURAL RESIDENTIAL / RURAL SMALL HOLDINGS UP TO 3.0HA

Mowed, slashed to a maximum height of 7.5cm. Mineral earth (bare earth) firebreaks not permitted.

All structures and buildings must have a minimum 2m clearance of all flammable material. All dead trees, shrubs must be removed from block unless application is made to retain dead trees, shrubs prior to 15 October and approved. Exemptions will only be considered if presented in writing by 15 October.

### RESIDENTIAL & SPECIAL RURAL / RURAL RESIDENTIAL / RURAL SMALL HOLDINGS 3.0HA PLUS

Fire breaks must be mineral earth (bare earth) a minimum 3m wide and have minimum overhead clearance 4m or have flammable material graded, mowed or slashed to a maximum height of 7.5cm over the entire property (excluding managed vegetation such as ornamental trees, distinct islands of vegetation remote from boundaries and assets).

All structures and buildings must have a minimum 3m clearance of all flammable material. All dead trees, shrubs must be removed from block unless application is made to retain dead trees, shrubs prior to 15 October and approved. Exemptions will only be considered if presented in writing by 15 October.

If it is considered for any reason to be impracticable to clear firebreaks as required by this notice, or if you consider natural features render firebreaks unnecessary, you may make your case in writing to the Shire.

### FUEL PUMPS (FUEL DEPOTS)

On or before the 15 October all grass and similar material is to be cleared from such places where drum ramps are located and where drums, empty or full, are stored and such areas to be maintained cleared of grass and similar flammable material until 15 March.

### FIRE MANAGEMENT PLANS

If your property has an approved fire management plan in place then you are to comply with the requirements of that plan in full.

### FARM BUILDINGS AND UNATTENDED ELECTRIC MOTORS AND HAY STACKS

Fire breaks at least 2m in width completely surrounding and not more than 20m from the perimeter of any building, group of buildings or haystacks. All flammable material must be removed from an area 3m in width immediately surrounding the building. All flammable material must be removed from an area 3m in width immediately surrounding an unattended electric motor site.

### UNATTENDED FUEL OPERATED MOTORS

All flammable material must be removed from an area 2m in width immediately surrounding an unattended fuel operated motor whether the motor is intended to be used or not.

### RURAL LAND

Firebreaks must be provided not less than 2m in width inside and along the whole of the external boundaries of the properties owned or occupied; where this is not practicable the firebreaks must be provided as near as possible to, and within, such boundaries.

### BARBEQUES AND INCINERATORS

Gas and electric barbeques are permitted any time. Solid fuel barbeques and incinerators are **PROHIBITED** on days of VERY HIGH FIRE DANGER or above.

### PENALTY

The penalty for failing to comply with this notice is a fine of up to $250 and a person in default is also liable, whether prosecuted or not, to pay the cost of performing the work in this notice. If it is not carried out by the owner or occupier by the date required by this notice.

## BUSH FIRE CONTROL OFFICERS

**Chief Bush Fire Control Officer & Fire Weather Officer**

Andrew Vlahov — Mob: 0427 205 144
UHF: 5

**Yetna Brigade, Deputy Chief Bush Fire Control Officer & Deputy Fire Weather Officer**

**Local Bush Fire Control Office**
Jason Stokes — Ph: 9920 5555, Mob: 0407 388 511

(in the absence of the Chief Bush Fire Control Officer/Fire Weather Officer, the Deputy becomes the Acting Chief Bush Fire Control Officer/Fire Weather Officer)

**Naraling Brigade**

**Local Bush Fire Control Officer:**
Craig Mincherton — Ph: 9920 3033, Mob: 0417 957 075
UHF: 33

**Howatharra Brigade**

**Local Bush Fire Control Officer:**
Calvin Royce — Ph: 9925 1010, Mob: 0427 251 016
UHF: 29

**Nabawa Brigade**

**Local Bush Fire Control Officer:**
Neil Kupsch — Ph: 9920 5050, Mob: 0429 108 289
UHF: 4

**Yuna Brigade**

**Local Bush Fire Control Officer:**
Shaun Earl — Mob: 0429 108 425
UHF: 20

**Durawah/Valentine Brigade**

**Local Bush Fire Control Office**
Bruce Ley — Mob: 0428 930 423
UHF: 51

**Shire and Emergency Two-way Radio Channel**

UHF: 11 — Senior Ranger: 0428 948 073

**Bush Fire Services**
**FESA**

**Ph: 9956 0000**

000 EMERGENCY

## CONTRACTORS

| | |
|---|---|
| Morgan Mowing | 0439 242 993 |
| Central Earthmoving | 0459 301 851 |
| Centre Point Earthmoving - Chris Newman | 0427 976 833 |
| Graham Hancock | 0408 230 421 |
| Midwest Mulching & Mowing | 0429 341 306 |
| SMS Group WA | 9935 9230 |
| Ivey Contracting **(Grading Only)** | 0428 840 935 |

### Tree Plantations

Construct a 30m wide mineral earth firebreak around the perimeter of the plantation, with a 4m high vertical clearance of all inflammable material. This being in addition to compliance with the DFES 'Guidelines for Plantation Fire Protection' requirements, the Shire of Chapman Valley 'Tree Farms' Local Planning Policy and specific individual plantation development approval conditions.

## PENALTIES

| | |
|---|---|
| Failure to maintain a firebreak as per firebreak order | $250 |
| Offence relating to lighting a fire in the open air | $250 |
| Setting fire to bush during prohibited burning period | $250 |
| Failure of Occupier to extinguish a bushfire | $250 |
| Refusal to state name and abode or stating a false name and abode | $100 |
| Failure to produce permit to burn | $100 |

Fire Control Officers are not obliged to issue permits.

Permits cannot be issued over the phone and should a Fire Control Officer refuse to issue a permit, it's a breach of the Bush Fire Act 1954 to request a permit from another Fire Control Officer.

You MUST have a copy of the permit on you during the burn.

SHIRE OF
Chapman Valley
*love the rural life!*

### FIRST AND FINAL

# Fire Break Notice 2024/25 Period

**SECTION 33 BUSH FIRE ACT**

**PROHIBITED BURNING PERIOD YUNA (Zone 2)**
15 October to 14 February
**All OTHER AREAS (Zone 4)**
15 October to 14 February
**STRICTLY NO BURNING**

**RESTRICTED BURNING PERIOD YUNA (Zone 2)**
1 September to 14 October
15 February to 7 April
**ALL OTHER AREAS (Zone 4)**
1 September to 14 October
15 February to 7 April
**PERMITS ARE REQUIRED**

**COMPULSORY FIREBREAKS (Zone 4)**
**Nabawa / Yetna / Howatharra Brigades**
15 October to 7 April

**FIRST AND FINAL NOTICE IS HEREBY SERVED TO ALL RESIDENTS AND RATEPAYERS**

Failure to install and maintain firebreaks in accordance with this notice may result in a $5,000 fine.

# Appendix D

## North West Coastal Hwy/Wokarena Rd Intersection Upgrade Design Report

# Shire of Chapman Valley

## North West Coastal Hwy/Wokarena Rd Intersection Upgrade

## Design Report

August 2013

# Table of contents



# Table index



# Appendices

# 1. Introduction

## 1.1 Background

North West Coastal Highway is one of the main north south road connections between Geraldton and Port Hedland. Wokarena Road is the main connection of the planned Wokarena Heights Subdivision into the North West Coastal Highway.

This design is to improve the current intersection through the addition of auxiliary lanes from the north and south side of North West Coastal Highway into Wokarena Road, based on the traffic volumes allowing for future gradual development of the Wokarena Heights Subdivision.

### 1.1.1 Traffic Assessment

A traffic study (refer to Appendix A for the Traffic Study Report) was conducted to determine a base and future year scenario of the proposed intersection and review the required facilities for the intersection due to the road design speed and geometric parameters.

The traffic study report indicates that the intersection will operate within capacity if installed with no further lane treatments required along North West Coastal Highway. However, due to the approach speeds and gradient, the use of Austroads guidance has indicated the requirement for an auxiliary left turn lane and channelised right turn lane.

### 1.1.2 Survey

No survey data or as constructed information was available from the Shire of Chapman Valley or from Main Roads WA. Therefore GHD obtained site survey information using an in house survey team.

### 1.1.3 Services

Services investigation revealed the presence of the Water Corporation services in the vicinity of the proposed works. Overhead power lines and below ground Telstra assets are also present.

## 1.2 Purpose of This Report

GHD have been engaged by the Shire of Chapman Valley for the detailed design and documentation of the improvement of the North West Coastal Highway / Wokarena Road intersection. The intersection design includes a channelised right turn lane into Wokarena Road and a left turn auxiliary lane from North West Coastal Highway into Wokarena Road.

This report presents the detailed design of the intersection improvement works and includes the following aspects:

- Design standards;
- Intersection design and road widening;
- Pavement marking and signage design;
- Stormwater drainage design;
- Lighting design; and
- Project cost indication.

## 1.3 Scope and Limitations

This report has been prepared by GHD for Shire of Chapman Valley and may only be used and relied on by Shire of Chapman Valley for the purpose agreed between GHD and the Shire of Chapman Valley as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Shire of Chapman Valley arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The Project Cost Indication is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Project Cost Indication and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the works/project can or will be undertaken at a cost which is the same or less than the Project Cost Indication.

Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

# 2. Design Standards

## 2.1 General

Design standards generally conform to Main Roads WA and Austroads requirements, that includes design criteria for design speed, design vehicles, typical cross section dimensions, horizontal and vertical alignments, stormwater drainage and intersection design.

## 2.2 Roads

### 2.2.1 Design Speed

The traffic study report indicates a current design speed of 100 km/hr for North West Coastal Highway. The existing horizontal geometry on the curve approaching the intersection does not meet the requirements for approach speed and gradient. Thus, a dedicated left turn auxiliary lane and channelised right turn lane are proposed to meet the requirements for increased traffic volumes assuming future growth rates.

### 2.2.2 Design Vehicle

Design vehicles must be able to make legal, although not necessarily lane correct turning movements. The design vehicle adopted for the swept path analysis of the proposed works is a 19m semi-trailer. Road alignment and intersection geometry was tested with the aid of software to check the turning radius for large vehicles.

### 2.2.3 Traffic Study

A traffic study was undertaken using the Main Roads WA provided traffic information. Refer to the Traffic Study Report in Appendix A for discussion on the traffic volumes used in the upgrade intersection design.

### 2.2.4 Typical Cross Section

#### *North West Coastal Highway*

The typical cross section for the North West Coastal Highway adopts the existing road cross sections but with the addition of the channelised right turn lane and a dedicated left turn auxiliary lane as recommended in the traffic study report:

- Right turn treatment: additional width of 3.5 metres over a length of 219 metres;
- On a gradient of less than 3%, left turn treatment required with an additional width of 3.5 metres over a length of 84 metres; and.
- The carriageway comprises of two (2) 3.5m traffic lanes with 1m shoulder, 1m verge and kerbed verge at intersections.

#### *Wokarena Road*

The typical cross section for Wokarena Road comprises of two (2) 3.5m traffic lanes, 2.5m kerbed verge at intersections and 1m shoulder beyond the kerbed area.

### 2.2.5 Horizontal Geometry

Horizontal geometry is in accordance with Main Roads WA and Austroad design guidelines.

Table 1 Horizontal Alignment Criteria

| Item | Value |
|---|---|
| Grades | Extension of existing |
| Minimum Horizontal Radius | As existing |
| Superelevation | Extension of existing |
| Lane widths | 3.5m |
| Shoulder width | 1.0m sealed |
| Verge width | 1.0m northbound on North West Coastal Highway<br>2.5m when kerbed |
| Batters – Fill | 1V : 6H |
| Batters – Cut | 1V : 4H |
| Kerbing | The road shall be unkerbed except where required at the intersection |

### 2.2.6 Vertical Geometry

No vertical geometric design is required. The road widening adopts the existing vertical geometry for both North West Coastal Highway and Wokarena Road.

### 2.2.7 Drainage

Given that the proposed works has minimal need for the design and construction of new drainage infrastructure, the majority of typical design standards were found to be inapplicable to the project.

### 2.2.8 Table Drains

All open drains has been designed in accordance with the Main Roads Road and Traffic Engineering Branch's Guideline "Open Drains for Roads" Document No. 67-08-74 (Revision 1B).

In particular, table drains shall be designed to the following design criteria:

- Design Average Recurrence Interval (ARI) of 10 years;
- Minimum drain depth (from the edge of the road shoulder to the invert) is 0.3 m;
- Drain side slopes of 1 in 4; and
- Absolute minimum drain gradient of 0.3%.

### 2.2.9 Street Lighting

Street lighting design is in accordance with Western Power lighting standards and to AS/NZS1158 Category V3.

# 3. Design

## 3.1 Road Design

The intersection of North West Coastal Highway and Wokarena Road is an unsignalised T-intersection with no current dedicated left or right turn pockets on either of the intersection legs. The design for the North West Coastal Highway and Wokarena Road intersection was conducted such that costs and impacts were minimal, while attaining maximum benefits. Design was conducted with reference to Main Roads WA and Austroads standards. Refer to Appendix B for the Drawing Index.

### 3.1.1 Cross Section and Widening

Pavement widening has been developed as an extension of the existing road, maintaining the existing alignment and cross fall as much as possible. Pavement widening is required at the following sections:

- Dedicated left turn auxiliary lane extending 84m north of the intersection along North West Coastal Highway. Widening is constructed from the existing edge of seal and comprises 3.5m of sealed pavement, 0.6m sealed shoulder and 2.5m of unsealed verge;
- Channelised right turn lane extending 219m south of the intersection along North West Coastal Highway. Widening is constructed from the existing edge of seal and comprises 3.5m of sealed pavement and 1m of sealed shoulder and 1 m of unsealed verge;
- Widening to accommodate a separation island with pavement marking along North West Coastal Highway north and south of Wokarena Road; and
- Widening at the intersection to allow for turning paths for a 19m semi-trailer truck.

#### *Superelevation*

The pavement will be an extension of the existing cross fall along North West Coastal Highway and Wokarena Road. Requirements for superelevation were not checked as no as constructed data for superelevation was provided.

According to the 2011 Main Roads WA Curve Tables, the required superelevation is 4.5% for a 90km/hr design speed and a 500m curve. The existing superelevation ranges from 1% to 7%.

### 3.1.2 Horizontal Alignment

An additional 3.5 m lane along North West Coastal Highway has been developed to allow separation of left and right turn movements. Separation islands (diagonal markings at pavement level) are proposed to be installed on North West Coastal Highway approaching the intersection to allow this development of separate left and right turn movements.

### 3.1.3 Vertical Alignment

The road widening adopts the existing vertical geometry for both North West Coastal Highway and Wokarena Road. All proposed intersection modifications are extensions of existing cross falls.

### 3.1.4 Tie In and Blend Areas

The design must tie in and be consistent with actual on site features. Specifically, the existing geometry was optimised as much as possible in the design and continuity was maximised with adjacent pavement and surfacing conditions, pavement markings, surface texture, joint lines and kerb conditions.

However, where the road design varies from the existing alignment, the following tie ins and blend areas were designed in order to minimise disturbance:

- All pavement widening works blend into existing pavement earthworks at their extents over 20 m length and the design levels and cross sections blend into the existing surface in this area; and
- Existing pavement superelevation and cross fall are maintained and extended into new design.

### 3.1.5 Intersection Design

#### *Intersection treatment*

The North West Coastal Highway and Wokarena Road Traffic Study (see Appendix A) was conducted to review road accessibility as part of the Wokarena Road Structure Plan development to determine an appropriate intersection treatment to satisfy the A.M. and P.M. peak hour traffic volumes for the forecast year 2031.

Results from the traffic study indicated that the intersection will operate within capacity if installed with no further lane treatments required along the North West Coastal Highway. However, due to the approach speeds and gradient on the road approach, Austroads guidance has indicated the requirement for an auxiliary left turn lane and channelised right turn lane.

The study also found that the Level of Service (LOS) A is applicable for the 2012 and 2031 scenarios. It is also advised that the queue lengths should not exceed 23m in both the 2031 A.M. and P.M. peak hour scenarios.

The final intersection layout comprises of the following requirements based on Austroads guidance:

- Right turn treatment: additional width of 3.5 metres over a length of 219 metres, assuming flat grade and assuming no B-doubles or road trains turning into Wokarena Road;
- On gradients less than 3%, there would be a left turn treatment required with an additional width of 3.5 metres over a length of 70 metres. It is expected that there is a downgrade of over 3% therefore the lane length should be increased to 84 metres;
- In total, the additional width requirements would therefore be 7m; this is in addition to the existing requirements that include, on each side, a 1m sealed shoulder and a 1 to 2.5m verge;
- Vehicle turning templates were used to determine the exact requirements, along with other detailed considerations; and
- This layout results in a substantial improvement in performance for the vehicles entering Wokarena Road and improves capacity of the right and left turn movement from North West Coastal Highway into Wokarena Road.

#### *Intersection medians and kerbing*

Painted medians with diagonal markings are to be installed in the vicinity of the intersection.

Both North West Coastal Highway and Wokarena Road are unkerbed except at the intersection.

### 3.1.6 Pedestrian and cyclist facilities

Currently, no pedestrian and cyclist facilities are provided at the intersection of North West Coastal Highway and Wokarena Road.

No formal pedestrian facilities are provided at the intersection given the remote nature of the area. There are no developments or footpaths in the vicinity of the works.

## 3.2 Earthworks and Batter Slopes

Fill batter of 1V:6H is employed, while cut batters are set at 1V:4H based on the Main Roads WA supplement to Austroads. Where pavement widening is required, drains are graded at minimum of 0.3% longitudinal slope.

The earthworks batters on both sides of North West Coastal Highway extend outside the cadastral boundary because of the extension/widening of the existing road due to the introduction of a dedicated left turn auxiliary lane and channelised right turn lane. Given that the encroachment consists of minor batter earthworks that do not impact on any usable land, it is recommended that no property acquisition be undertaken for these minor earthworks encroaches. Refer to Drawings 201304-0311 to 201304-0316.

## 3.3 Drainage Design

The philosophy of the proposed drainage works is to minimise changes to the existing drainage system. Extensive drainage design is not required at the site as the proposed widening of the pavement does not alter the existing topography significantly.

The proposed drainage works will include the following:

- Incorporation of a kerb opening at the low point of the kerbed section at the intersection;
- Realignment of the existing table drain along southbound North West Coastal Highway from Cha. 301 to Cha. 512.5 as well as along Wokarena Road to North West Coastal Highway from the intersection to Cha. 83; and
- Construction of a proposed culvert underneath Wokarena Road to replace the existing culvert affected by the intersection upgrade.

### 3.3.1 Site Drainage

The existing stormwater runoff flows off the road surface towards existing table drains on both sides of the road. The survey shows that the existing drainage flows from the north to the south along North West Coastal Highway. Based on the site survey, a drainage culvert underneath the North West Coastal Highway and Wokarena Road intersection will be affected by the proposed road works. Due to the limited survey information, the size of the existing culvert has not been identified.

The realignment of the existing table drain is required due to the proposed road widening. As the increase in impervious area due to the road widening is expected to generate an insignificant additional amount of stormwater flow, the size and depth of the realigned table drain as well as the size of the proposed culvert will match the existing drainage system.

### 3.3.2 Table Drain

As the proposed intersection upgrade affects the alignment of the existing table drain, part of the existing table drain has to be realigned to accommodate the proposed road widening approaching the Wokarena Road intersection. A new table drain has been proposed along the southbound lane of North West Coastal Highway from Cha. 301 to Cha. 512.5. The table drain has been designed according to the standards listed in Section 2.2.8.

The table drain will collect stormwater runoff from the road and adjacent road reserve only and convey them to the south of North West Coastal Highway as consistent with the existing topography.

### 3.3.3 Culvert Crossing

The proposed culvert crossing underneath the Wokarena Road intersection will replace the existing culvert that has to be removed to accommodate the widening of the pavement. As the proposed culvert crossing will convey collected flows and connects to the existing table drain, the exact elevation and location of the existing table drain as well as the existing pipe culvert to be removed shall be verified on site prior to construction of the new culvert crossing.

## 3.4 Lighting Design

Street Lighting has been designed to Western Power lighting standards and to AS/NZS1158 Category V3.

Street light poles will be standard Western Power 12.5m high impact absorbing poles. Standard Western Power 250W high pressure sodium light fittings shall be used.

Power will be supplied to the street lighting using typical Western Power unmetered supply connections via underground cabling. Cabling will be to Western Power specifications.

The street lighting design will be provided to Western Power for their approval.

## 3.5 Pavement Marking and Signage

Existing minor signs will be relocated to suit the new intersection geometry and installation of new signs will be designed in accordance with Main Roads WA Traffic Engineering standards.

All new line marking will be tied into existing. New line marking will be installed for the modifications including road centre line markings, give way line on approach of Wokarena Road and diagonal lines to separate the northbound and southbound lanes of North West Coastal Highway.

# 4. Services

### 4.1.1 General

All service information from the project was obtained from Dial Before You Dig (DBYD) search and feature survey taken from site. All known services identified within the vicinity of the project are included on the drawings. Physical verification of the services shown to be either directly impacted by the design or critically close to the works shall be undertaken prior to construction.

### 4.1.2 Water Corporation

A 150mm existing Water Corporation water main runs along the eastern side of North West Coastal Highway and crosses to the western side at the Wokarena intersection.

# 5. Project Cost Indication

A preliminary cost indication for the works has been undertaken by Davson + Ward Quantity Surveyors and Construction Cost Consultants. The cost indication has been derived from the 100% design drawing set in accordance with the Main Roads Standard Method of Measurement for Construction Works (SMM). A summary of the cost indication is provided in Table 2.

Staging has been provided for the purpose of funding. The cost has been split up between the northbound carriageway and the southbound carriageway as development staging has not been established at present.

Table 2 Preliminary Cost Indication Summary

| Item | Cost indication |
|---|---|
| A. Southbound Phase | $ 467,864.77 |
| B. Northbound Phase | $ 371,630.59 |
| C. Roadway Lighting | $ 430,848.00 |
| **Total of Cost Estimate (GST inclusive)** | **$1,270,343.36** |

The full preliminary cost indication is provided in Appendix C.

# 6. Conclusion

The North West Coastal Highway and Wokarena Road Intersection improvement design consists of the following:

- The addition of a 3.5m left turn lane from North West Coastal Highway to Wokarena Road;
- The addition of a 3.5m right turn lane from North West Coastal Highway to Wokarena Road;
- New kerb and kerb openings at the intersection;
- Road widening as an extension of the existing road cross fall and superelevation;
- Utilisation of the existing drainage system with minimal changes where required; and
- Street lighting designed to Western Power lighting standards and to AS/NZS1158 Category V3..

# Appendices

# Appendix A – Traffic Study Report

# Shire of Chapman Valley

## Wokarena Road

## Information for MRWA

2 August 2013

# Table of contents



# Table index



# Figure index



# Appendices

# 1. Introduction

The Shire of Chapman Valley has appointed GHD to conduct a review of road accessibility as part of the Wokarena Road Structure Plan development proposal. This report provides SIDRA output information for the Wokarena Road/ North West Costal Highway for a Base and Future Year scenario and a review of required facilities for the intersection due to road design speed and geometric parameters.

A planned intersection has already been proposed for an "Ultimate Layout" scenario which is the layout that this report will discuss.

The location of this proposed intersection is shown in Figure 1. The intersection discussed in this report is being investigated due to a proposed Structure Plan which will use the intersection as access onto the North West Costal Highway.

**Figure 1 Location of intersection**


Map courtesy of Google Earth 2013

## 1.1 Current layout

The intersection is a three leg layout with all left and ahead movements on the northern leg, right and ahead movements on the southern leg and left and right turn movements on the

eastern leg. The north and south legs both have two lanes northbound and a single lane southbound. Figure 6 shows SIDRA details of the proposed layout.

All intersection layout details including lane widths are included in Appendix A.

# 2. Traffic data

Traffic data used for SIDRA model analysis of the proposed signalised intersection of Wokarena Road/ North West Costal Highway was obtained from traffic volumes provided by Main Roads (An average daily volume recorded as 3113 vehicles per day South of Drummond Cove Road was used and is the average daily volume for the period Friday 16th July 2010 to Friday 23rd July 2010.)

The peak hour flow calculations were carried out by identifying the location of the main attractors and generators for traffic in each peak hour. For this assessment, it was assumed that the main attractor for the am peak hour would be the town of Geraldton, to the south of the intersection. The proposed development, east of the intersection and traffic moving away from the town of Geraldton is assumed to be the main attractors for traffic in the pm peak hour.

## 2.1 Methodology

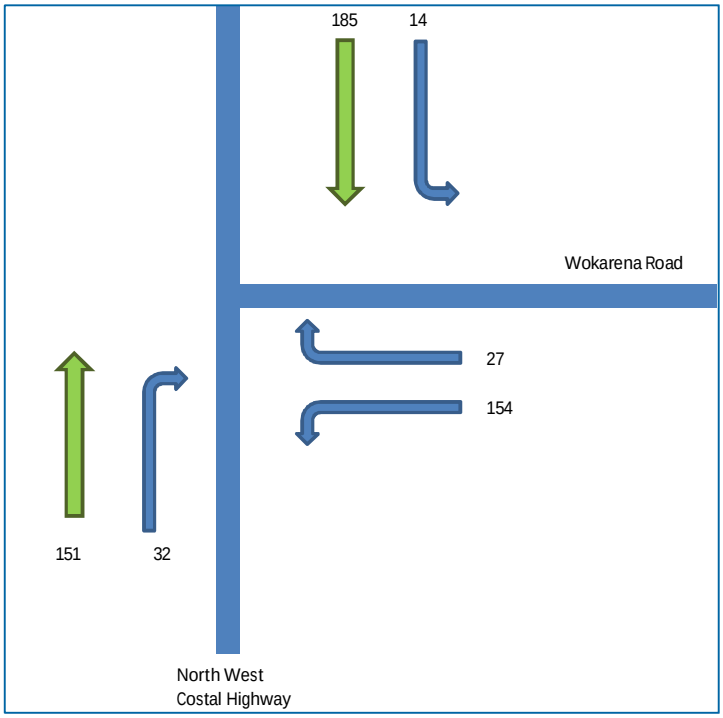
Using the traffic volumes and given dimensions previously discussed, two scenarios were created:

- 2012 base am and pm
- 2031 future year am and pm

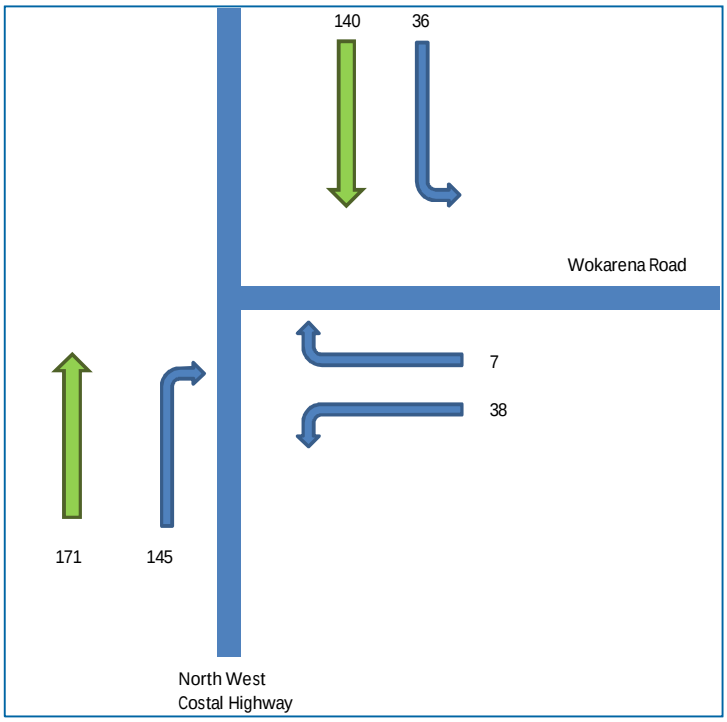
After discussions with Main Roads, a 4% annual increase was used for all traffic data and volumes for base and future year are shown in Figure 2 to Figure 5.

A 4% heavy vehicle distribution was also used for north and south bound movements at the intersection and a 2% heavy vehicle distribution was used for all movements in and out of the development access.

Figure 2 Base 2012 AM flows



## Figure 3 Base 2012 PM flows




## Figure 4 Future year 2031 AM Flows

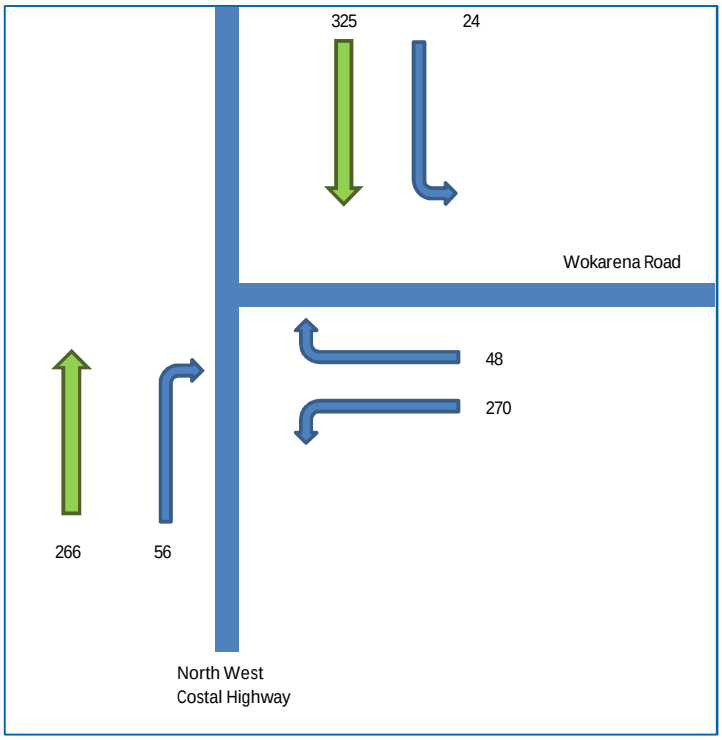
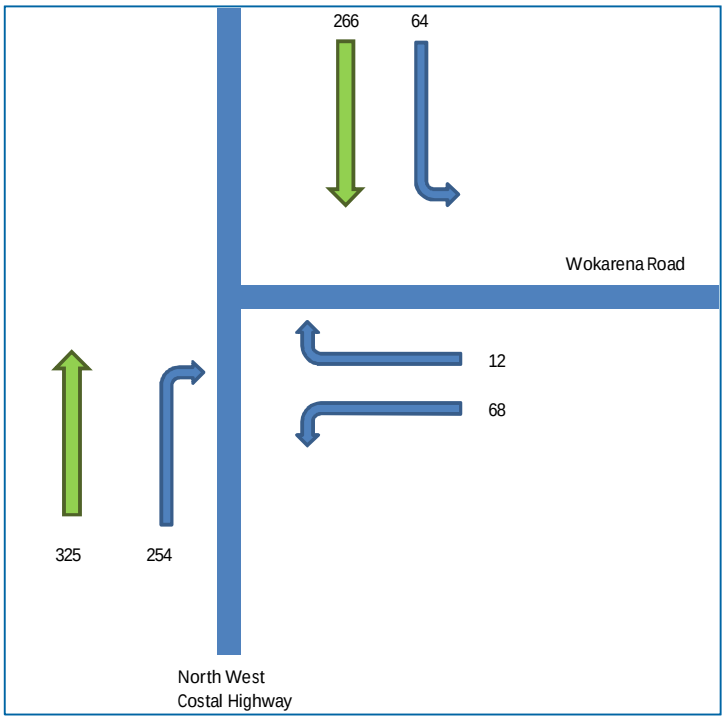


Figure 5 Future year 2031 PM flows




## 2.2 Analysis results summary

A summary of the results provided from the SIDRA models for the two scenarios is provided in Table 1 based on the following geometry in Figure 6. A copy of the SIDRA outputs is included in Appendix A.

Figure 6 Proposed intersection layout

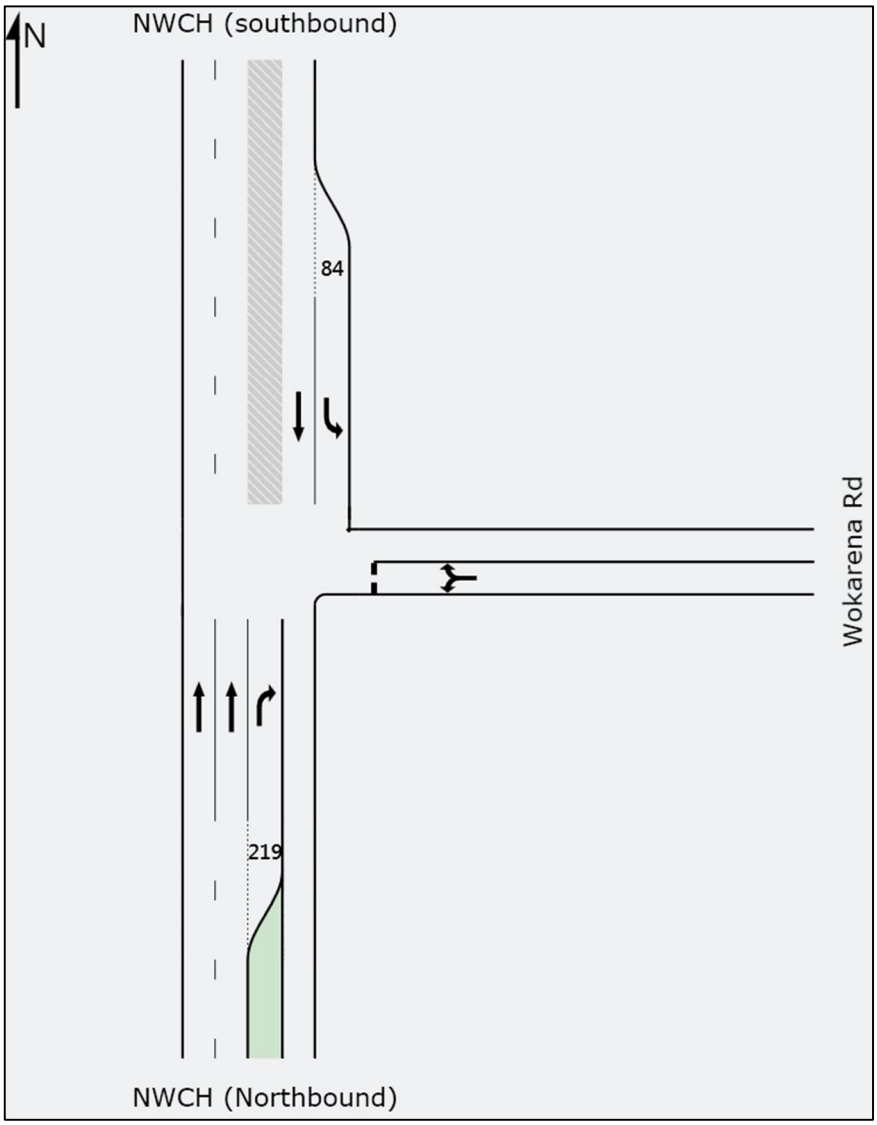



**Table 1 SIDRA summary of results**

| Scenario | Level of Service | Average Delay (seconds) | Degree of Saturation | Queue length (Metres) |
|---|---|---|---|---|
| 2012 am | B | 5.0 | 0.298 | 9.2 |
| 2012 pm | A | 3.9 | 0.119 | 3.5 |
| 2031 am | B | 5.5 | 0.483 | 22.4 |
| 2031 pm | B | 4.4 | 0.249 | 7.9 |

The results show a Level of Service (LOS) A and an average delay of less than 10 seconds for both scenarios.

The Degree of Saturation (DOS) for both scenarios shows that the layout should operate below the 90% acceptable DOS threshold.

It is predicted from the results that the queue lengths should not exceed 23 m in both the 2031 am and pm peak scenarios.

Based on this information, the intersection should operate satisfactorily in both the base and future year scenarios.

# 3. Austroads guidance

Austroads "*Guide to Road Design*" Part 4 A "*Unsignalised and Signalised Intersections*" (2009) provides guidance used to identify type of turning treatments, i.e. basic, auxiliary lane or channelized in Section 4.8. for turning vehicles regarding lane widths, turning pockets and associated lane distances.

Based on the current layout, lane configurations, gradients on approaches and a design speed of 100 km/ hour (90 km/ hour posted speed plus 10 km/ hour), the following layout based on this guidance would be required for the intersection:

- Right-turn treatment: additional width of 3.5 metres over a length of 219 metres, assuming flat grade and assuming no B-doubles or road trains turning into Wokarena Road
- On a gradient of less than 3%, there would be a left-turn treatment required with an additional width of 3.5 metres over a length of 70 metres. It is expected that there is a downgrade of over 3%, therefore the lane length should be increased to 84 metres.
- In total, the additional width requirements would therefore be seven metres; this is in addition to the existing requirements which include, on each side, a one metre sealed shoulder, an unsealed shoulder (typically one metre) and a verge (typically five metres)
- Vehicle turning templates should be used to determine the exact requirements, along with other detailed considerations

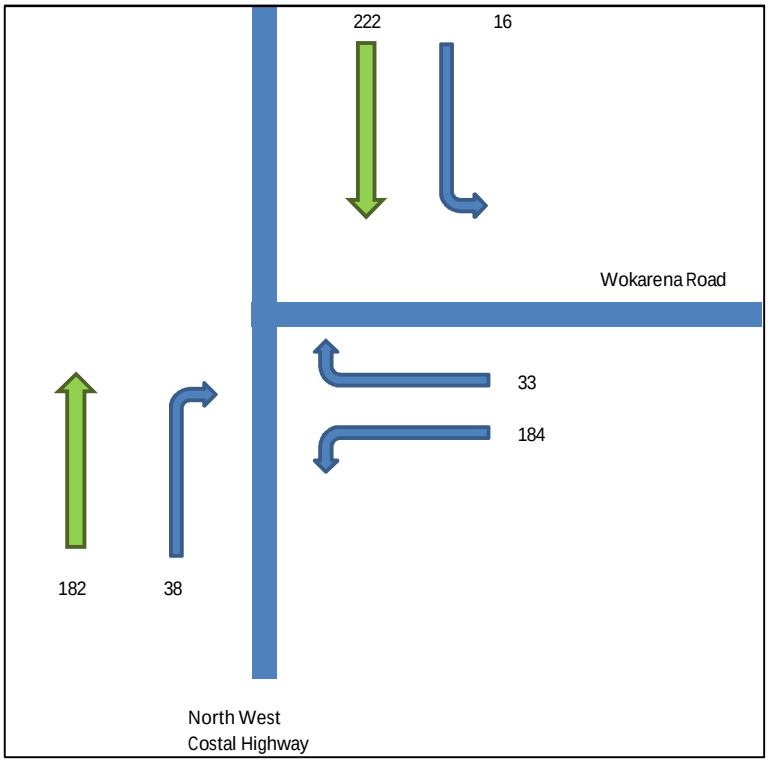
Figure 6 provides a SIDRA layout of the proposed intersection.

# 4. Staging process

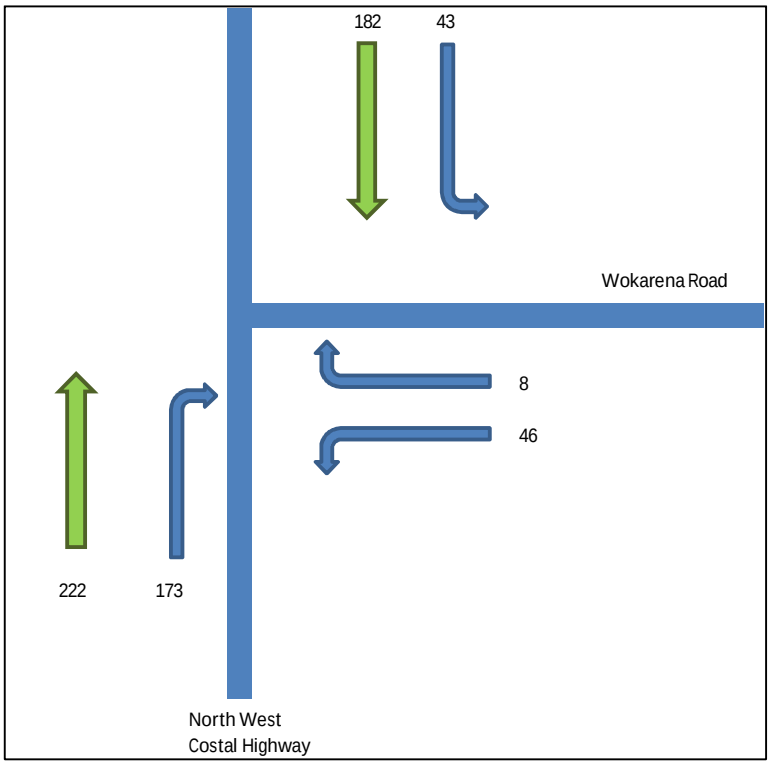
To achieve the most appropriate provision of access based on traffic volumes, traffic volumes have been calculated to identify volumes for 2017 and 2021. This will assist in providing a method of staging during both these years of growth.

Figure 7 to Figure 10 shows traffic flows for each of these assessment years in the am and pm peak period and SIDRA modelling has been carried out using a trial and error method of minimising upgrade works essential to ensure capacity of the intersection is not exceeded in both assessment years (2017 and 2021).

Figure 7 2017 AM Peak flows



## Figure 8 2017 PM peak flows




## Figure 9 2021 AM peak flows

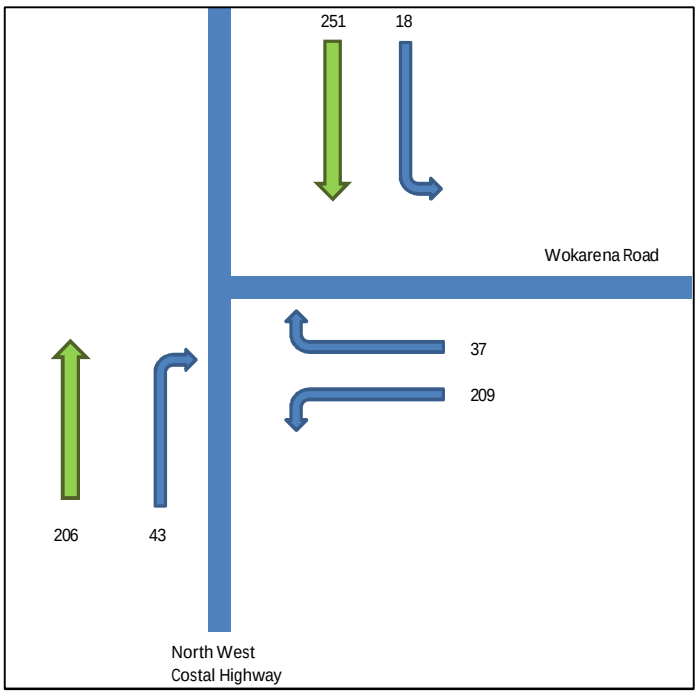


Figure 10 2021 AM peak flows

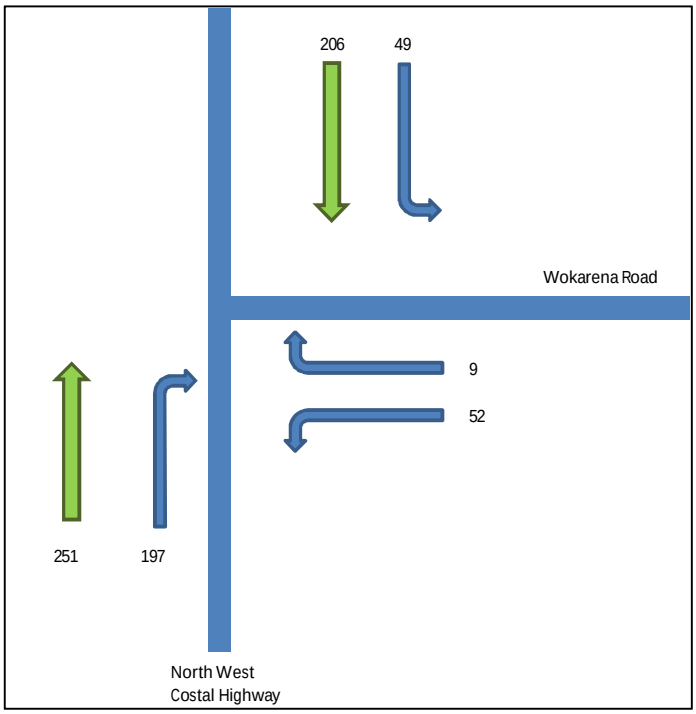
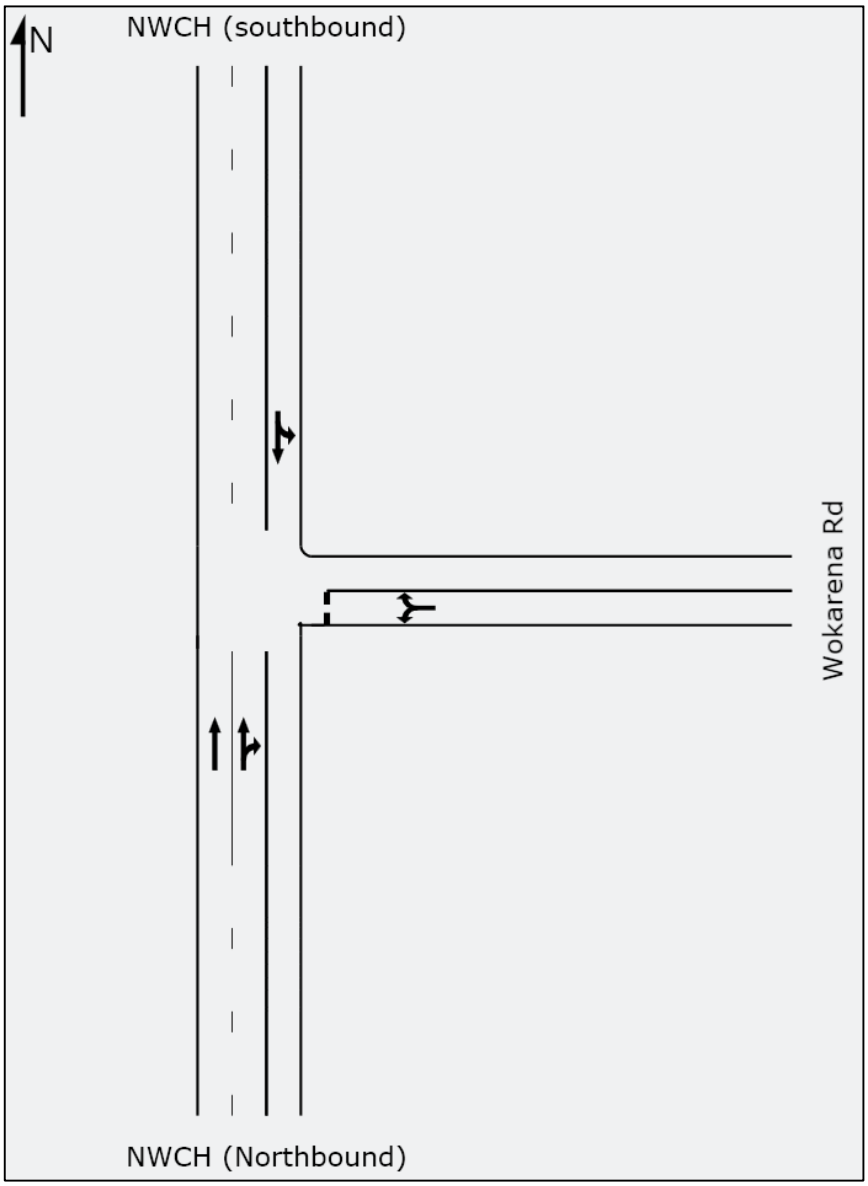



Table 2 shows output results for SIDRA modelling for both 2017 and 2021 years of assessment based on minimum upgrades for the intersection. The layouts of the intersection used for each assessment year is shown in Figure 11.

**Table 2 SIDRA summary of results**

| Scenario | Level of Service | Average Delay (seconds) | Degree of Saturation | Queue length (Metres) |
|---|---|---|---|---|
| 2017 am | A | 3.6 | 0.27 | 8.0 |
| 2017 pm | A | 3.7 | 0.15 | 4.5 |
| 2021 am | A | 3.9 | 0.32 | 10.4 |
| 2021 pm | A | 3.8 | 0.18 | 5.4 |

Figure 11 2017/ 2021 layout




From the SIDRA assessment results for years 2017 and 2021, the LoS for each assessment year, am and pm peaks did not exceed a LoS of A.

It is also apparent that without the right and left turn treatments at the intersection for 2031 am and pm peak modelling, the overall LoS for these 2031 assessment peak periods showed a LoS A. However, It should be important to understand that from a safety aspect, with traffic growth at this time as well as additional right turn and left turn movements on a sign posted 90 km/ hour road, the provision of these turning treatments would reduce the likelihood of collisions typically occurring with such right and left turn movements (right angle, rear end collisions etc).

# 5. Conclusions and recommendations

This report provides a detailed review and assessment of the SIDRA modelling for the proposed intersection of North West Costal Highway/ Wokarena Road.

SIDRA modelling results indicate that this intersection would operate to within capacity if installed with no further lane treatments along the North West Coastal Highway however, due to the approach speeds and gradient on the road approach, the use of Austroads Guidance has indicated the requirement for an auxiliary left turn lane and channelized right turn lane.

# Appendices

# Appendix A SIDRA modelling analysis data

**Content**

GHD

GHD House, 239 Adelaide Tce. Perth, WA 6004
P.O. Box 3106, Perth WA 6832
T: 61 8 6222 8222 F: 61 8 6222 8555 E: permail@ghd.com.au



G:\61\28702\WP\128248.docx

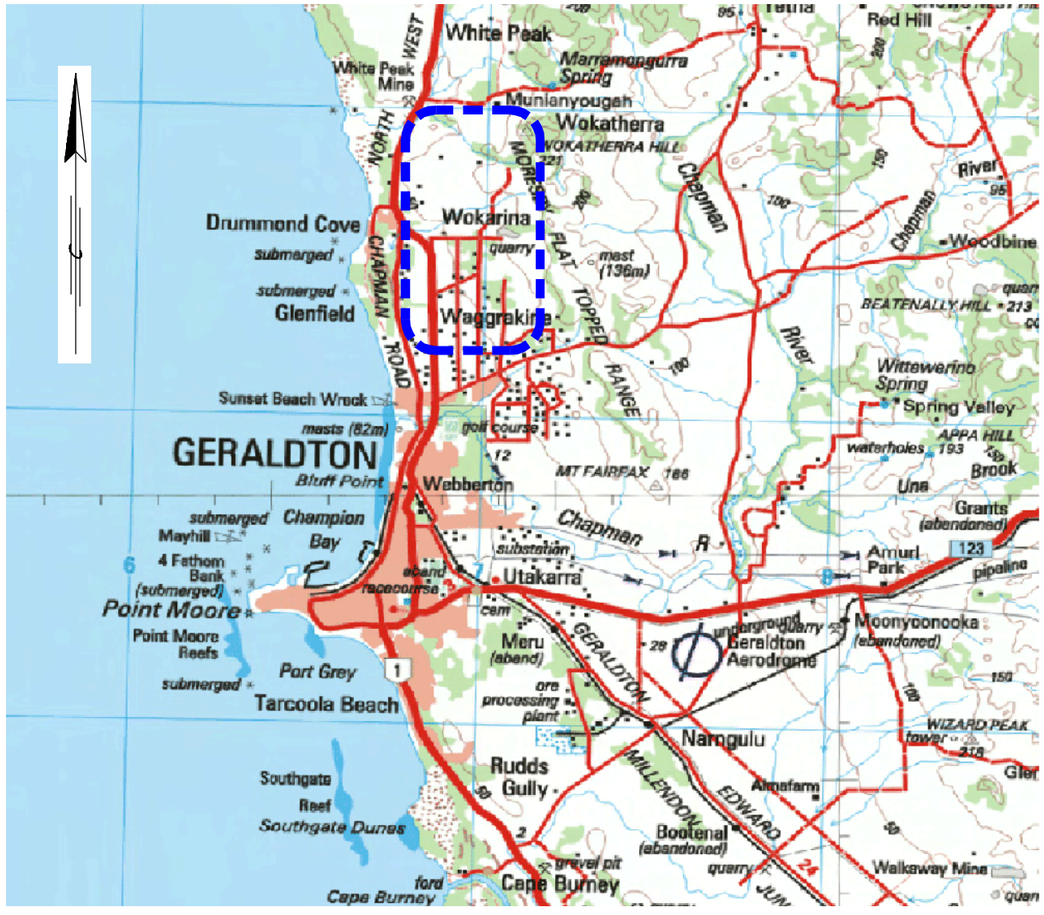
Document Status

| Rev No. | Author | Reviewer | | Approved for Issue | | |
|---|---|---|---|---|---|---|
| | | Name | Signature | Name | Signature | Date |
| A | Richard Farmer | [illegible] | [illegible] | [illegible] | [illegible] | ~~10.12.2012~~ 02-08-13 |
| | | | | | | |
| | | | | | | |

www.ghd.com

# Appendix B – Drawing Index

# SHIRE OF CHAPMAN VALLEY
# NORTH WEST COASTAL HIGHWAY / WOKARENA ROAD
# INTERSECTION UPGRADE




LOCALITY PLAN
N.T.S.

LEGEND:

LOCATION OF WORKS

## DRAWING INDEX

| DRG. NO | DESCRIPTION |
|---|---|
| 201304-0310 | LOCALITY PLAN AND DRAWING INDEX |
| 201304-0311 | GENERAL ARRANGEMENT PLAN |
| 201304-0312 | ROAD LAYOUT & SET-OUT PLAN |
| 201304-0313 | PLAN AND PROFILE - MC00 - CHA. 0 TO CHA. 275 |
| 201304-0314 | PLAN AND PROFILE - MC00 - CHA. 275 TO CHA. 519.93 |
| 201304-0315 | PLAN AND PROFILE - MC01 - CHA. 0 TO CHA. 91.23 |
| 201304-0316 | TYPICAL SECTION DETAILS |
| 201304-0317 | CROSS SECTIONS - MC00 - CHA. 0 TO CHA. 175 |
| 201304-0318 | CROSS SECTIONS - MC00 - CHA. 200 TO CHA. 375 |
| 201304-0319 | CROSS SECTIONS - MC00 - CHA. 400 TO CHA. 519.93 |
| 201304-0320 | CROSS SECTIONS - MC01 - CHA. 25 TO CHA. 91.23 |
| 201304-0321 | PAVEMENT MARKINGS & MINOR SIGNING |
| 201304-0322 | PAVEMENT PLAN |
| 201304-0323 | DRAINAGE PLAN |
| 201304-0324 | STREET LIGHTING LAYOUT & POLE SCHEDULE |

DIAL BEFORE YOU DIG www.1100.com.au

WARNING
SERVICES AND CADASTRAL BOUNDARY LOCATIONS SHOWN ARE ONLY INDICATIVE AND MUST NOT BE USED FOR EXCAVATION. THE "ONE CALL 1100" SYSTEM SHALL BE USED TO OBTAIN ACCURATE SERVICE LOCATIONS.

AMENDMENTS

| No. | DESCRIPTION | APPROVED & DATE |
|---|---|---|
| A | ISSUED FOR 100% CLIENT REVIEW | JM 08.03.2013 |
| B | ISSUED FOR 100% DESIGN REVIEW | JM 07.06.2013 |
| C | ISSUED FOR TENDER | JM |

NOTES

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: GCG94
HEIGHT DATUM: AHD

Government of Western Australia
mainroads WESTERN AUSTRALIA
MID WEST REGION
EASTWARD ROAD Geraldton 6531
Telephone (08) 9956 1200 Fax (08) 9956 1240

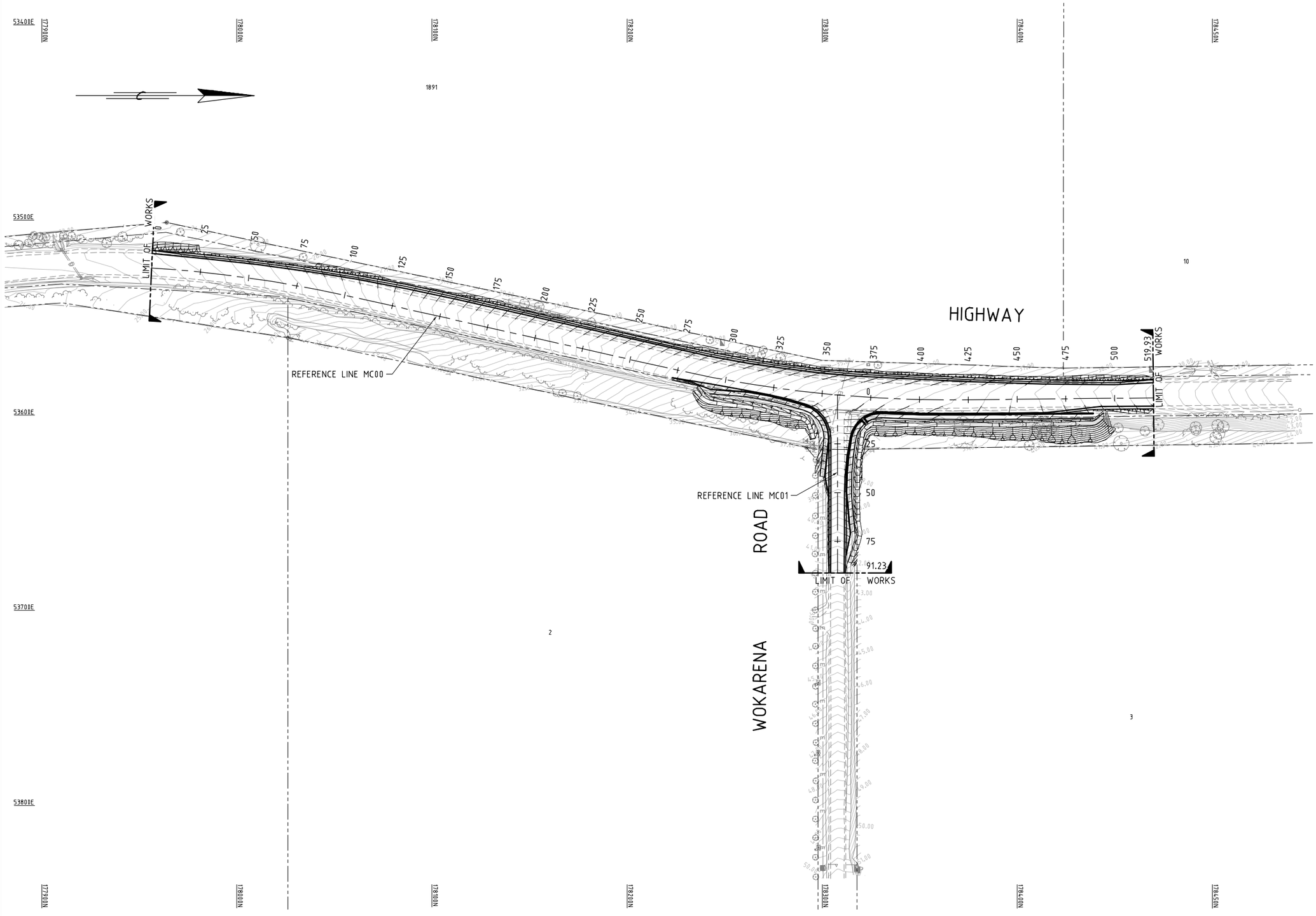

GHD
'GHD House', 239 Adelaide Terrace Perth WA 6004
PO Box Y3106 Perth WA 6832 Australia
T (08) 6222 8222 F (08) 6222 8555
E permail@ghd.com.au www.ghd.com.au


DRAWING NUMBER/DOCUMENT ID
DESIGNED / DRAWN S.TERCENO / K.PALARCA
VERIFIED
DIRECTOR
SCALES N.T.S
A1

MRWA FILE NUMBER
APPROVED (MRWA)

NORTH WEST COASTAL HWY(H007)
WOKARENA ROAD (5160128)
14.84 SLK - 15.49 SLK
LOCALITY PLAN & DRAWING INDEX

LOCAL AUTHORITY (516) SHIRE OF CHAPMAN VALLEY
MRWA DRAWING NUMBER
201304-0310-C




## GENERAL ARRANGEMENT PLAN
1:1000

DIAL BEFORE YOU DIG www.1100.com.au

**WARNING**
SERVICES AND CADASTRAL BOUNDARY LOCATIONS SHOWN ARE ONLY INDICATIVE AND MUST NOT BE USED FOR EXCAVATION. THE "ONE CALL 1100" SYSTEM SHALL BE USED TO OBTAIN ACCURATE SERVICE LOCATIONS.

### AMENDMENTS

| No. | DESCRIPTION | APPROVED & DATE |
|---|---|---|
| A | ISSUED FOR 100% CLIENT REVIEW | JM 08.03.2013 |
| B | ISSUED FOR 100% DESIGN REVIEW | JM 07.06.2013 |
| C | ISSUED FOR TENDER | JM |

### NOTES

### LEGEND:
- DESIGN CONTOUR
- EXISTING CONTOUR
- EXISTING CADASTRAL BOUNDARY
- EXISTING ELECTRICAL LINE
- EXISTING DRAINAGE
- EXISTING FENCE
- EXISTING VEGETATION
- EXISTING TREES
- EXISTING WATER TAP
- EXISTING ELECTRICAL POST
- EXISTING CONCRETE POST
- EXISTING TELEPHONE PIT
- EXISTING ELECTRICAL PIT
- EXISTING TELSTRA PIT

### METADATA
GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: GCG 94
HEIGHT DATUM: AHD

Government of Western Australia
mainroads WESTERN AUSTRALIA
MID WEST REGION
EASTWARD ROAD Geraldton 6531
Telephone (08) 9956 1200 Fax (08) 9956 1240

GHD
'GHD House', 239 Adelaide Terrace Perth WA 6004
PO Box Y3106 Perth WA 6832 Australia
T (08) 6222 8222 F (08) 6222 8555
E permail@ghd.com.au www.ghd.com.au

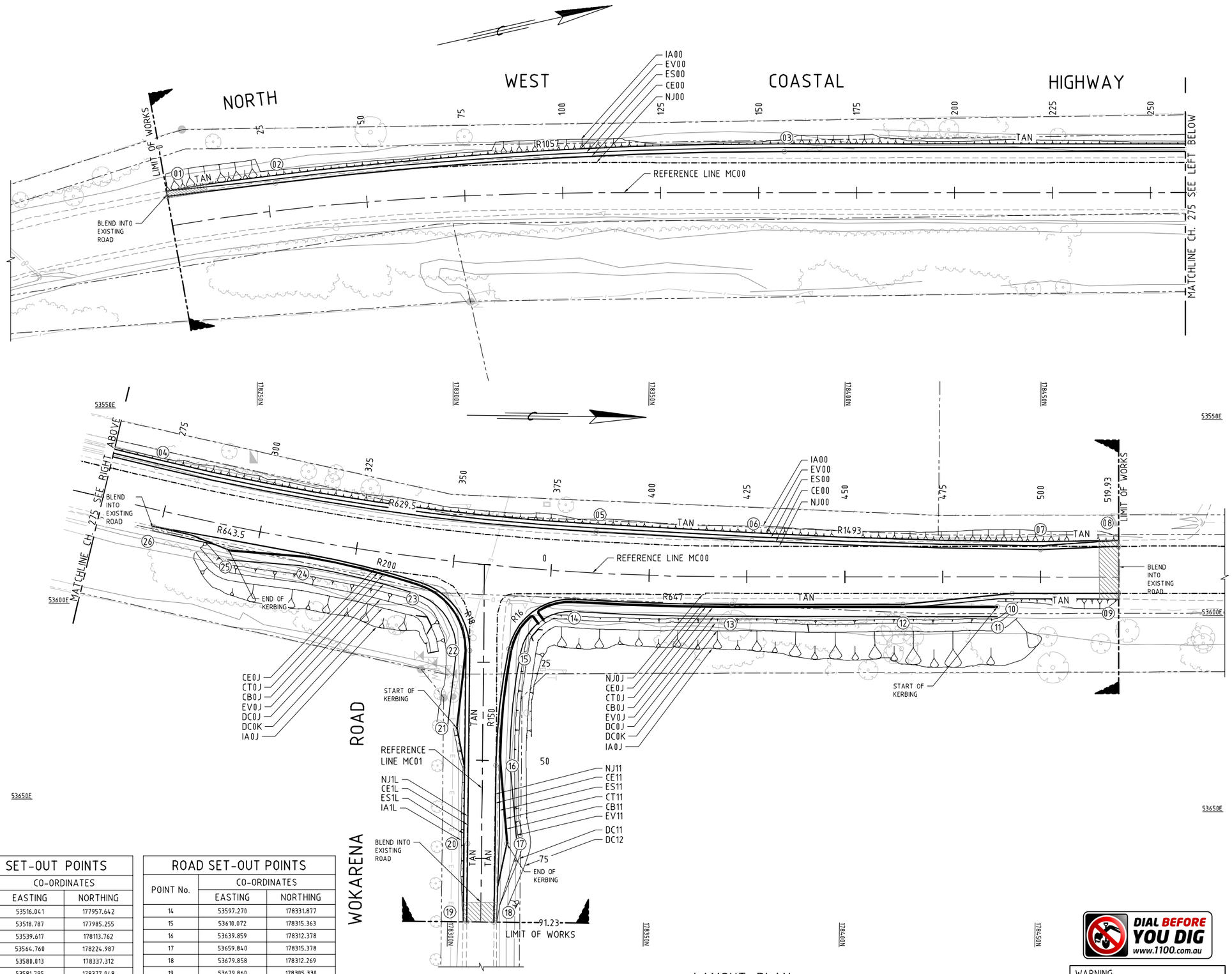
DRAWING NUMBER/DOCUMENT ID
DESIGNED / DRAWN S.TERCENO / K.PALARCA
VERIFIED
DIRECTOR

SCALES 1:1000
A1

MRWA FILE NUMBER
APPROVED (MRWA)

NORTH WEST COASTAL HWY(H007)
WOKARENA ROAD (5160128)
14.84 SLK - 15.49 SLK
GENERAL ARRANGEMENT PLAN

LOCAL AUTHORITY (516) SHIRE OF CHAPMAN VALLEY
MRWA DRAWING NUMBER
201304-0311-C




## ROAD SET-OUT POINTS

| POINT No. | CO-ORDINATES | |
|---|---|---|
| | EASTING | NORTHING |
| 01 | 53516.041 | 177957.642 |
| 02 | 53518.787 | 177985.255 |
| 03 | 53539.617 | 178113.762 |
| 04 | 53564.760 | 178224.987 |
| 05 | 53580.013 | 178337.312 |
| 06 | 53581.795 | 178377.048 |
| 07 | 53583.278 | 178450.713 |
| 08 | 53582.244 | 178470.679 |
| 09 | 53594.292 | 178470.836 |
| 10 | 53594.597 | 178443.625 |
| 11 | 53598.015 | 178439.913 |
| 12 | 53597.662 | 178415.859 |
| 13 | 53598.111 | 178372.171 |

## ROAD SET-OUT POINTS

| POINT No. | CO-ORDINATES | |
|---|---|---|
| | EASTING | NORTHING |
| 14 | 53597.270 | 178331.877 |
| 15 | 53610.072 | 178315.363 |
| 16 | 53639.859 | 178312.378 |
| 17 | 53659.840 | 178315.378 |
| 18 | 53679.858 | 178312.269 |
| 19 | 53679.860 | 178305.330 |
| 20 | 53659.860 | 178305.379 |
| 21 | 53630.566 | 178302.378 |
| 22 | 53610.632 | 178305.376 |
| 23 | 53593.485 | 178292.848 |
| 24 | 53586.539 | 178263.693 |
| 25 | 53585.626 | 178243.506 |
| 26 | 53579.792 | 178224.238 |

## LAYOUT PLAN
1:500

**WARNING**
SERVICES AND CADASTRAL BOUNDARY LOCATIONS SHOWN ARE ONLY INDICATIVE AND MUST NOT BE USED FOR EXCAVATION. THE "ONE CALL 1100" SYSTEM SHALL BE USED TO OBTAIN ACCURATE SERVICE LOCATIONS.

DIAL BEFORE YOU DIG www.1100.com.au

## AMENDMENTS

| No. | DESCRIPTION | APPROVED & DATE |
|---|---|---|
| A | ISSUED FOR 100% CLIENT REVIEW | JM 08.03.2013 |
| B | ISSUED FOR 100% DESIGN REVIEW | JM 07.06.2013 |
| C | ISSUED FOR TENDER | JM |

## NOTES

1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.
2. ALL KERBING TO BE SEMI MOUNTABLE UNLESS OTHERWISE SPECIFIED. REFER TO MRWA STD. DRG. No. 9331-0376.
3. TRANSITION TO EXISTING ROAD AT ALL TIE IN POINTS. REFER TO MRWA STD. DRG. No. 9331-0377.
4. FOR PAVEMENT MARKING AND SIGNAGE REFER TO DRG. 201304-0321. REFER TO MRWA STD DRG. No. 200331-183-8.
5. THE CONTRACTOR SHALL VERIFY ALL DRAWINGS AND CONDITIONS AT THE SITE, AND SHALL NOTIFY THE ENGINEER BETWEEN ACTUAL CONDITIONS AND INFORMATION ON THE DRAWINGS BEFORE PROCEEDING WITH THE WORK.
6. THE CONTRACTOR SHALL VERIFY ALL OTHER EXISTING FEATURES AND/OR STRUCTURES AFFECTED BY THE PROPOSED WORKS NOT SPECIFIED ON THE DRAWINGS PRIOR TO CONSTRUCTION.

## LEGEND:

- EXISTING CADASTRAL BOUNDARY
- EXISTING ELECTRICAL LINE
- EXISTING DRAINAGE
- EXISTING FENCE
- EXISTING VEGETATION
- EXISTING TREES
- EXISTING WATER TAP
- EXISTING ELECTRICAL POST
- EXISTING CONCRETE POST
- EXISTING TELEPHONE PIT
- EXISTING ELECTRICAL PIT
- EXISTING TELSTRA PIT

## METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: GCG94
HEIGHT DATUM: AHD

Government of Western Australia
mainroads WESTERN AUSTRALIA
MID WEST REGION
EASTWARD ROAD Geraldton 6531
Telephone (08) 9956 1200 Fax (08) 9956 1240

GHD
'GHD House', 239 Adelaide Terrace Perth WA 6004
PO Box Y3106 Perth WA 6832 Australia
T (08) 6222 8222 F (08) 6222 8555
E permail@ghd.com.au www.ghd.com.au

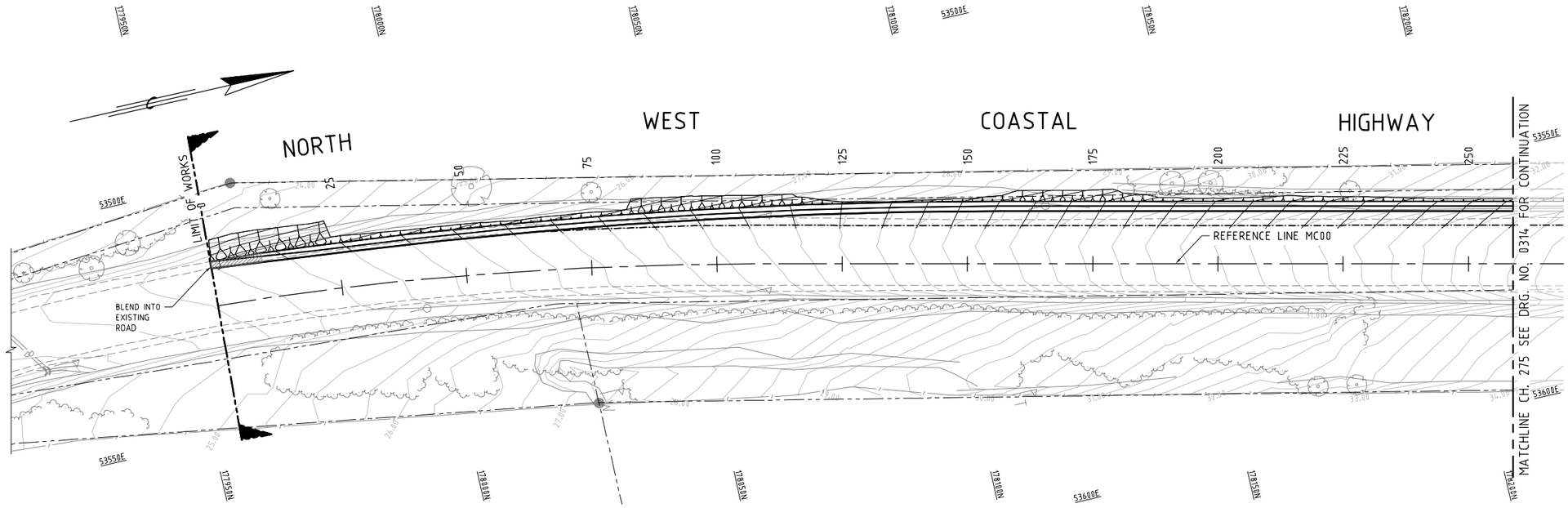
DRAWING NUMBER/DOCUMENT ID
DESIGNED / DRAWN S.TERCENO / K.PALARCA
VERIFIED
DIRECTOR

SCALES 1:500 A1

MRWA FILE NUMBER
APPROVED (MRWA)

NORTH WEST COASTAL HWY(H007)
WOKARENA ROAD (5160128)
14.84 SLK - 15.49 SLK
ROAD LAYOUT & SET-OUT PLAN

LOCAL AUTHORITY (516) SHIRE OF CHAPMAN VALLEY
MRWA DRAWING NUMBER
201304-0312-C




PLAN
1:500

DATUM RL. 17.00

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ROAD EDGE - RHS | LEVELS OF RHS TO REMAIN AS EXISTING | | | | | | | | | | 33.473 |
| ROAD EDGE - LHS | 24.732 | 25.193 | 25.750 | 26.392 | 27.071 | 27.764 | 28.627 | 29.525 | 30.422 | 31.290 | 32.198 | 33.141 |
| EXISTING GROUND ON MC00 | 24.516 | 24.989 | 25.551 | 26.180 | 26.923 | 27.698 | 28.623 | 29.555 | 30.472 | 31.359 | 32.378 | 33.400 |
| CHAINAGE ON MC00 | 0.00 | 25.00 | 50.00 | 75.00 | 100.00 | 125.00 | 150.00 | 175.00 | 200.00 | 225.00 | 250.00 | 275.00 |

PROFILE - NORTH WEST COASTAL HIGHWAY CHA 0 TO CHA 275
SCALE: 1:500H, 1:500V

DIAL BEFORE YOU DIG www.1100.com.au

WARNING
SERVICES AND CADASTRAL BOUNDARY LOCATIONS SHOWN ARE ONLY INDICATIVE AND MUST NOT BE USED FOR EXCAVATION. THE "ONE CALL 1100" SYSTEM SHALL BE USED TO OBTAIN ACCURATE SERVICE LOCATIONS.

## AMENDMENTS

| No. | DESCRIPTION | APPROVED & DATE |
|---|---|---|
| A | ISSUED FOR 100% CLIENT REVIEW | JM 08.03.2013 |
| B | ISSUED FOR 100% DESIGN REVIEW | JM 07.06.2013 |
| C | ISSUED FOR TENDER | JM |

## NOTES

1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.
2. FOR ROAD TYPICAL SECTION DETAILS REFER TO DRG. 201304-0316.
3. STRING MC00 AND MC01 LEVELS TO MATCH EXISTING ROAD PROFILE.
4. PAVEMENT WIDENING TO TIE SMOOTHLY TO EXISTING AND MAINTAIN EXISTING CROSSFALLS IN ALL DIRECTIONS.
5. FOR PAVEMENT MARKING AND SIGNAGE REFER TO DRG. 201304-0321.

## LEGEND:

- DESIGN CONTOUR
- 1.00 EXISTING CONTOUR
- EXISTING CADASTRAL BOUNDARY
- E EXISTING ELECTRICAL LINE
- D EXISTING DRAINAGE
- EXISTING FENCE
- EXISTING VEGETATION
- EXISTING TREES
- EXISTING WATER TAP
- EXISTING ELECTRICAL POST
- EXISTING CONCRETE POST
- EXISTING TELEPHONE PIT
- EXISTING ELECTRICAL PIT
- EXISTING TELSTRA PIT

## METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: GCG94
HEIGHT DATUM: AHD

Government of Western Australia
mainroads WESTERN AUSTRALIA
MID WEST REGION
EASTWARD ROAD Geraldton 6531
Telephone (08) 9956 1200 Fax (08) 9956 1240

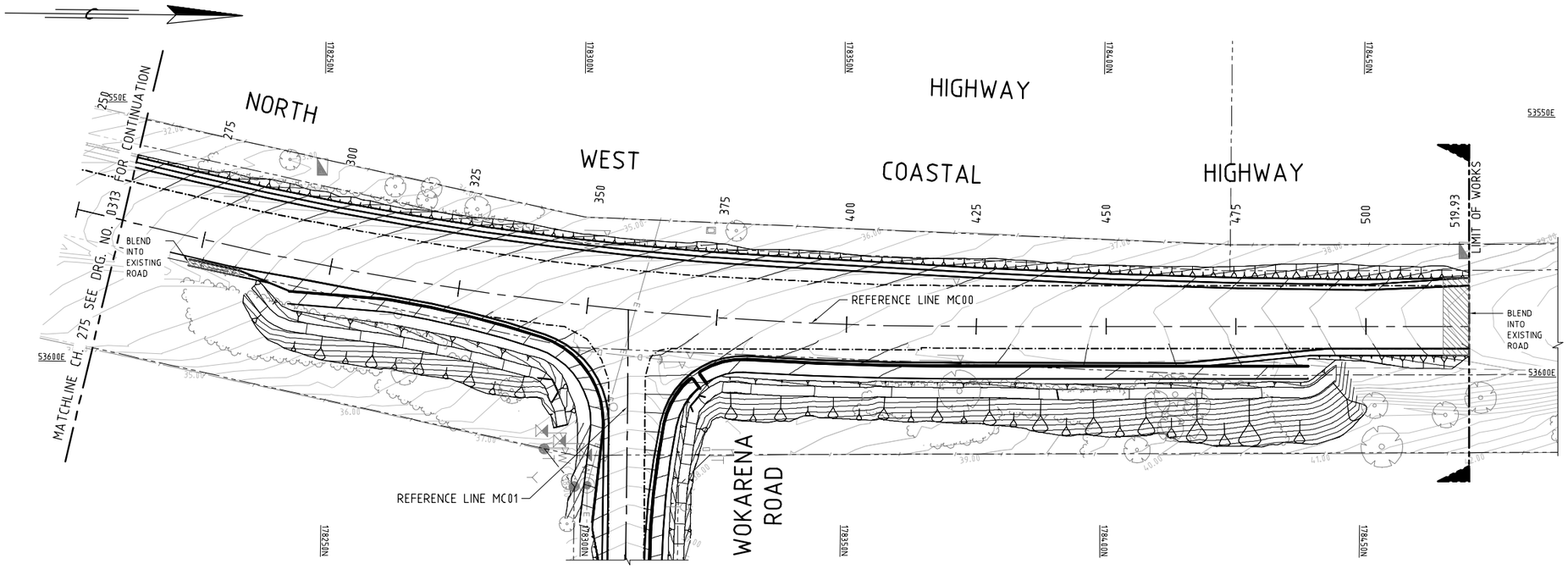
GHD
'GHD House', 239 Adelaide Terrace Perth WA 6004
PO Box Y3106 Perth WA 6832 Australia
T (08) 6222 8222 F (08) 6222 8555
E permail@ghd.com.au www.ghd.com.au

DRAWING NUMBER/DOCUMENT ID
DESIGNED / DRAWN S.TERCENO / K.PALARCA
VERIFIED
DIRECTOR

SCALES 1:500 A1

MRWA FILE NUMBER
APPROVED (MRWA)

NORTH WEST COASTAL HWY(H007)
WOKARENA ROAD (5160128)
14.84 SLK - 15.49 SLK
PLAN AND PROFILE
MC00 - CHA. 0 TO CHA. 275
LOCAL AUTHORITY (516) SHIRE OF CHAPMAN VALLEY
MRWA DRAWING NUMBER
201304-0313-C




LAYOUT PLAN
1:500

DATUM RL. 25.00

| CHAINAGE ON MC00 | ROAD EDGE - RHS | ROAD EDGE - LHS | EXISTING GROUND ON MC00 |
|---|---|---|---|
| 275.00 | 33.472 | 33.141 | 33.400 |
| 300.00 | 34.419 | 33.999 | 34.332 |
| 325.00 | 35.306 | 34.793 | 35.157 |
| 350.00 | NWCH/WOKARENA INTERSECTION | 35.516 | 35.865 |
| 375.00 | | 36.126 | 36.474 |
| 400.00 | 37.089 | 36.646 | 36.977 |
| 425.00 | 37.396 | 37.183 | 37.352 |
| 450.00 | 37.806 | 37.649 | 37.799 |
| 475.00 | 38.274 | 38.276 | 38.316 |
| 500.00 | 38.955 | 38.933 | 39.021 |
| 519.93 | 39.493 | 39.477 | 39.686 |

PROFILE - NORTH WEST COASTAL HIGHWAY CHA 275 TO CHA 519.93
SCALE: 1:500H, 1:500V

DIAL BEFORE YOU DIG www.1100.com.au

WARNING
SERVICES AND CADASTRAL BOUNDARY LOCATIONS SHOWN ARE ONLY INDICATIVE AND MUST NOT BE USED FOR EXCAVATION. THE "ONE CALL 1100" SYSTEM SHALL BE USED TO OBTAIN ACCURATE SERVICE LOCATIONS.

## AMENDMENTS

| No. | DESCRIPTION | APPROVED & DATE |
|---|---|---|
| A | ISSUED FOR 100% CLIENT REVIEW | JM 08.03.2013 |
| B | ISSUED FOR 100% DESIGN REVIEW | JM 07.06.2013 |
| C | ISSUED FOR TENDER | JM |

## NOTES

1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.
2. FOR ROAD TYPICAL SECTION DETAILS REFER TO DRG. 201304-0316.
3. STRING MC00 AND MC01 LEVELS TO MATCH EXISTING ROAD PROFILE.
4. PAVEMENT WIDENING TO TIE SMOOTHLY TO EXISTING AND MAINTAIN EXISTING CROSSFALLS IN ALL DIRECTIONS.
5. FOR PAVEMENT MARKING AND SIGNAGE REFER TO DRG. 201304-0321.

## LEGEND:

- DESIGN CONTOUR
- 1.00 EXISTING CONTOUR
- EXISTING CADASTRAL BOUNDARY
- E EXISTING ELECTRICAL LINE
- D EXISTING DRAINAGE
- F EXISTING FENCE
- EXISTING VEGETATION
- EXISTING TREES
- EXISTING WATER TAP
- EXISTING ELECTRICAL POST
- EXISTING CONCRETE POST
- EXISTING TELEPHONE PIT
- EXISTING ELECTRICAL PIT
- EXISTING TELSTRA PIT

## METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: GCG94
HEIGHT DATUM: AHD

Government of Western Australia
mainroads WESTERN AUSTRALIA
MID WEST REGION
EASTWARD ROAD Geraldton 6531
Telephone (08) 9956 1200 Fax (08) 9956 1240

GHD
'GHD House', 239 Adelaide Terrace Perth WA 6004
PO Box Y3106 Perth WA 6832 Australia
T (08) 6222 8222 F (08) 6222 8555
E permail@ghd.com.au www.ghd.com.au

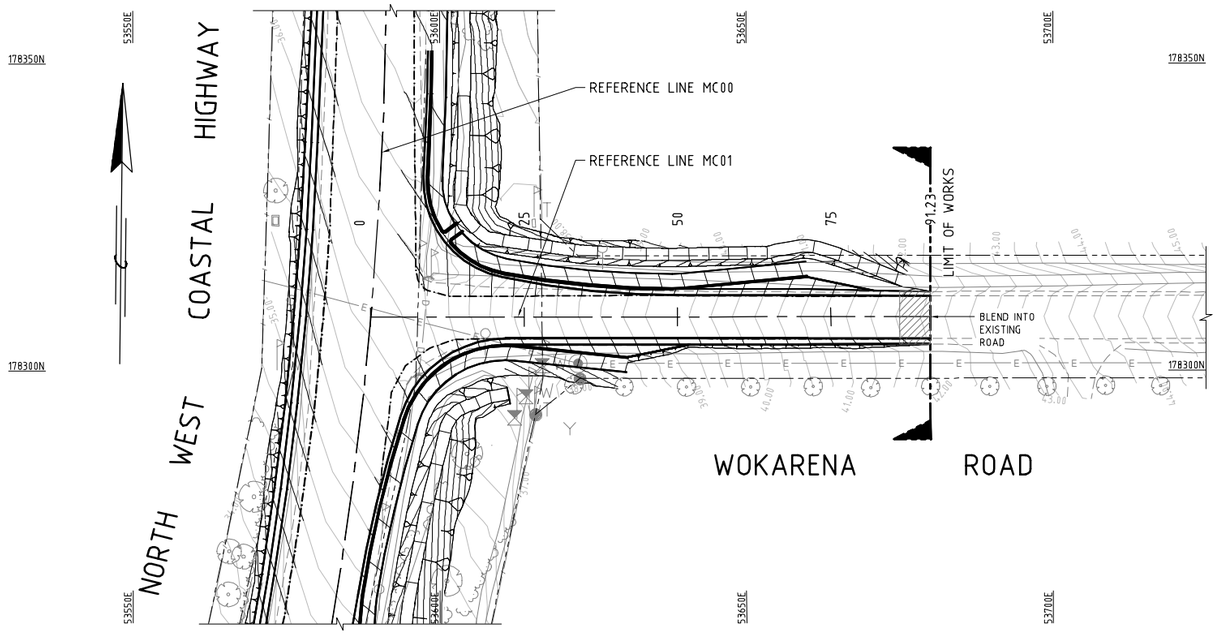
DRAWING NUMBER/DOCUMENT ID
DESIGNED / DRAWN S.TERCENO / K.PALARCA
VERIFIED
DIRECTOR

SCALES 1:500 A1

MRWA FILE NUMBER
APPROVED (MRWA)

NORTH WEST COASTAL HWY(H007)
WOKARENA ROAD (5160128)
14.84 SLK - 15.49 SLK
PLAN AND PROFILE
MC00 - CHA.275 TO CHA. 519.93
LOCAL AUTHORITY (516) SHIRE OF CHAPMAN VALLEY

MRWA DRAWING NUMBER
201304-0314-C




LAYOUT PLAN
1:500

DATUM RL. 28.00

| | 0.00 | 25.00 | 50.00 | 75.00 | 91.23 |
|---|---|---|---|---|---|
| ROAD EDGE - RHS | | 37.535 | 39.254 | 41.006 | 42.039 |
| ROAD EDGE - LHS | | 37.620 | 39.291 | 40.987 | 42.026 |
| EXISTING GROUND ON MC01 | 36.071 | 37.640 | 39.367 | 41.083 | 42.163 |
| CHAINAGE ON MC01 | 0.00 | 25.00 | 50.00 | 75.00 | 91.23 |

PROFILE - WOKARENA ROAD CH 0 TO CH 91.23
SCALE: 1:500H, 1:500V

DIAL BEFORE YOU DIG www.1100.com.au

WARNING
SERVICES AND CADASTRAL BOUNDARY LOCATIONS SHOWN ARE ONLY INDICATIVE AND MUST NOT BE USED FOR EXCAVATION. THE "ONE CALL 1100" SYSTEM SHALL BE USED TO OBTAIN ACCURATE SERVICE LOCATIONS.

## AMENDMENTS

| No. | DESCRIPTION | APPROVED & DATE |
|---|---|---|
| A | ISSUED FOR 100% CLIENT REVIEW | JM 08.03.2013 |
| B | ISSUED FOR 100% DESIGN REVIEW | JM 07.06.2013 |
| C | ISSUED FOR TENDER | JM |

## NOTES

1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.
2. FOR ROAD TYPICAL SECTION DETAILS REFER TO DRG. 201304-0316.
3. STRING MC00 AND MC01 LEVELS TO MATCH EXISTING ROAD PROFILE.
4. PAVEMENT WIDENING TO TIE SMOOTHLY TO EXISTING AND MAINTAIN EXISTING CROSSFALLS IN ALL DIRECTIONS.
5. FOR PAVEMENT MARKING AND SIGNAGE REFER TO DRG. 201304-0321.

## LEGEND:

- DESIGN CONTOUR
- 1.00 EXISTING CONTOUR
- EXISTING CADASTRAL BOUNDARY
- E EXISTING ELECTRICAL LINE
- D EXISTING DRAINAGE
- / EXISTING FENCE
- EXISTING VEGETATION
- EXISTING TREES
- EXISTING WATER TAP
- EXISTING ELECTRICAL POST
- EXISTING CONCRETE POST
- EXISTING TELEPHONE PIT
- EXISTING ELECTRICAL PIT
- EXISTING TELSTRA PIT

## METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: GCG94
HEIGHT DATUM: AHD

Government of Western Australia
mainroads WESTERN AUSTRALIA
MID WEST REGION
EASTWARD ROAD Geraldton 6531
Telephone (08) 9956 1200 Fax (08) 9956 1240

GHD
'GHD House', 239 Adelaide Terrace Perth WA 6004
PO Box Y3106 Perth WA 6832 Australia
T (08) 6222 8222 F (08) 6222 8555
E permail@ghd.com.au www.ghd.com.au

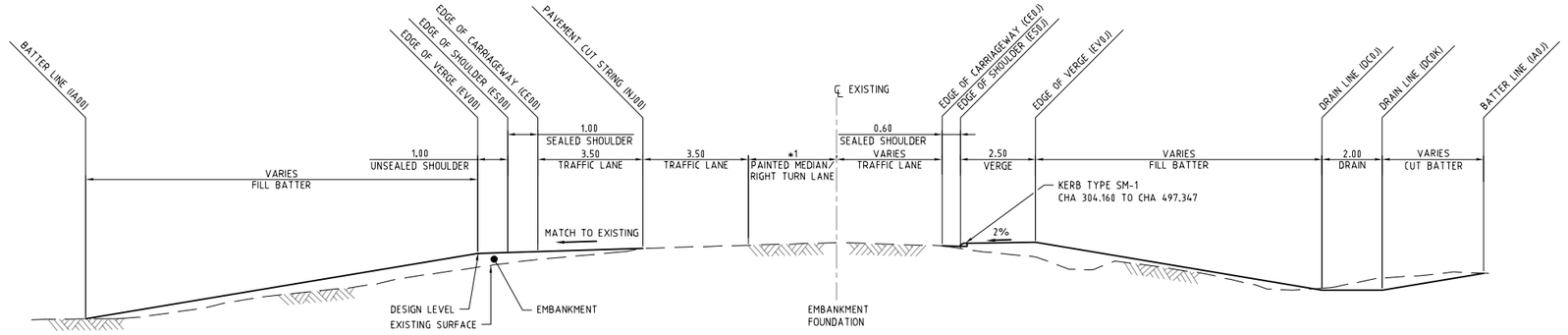
DRAWING NUMBER/DOCUMENT ID
DESIGNED / DRAWN S.TERCENO / K.PALARCA
VERIFIED
DIRECTOR

SCALES 1:500 A1

MRWA FILE NUMBER
APPROVED (MRWA)

NORTH WEST COASTAL HWY(H007)
WOKARENA ROAD (5160128)
14.84 SLK - 15.49 SLK
PLAN AND PROFILE
MC01 - CHA. 0 TO CHA. 91.23
LOCAL AUTHORITY (516) SHIRE OF CHAPMAN VALLEY

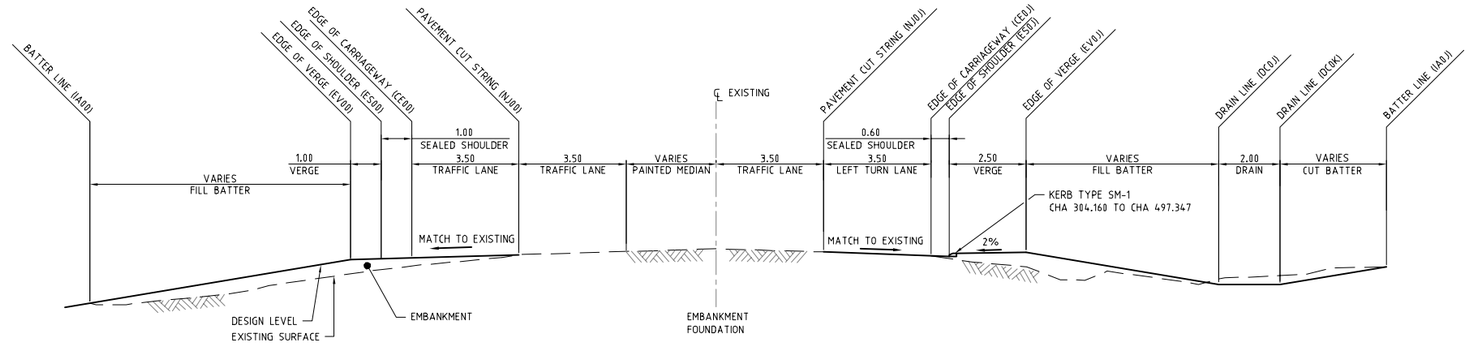
MRWA DRAWING NUMBER
201304-0315-C




## TYPICAL SECTION - NORTH WEST COASTAL HIGHWAY PAINTED MEDIAN/RIGHT TURN LANE AT CHA. 325

1:100

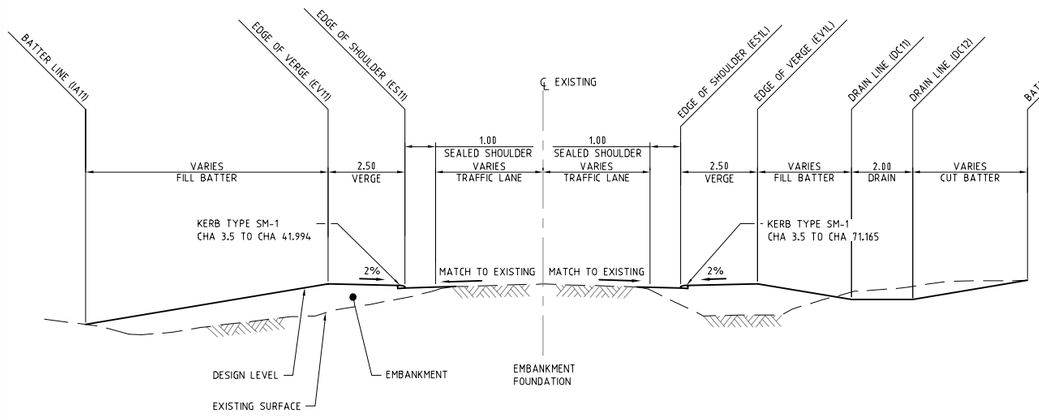
*1 VARIES PAINTED MEDIAN - CHA 40.804 TO CHA 174.998
3.5 RIGHT TURN LANE - CHA 174.998 TO CHA 309.162




## TYPICAL SECTION - NORTH WEST COASTAL HIGHWAY PAINTED MEDIAN/RIGHT TURN LANE AT CHA. 450

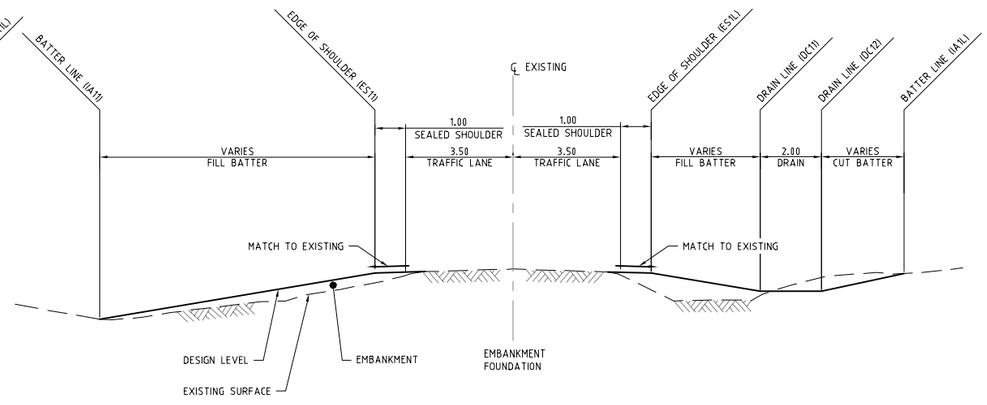
1:100

| TYPICAL SECTIONS | |
|---|---|
| FILL HEIGHT | BATTER SLOPE (H TO V) |
| 0.0 - 1.0m | 6 TO 1 |
| 1.0m | 4 TO 1 |
| CUT HEIGHT | BATTER SLOPE (H TO V) |
| 0.0 - 2.5m | 4 TO 1 |
| 2.5m | 3 TO 1 |




## TYPICAL ROAD KERBED CROSS SECTION - WOKARENA ROAD

1:100




## TYPICAL ROAD UNKERBED CROSS SECTION - WOKARENA ROAD

1:100

DIAL BEFORE YOU DIG www.1100.com.au

WARNING

SERVICES AND CADASTRAL BOUNDARY LOCATIONS SHOWN ARE ONLY INDICATIVE AND MUST NOT BE USED FOR EXCAVATION. THE "ONE CALL 1100" SYSTEM SHALL BE USED TO OBTAIN ACCURATE SERVICE LOCATIONS.

### AMENDMENTS

| No. | DESCRIPTION | APPROVED & DATE |
|---|---|---|
| A | ISSUED FOR 100% CLIENT REVIEW | JM 08.03.2013 |
| B | ISSUED FOR 100% DESIGN REVIEW | JM 07.06.2013 |
| C | ISSUED FOR TENDER | JM |

### NOTES

1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.
2. FOR EXTENT OF KERB, REFER TO ROAD LAYOUT AND SETOUT PLAN DRAWING NO. 201304-0312.
3. FOR CUT AND FILL BATTER DETAILS AND STRING LABELLING DETAILS, REFER TO DRAWING NO. 201304-0317 TO 201304-0320.

### METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: GCG94
HEIGHT DATUM: AHD

Government of Western Australia
mainroads WESTERN AUSTRALIA
MID WEST REGION
EASTWARD ROAD Geraldton 6531
Telephone (08) 9956 1200 Fax (08) 9956 1240

GHD
'GHD House', 239 Adelaide Terrace Perth WA 6004
PO Box Y3106 Perth WA 6832 Australia
T (08) 6222 8222 F (08) 6222 8555
E permail@ghd.com.au www.ghd.com.au

DRAWING NUMBER/DOCUMENT ID
DESIGNED / DRAWN S.TERCENO / K.PALARCA
VERIFIED
DIRECTOR
SCALES 1:100
A1

MRWA FILE NUMBER
APPROVED (MRWA)

# NORTH WEST COASTAL HWY(H007)

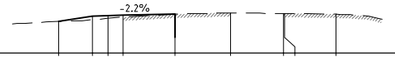
WOKARENA ROAD (5160128)
14.84 SLK - 15.49 SLK
TYPICAL SECTION DETAILS

LOCAL AUTHORITY (516) SHIRE OF CHAPMAN VALLEY
MRWA DRAWING NUMBER
201304-0316-C


DATUM R.L. 24.00

| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ00 | | | |
|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | 26.389 | 26.458 | 26.436 | 26.413 | 26.392 | | | |
| GROUND LEVEL | 26.389 | 26.334 | 26.366 | 26.378 | 26.392 | 26.305 | 26.181<br>26.180 | 26.161 |
| OFFSET | -11.020 | -10.122 | -9.122 | -8.121 | -7.190 | -3.701 | -0.113<br>0.000 | 3.275 |

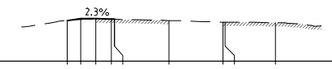
CHA 75.00




DATUM R.L. 27.00

| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ00 | | | |
|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | 29.834 | 29.404 | 29.426 | 29.449 | 29.525 | | | |
| GROUND LEVEL | 29.834 | 29.150 | 29.251 | 29.325 | 29.525 | 29.607 | 29.555<br>29.555 | 29.517 |
| OFFSET | -14.728 | -12.500 | -11.500 | -10.500 | -7.124 | -3.517 | -0.054<br>0.000 | 3.364 |

CHA 175.00




DATUM R.L. 23.00

| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ00 | | | |
|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | 25.658 | 25.802 | 25.779 | 25.755 | 25.750 | | | |
| GROUND LEVEL | 25.658 | 25.733 | 25.759 | 25.746 | 25.750 | 25.666 | 25.551<br>25.551 | 25.533 |
| OFFSET | -10.279 | -9.416 | -8.416 | -7.415 | -2.195 | -3.659 | -0.127<br>0.000 | 3.281 |

CHA 50.00


DATUM R.L. 26.00

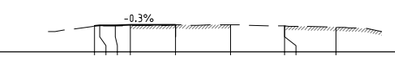
| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ00 | | | |
|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | 28.450 | 28.533 | 28.550 | 28.567 | 28.627 | | | |
| GROUND LEVEL | 28.450 | 28.457 | 28.473 | 28.488 | 28.627 | 28.694 | 28.624<br>28.623 | 28.567 |
| OFFSET | -12.975 | -12.480 | -11.480 | -10.488 | -7.075 | -3.551 | -0.022<br>0.000 | 3.342 |

CHA 150.00


DATUM R.L. 23.00

| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | | | | |
|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | 25.016 | 25.236 | 25.213 | 25.193 | | | | |
| GROUND LEVEL | 25.016 | 25.151 | 25.160 | 25.193 | 25.121 | 24.990<br>24.989 | 24.940 | |
| OFFSET | -10.356 | -9.037 | -8.037 | -7.151 | -3.547 | -0.060<br>0.000 | 3.387 | |

CHA 25.00




DATUM R.L. 26.00

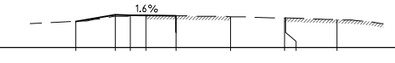
| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ00 | | | |
|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | 27.692 | 27.757 | 27.754 | 27.757 | 27.764 | | | |
| GROUND LEVEL | 27.692 | 27.687 | 27.710 | 27.724 | 27.764 | 27.772 | 27.690<br>27.690 | 27.617 |
| OFFSET | -12.387 | -11.079 | -10.079 | -7.086 | -3.501 | 0.000<br>0.008 | 3.360 | |

CHA 125.00

DATUM R.L. 22.00

| OFFSET LABEL | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | | | | | | | | |
| GROUND LEVEL | 24.697 | 24.695<br>24.731 | 24.638 | | 24.521<br>24.518 | 24.443 | | |
| OFFSET | -8.963 | -7.567<br>-7.122 | -3.570 | -0.113<br>0.000 | 3.377 | | | |

CHA 0.00




DATUM R.L. 25.00

| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ00 | | | |
|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | 26.707 | 27.133 | 27.117 | 27.102 | 27.071 | | | |
| GROUND LEVEL | 26.707 | 27.035<br>27.053 | 27.068 | 27.071 | 27.020 | 26.923<br>26.921 | 26.830 | |
| OFFSET | -13.589 | -10.038<br>-10.038 | -9.037 | -7.056 | -3.503 | 0.000<br>0.071 | 3.445 | |

CHA 100.00



## AMENDMENTS

| No. | DESCRIPTION | APPROVED & DATE |
|---|---|---|
| A | ISSUED FOR 100% CLIENT REVIEW | JM 08.03.2013 |
| B | ISSUED FOR 100% DESIGN REVIEW | JM 07.06.2013 |
| C | ISSUED FOR TENDER | JM |

## NOTES

1. DESIGN LEVELS ARE TO TOP OF PAVEMENT.
2. REFER TO DRG. 201304-0316 FOR TYPICAL SECTION DETAILS.

## METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: GCG94
HEIGHT DATUM: AHD

Government of Western Australia
mainroads WESTERN AUSTRALIA
MID WEST REGION
EASTWARD ROAD Geraldton 6531
Telephone (08) 9956 1200 Fax (08) 9956 1240

GHD
'GHD House', 239 Adelaide Terrace Perth WA 6004
PO Box Y3106 Perth WA 6832 Australia
T (08) 6222 8222 F (08) 6222 8555
E permail@ghd.com.au www.ghd.com.au

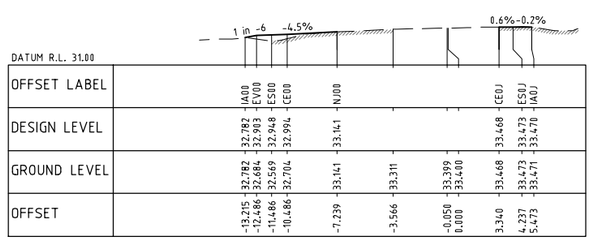
DRAWING NUMBER/DOCUMENT ID
DESIGNED / DRAWN S.TERCENO / K.PALARCA
VERIFIED
DIRECTOR

SCALES 1:200
A1

MRWA FILE NUMBER
APPROVED (MRWA)

NORTH WEST COASTAL HWY(H007)
WOKARENA ROAD (5160128)
14.84 SLK - 15.49 SLK
CROSS SECTIONS
MC00 - CHA. 0 TO CHA. 175
LOCAL AUTHORITY (516) SHIRE OF CHAPMAN VALLEY

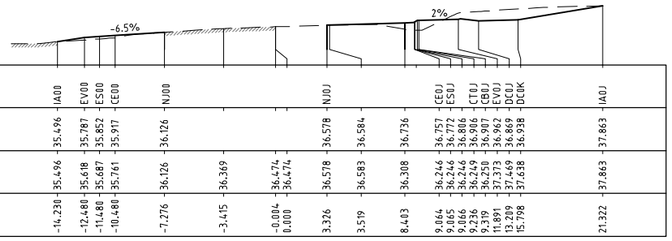
MRWA DRAWING NUMBER
201304-0317-C




DATUM R.L. 31.00

| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ00 | CE0J | ES0J | IA0J |
|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | 32.782 | 32.903 | 32.948 | 32.994 | 33.141 | 33.468 | 33.473 | 33.478 |
| GROUND LEVEL | 32.782 | 32.684 | 32.569 | 32.704 | 33.141 | 33.468 | 33.473 | 33.471 |
| OFFSET | -13.215 | -12.486 | -11.486 | -10.486 | -7.239 | 3.340 | 4.237 | 5.473 |

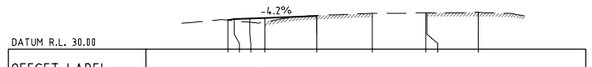
CHA 275.00




DATUM R.L. 34.00

| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ00 | NJ0J | CE0J | ES0J | CT0J | CB0J | DC0J | DC0K | IA0J |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | 35.496 | 35.787 | 35.852 | 35.917 | 36.126 | 36.578 | 36.584 | 36.736 | 36.757 | 36.772 | 36.806 | 36.946 | 36.967 | 37.138 | 36.869 | 36.938 | 37.863 |
| GROUND LEVEL | 35.496 | 35.618 | 35.687 | 35.761 | 36.126 | 36.369 | 36.474 | 36.474 | 36.578 | 36.583 | 36.308 | 36.246 | 36.246 | 36.246 | 36.249 | 36.236 | 36.236 | 36.891 | 37.469 | 37.638 | 37.863 |
| OFFSET | -14.238 | -12.488 | -11.488 | -10.488 | -7.276 | -3.415 | -0.004 | 0.000 | 3.326 | 3.519 | 8.483 | 9.064 | 9.065 | 9.066 | 9.236 | 9.391 | 11.891 | 13.259 | 15.798 | 21.322 |

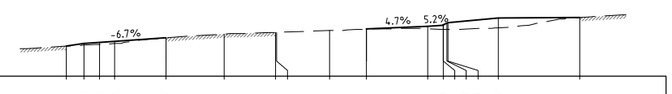
CHA 375.00




DATUM R.L. 30.00

| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ00 |
|---|---|---|---|---|---|
| DESIGN LEVEL | 31.902 | 31.973 | 32.015 | 32.057 | 32.198 |
| GROUND LEVEL | 31.902 | 31.863 | 31.772 | 31.792 | 32.198 | 32.343 | 32.378 | 32.379 | 32.405 |
| OFFSET | -12.930 | -12.500 | -11.500 | -10.500 | -7.127 | -3.498 | 0.000 | 0.044 | 3.420 |

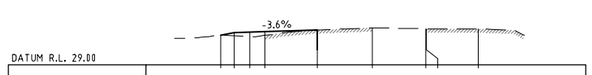
CHA 250.00




DATUM R.L. 33.00

| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ00 | NJ0J | CE0J | ES0J | CT0J | CB0J | EV0J | IA0J |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | 34.965 | 35.159 | 35.226 | 35.293 | 35.516 | 36.084 | 36.270 | 36.323 | 36.453 | 36.485 | 36.489 | 36.805 | 36.828 |
| GROUND LEVEL | 34.965 | 35.029 | 35.085 | 35.140 | 35.516 | 35.766 | 35.865 | 35.866 | 36.053 | 36.054 | 36.054 | 36.174 | 36.828 |
| OFFSET | -13.663 | -12.495 | -11.495 | -10.495 | -7.154 | -3.382 | 0.000 | 0.060 | 3.507 | 5.921 | 9.893 | 10.928 | 10.929 | 11.153 | 11.232 | 14.505 | 19.837 |

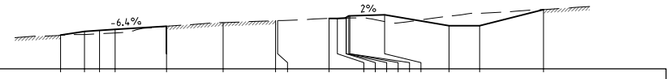
CHA 350.00




DATUM R.L. 29.00

| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ00 |
|---|---|---|---|---|---|
| DESIGN LEVEL | 30.949 | 31.097 | 31.133 | 31.168 | 31.298 |
| GROUND LEVEL | 30.949 | 30.902 | 30.854 | 30.924 | 31.298 | 31.426 | 31.359 | 31.358 | 31.349 |
| OFFSET | -13.390 | -12.500 | -11.500 | -10.500 | -7.894 | -3.495 | 0.000 | 0.020 | 3.405 |

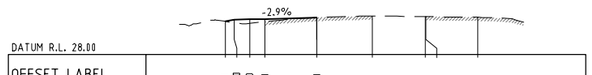
CHA 225.00




DATUM R.L. 32.00

| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ00 | NJ0J | CE0J | ES0J | CT0J | CB0J | EV0J | DC0J | DC0K | IA0J |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | 34.197 | 34.454 | 34.517 | 34.581 | 34.793 | 35.288 | 35.306 | 35.327 | 35.311 | 35.315 | 35.477 | 35.477 | 35.522 | 34.832 | 34.835 | 35.883 |
| GROUND LEVEL | 34.197 | 34.259 | 34.301 | 34.344 | 34.793 | 35.033 | 35.157 | 35.161 | 35.288 | 35.298 | 35.311 | 35.315 | 35.336 | 35.082 | 35.441 | 35.628 | 35.883 |
| OFFSET | -14.023 | -12.479 | -11.479 | -10.479 | -7.129 | -3.423 | 0.000 | 0.130 | 3.484 | 4.003 | 4.485 | 4.776 | 4.835 | 7.113 | 11.283 | 13.285 | 17.455 |

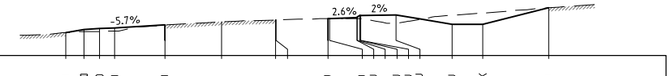
CHA 325.00




DATUM R.L. 28.00

| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ00 |
|---|---|---|---|---|---|
| DESIGN LEVEL | 30.167 | 30.266 | 30.295 | 30.324 | 30.422 |
| GROUND LEVEL | 30.166 | 30.074 | 30.043 | 30.144 | 30.422 | 30.525 | 30.473 | 30.472 | 30.435 |
| OFFSET | -13.094 | -12.508 | -11.508 | -10.508 | -7.114 | -3.488 | -0.060 | 0.000 | 3.380 |

CHA 200.00




DATUM R.L. 32.00

| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ00 | NJ0J | CE0J | ES0J | CT0J | CB0J | EV0J | DC0J | DC0K | IA0J |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | 33.698 | 33.697 | 33.755 | 33.812 | 33.999 | 34.416 | 34.419 | 34.467 | 34.517 | 34.477 | 34.477 | 34.617 | 34.663 | 34.049 | 34.047 | 35.111 |
| GROUND LEVEL | 33.698 | 33.566 | 33.576 | 33.592 | 33.999 | 34.217 | 34.322 | 34.332 | 34.416 | 34.417 | 34.426 | 34.427 | 34.428 | 34.115 | 34.637 | 34.775 | 35.111 |
| OFFSET | -13.687 | -12.494 | -11.494 | -10.494 | -7.230 | -3.542 | 0.000 | 0.016 | 3.395 | 3.586 | 5.317 | 5.487 | 5.547 | 7.834 | 11.510 | 13.512 | 17.786 |

CHA 300.00

DIAL BEFORE YOU DIG www.1100.com.au

WARNING

SERVICES AND CADASTRAL BOUNDARY LOCATIONS SHOWN ARE ONLY INDICATIVE AND MUST NOT BE USED FOR EXCAVATION. THE "ONE CALL 1100" SYSTEM SHALL BE USED TO OBTAIN ACCURATE SERVICE LOCATIONS.

## AMENDMENTS

| No. | DESCRIPTION | APPROVED & DATE |
|---|---|---|
| A | ISSUED FOR 100% CLIENT REVIEW | JM 08.03.2013 |
| B | ISSUED FOR 100% DESIGN REVIEW | JM 07.06.2013 |
| C | ISSUED FOR TENDER | JM |

## NOTES

1. DESIGN LEVELS ARE TO TOP OF PAVEMENT.
2. REFER TO DRG. 201304-0316 FOR TYPICAL SECTION DETAILS.

## METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: GCG94
HEIGHT DATUM: AHD

Government of Western Australia
mainroads WESTERN AUSTRALIA
MID WEST REGION
EASTWARD ROAD Geraldton 6531
Telephone (08) 9956 1200 Fax (08) 9956 1240

GHD
'GHD House', 239 Adelaide Terrace Perth WA 6004
PO Box Y3106 Perth WA 6832 Australia
T (08) 6222 8222 F (08) 6222 8555
E permail@ghd.com.au www.ghd.com.au

DRAWING NUMBER/DOCUMENT ID
DESIGNED / DRAWN S.TERCENO / K.PALARCA
VERIFIED
DIRECTOR

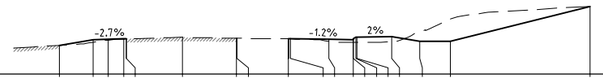
SCALES 1:200
A1

MRWA FILE NUMBER
APPROVED (MRWA)

# NORTH WEST COASTAL HWY(H007)

WOKARENA ROAD (5160128)
14.84 SLK - 15.49 SLK
CROSS SECTIONS
MC00 - CHA. 200 TO CHA. 375
LOCAL AUTHORITY (516) SHIRE OF CHAPMAN VALLEY

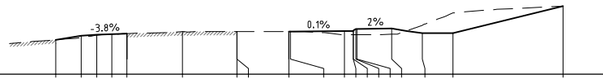
MRWA DRAWING NUMBER
201304-0318-C




DATUM R.L. 36.00

| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ00 | NJ0J | CE0J | ES0J | CT0J | CB0J | EV0J | DC0J | DC0K | IA0J |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | 37.853 | 38.216 | 38.244 | 38.271 | 38.276 | 38.275 | 38.274 | 38.244 | 38.226 | 38.276 | 38.376 | 38.421 | 38.120 | 38.118 | 40.393 | 40.393 |
| GROUND LEVEL | 37.853 | 38.059 | 38.193 | 38.264 | 38.276 | 38.275 | 38.271 | 38.120 | 38.046 | 38.046 | 38.046 | 38.046 | 38.786 | 39.574 | 40.393 | 40.393 |
| OFFSET | -11.557 | -9.376 | -8.376 | -7.376 | -7.201 | -3.563 | 0.014 | 0.000 | 3.374 | 3.500 | 5.992 | 7.600 | 7.601 | 7.770 | 7.830 | 10.100 | 11.907 | 13.908 | 23.039 | 23.039 |

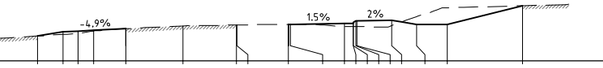
CHA 475.00




DATUM R.L. 35.00

| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ00 | NJ0J | CE0J | ES0J | CT0J | CB0J | EV0J | DC0J | DC0K | IA0J |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | 37.258 | 37.535 | 37.574 | 37.612 | 37.649 | 37.806 | 37.806 | 37.809 | 37.810 | 37.860 | 37.960 | 37.960 | 38.005 | 37.675 | 37.675 | 39.461 |
| GROUND LEVEL | 37.258 | 37.392 | 37.554 | 37.615 | 37.649 | 37.806 | 37.803 | 37.562 | 37.578 | 37.578 | 37.583 | 37.584 | 37.614 | 38.211 | 39.001 | 39.461 |
| OFFSET | -11.812 | -10.148 | -9.147 | -8.146 | -7.173 | -3.546 | 0.000 | 0.021 | 3.405 | 3.500 | 7.000 | 7.600 | 7.601 | 7.770 | 7.830 | 10.100 | 12.081 | 14.082 | 21.252 | 21.252 |

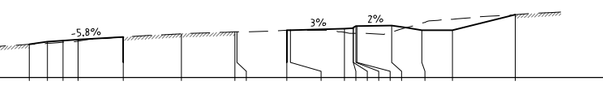
CHA 450.00




DATUM R.L. 35.00

| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ00 | NJ0J | CE0J | ES0J | CT0J | CB0J | EV0J | DC0J | DC0K | IA0J |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | 36.626 | 36.901 | 36.950 | 36.999 | 37.103 | 37.394 | 37.396 | 37.450 | 37.459 | 37.509 | 37.609 | 37.609 | 37.655 | 37.383 | 37.383 | 38.611 |
| GROUND LEVEL | 36.626 | 36.732 | 36.804 | 36.954 | 37.103 | 37.394 | 37.393 | 37.249 | 37.241 | 37.241 | 37.239 | 37.238 | 37.316 | 37.891 | 38.465 | 38.611 |
| OFFSET | -12.984 | -11.338 | -10.337 | -9.335 | -7.223 | -3.507 | 0.018 | 0.000 | 3.356 | 3.500 | 7.000 | 7.600 | 7.601 | 7.770 | 7.830 | 10.100 | 11.733 | 13.733 | 18.644 | 18.644 |

CHA 425.00




DATUM R.L. 34.00

| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ00 | NJ0J | CE0J | ES0J | CT0J | CB0J | EV0J | DC0J | DC0K | IA0J |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | 36.161 | 36.358 | 36.417 | 36.475 | 36.646 | 37.082 | 37.089 | 37.195 | 37.213 | 37.263 | 37.363 | 37.363 | 37.408 | 37.083 | 37.083 | 38.103 |
| GROUND LEVEL | 36.161 | 36.237 | 36.297 | 36.370 | 36.646 | 37.082 | 37.085 | 36.948 | 36.893 | 36.893 | 36.893 | 36.893 | 36.979 | 37.536 | 37.810 | 38.103 |
| OFFSET | -13.528 | -12.343 | -11.343 | -10.343 | -7.403 | -3.616 | 0.135 | 0.000 | 3.253 | 3.504 | 7.004 | 7.604 | 7.605 | 7.774 | 7.834 | 10.104 | 12.052 | 14.053 | 18.141 | 18.141 |

CHA 400.00



DATUM R.L. 37.00

| OFFSET LABEL | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | | | | | | | | | | | | | | |
| GROUND LEVEL | 39.275 | 39.331 | 39.476 | 39.510 | 39.618 | 39.686 | 39.560 | 39.493 | 39.430 | 39.430 | | | | |
| OFFSET | -9.686 | -9.359 | -7.854 | -7.229 | -3.608 | 0.000 | 3.317 | 4.195 | 5.604 | 5.605 | | | | |

CHA 519.93




DATUM R.L. 36.00

| OFFSET LABEL | IA00 | EV00 | ES00 | CE00 | NJ0J | CE0J | ES0J | IA0J |
|---|---|---|---|---|---|---|---|---|
| DESIGN LEVEL | 38.446 | 38.873 | 38.906 | 38.933 | 38.958 | 38.942 | 38.917 | 38.732 |
| GROUND LEVEL | 38.446 | 38.751 | 38.872 | 38.933 | 38.958 | 38.923 | 38.848 | 38.733 |
| OFFSET | -11.586 | -9.026 | -8.030 | -7.214 | -3.570 | -0.045 | 0.000 | 3.325 | 4.214 | 5.578 | 6.685 |

CHA 500.00

DIAL BEFORE YOU DIG
www.1100.com.au

WARNING

SERVICES AND CADASTRAL BOUNDARY LOCATIONS SHOWN ARE ONLY INDICATIVE AND MUST NOT BE USED FOR EXCAVATION. THE "ONE CALL 1100" SYSTEM SHALL BE USED TO OBTAIN ACCURATE SERVICE LOCATIONS.

## AMENDMENTS

| No. | DESCRIPTION | APPROVED & DATE |
|---|---|---|
| A | ISSUED FOR 100% CLIENT REVIEW | JM 08.03.2013 |
| B | ISSUED FOR 100% DESIGN REVIEW | JM 07.06.2013 |
| C | ISSUED FOR TENDER | JM |

## NOTES

1. DESIGN LEVELS ARE TO TOP OF PAVEMENT.
2. REFER TO DRG. 201304-0316 FOR TYPICAL SECTION DETAILS.

## METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: GCG94
HEIGHT DATUM: AHD

Government of Western Australia
mainroads WESTERN AUSTRALIA

MID WEST REGION

EASTWARD ROAD Geraldton 6531
Telephone (08) 9956 1200 Fax (08) 9956 1200

GHD
'GHD House', 239 Adelaide Terrace Perth WA 6004
PO Box Y3106 Perth WA 6832 Australia
T (08) 6222 8222 F (08) 6222 8555
E permail@ghd.com.au www.ghd.com.au

DRAWING NUMBER/DOCUMENT ID

DESIGNED / DRAWN S.TERCENO / K.PALARCA

VERIFIED

DIRECTOR

SCALES 1:200

A1

MRWA FILE NUMBER

APPROVED (MRWA)

# NORTH WEST COASTAL HWY(H007)

WOKARENA ROAD (5160128)

14.84 SLK - 15.49 SLK

## CROSS SECTIONS

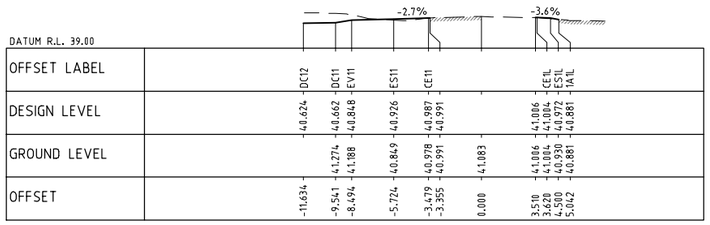
MC00 - CHA. 400 TO CHA. 519.93

LOCAL AUTHORITY (516) SHIRE OF CHAPMAN VALLEY

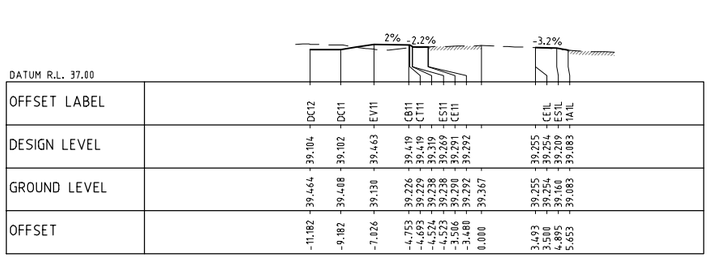
MRWA DRAWING NUMBER

201304-0319-C

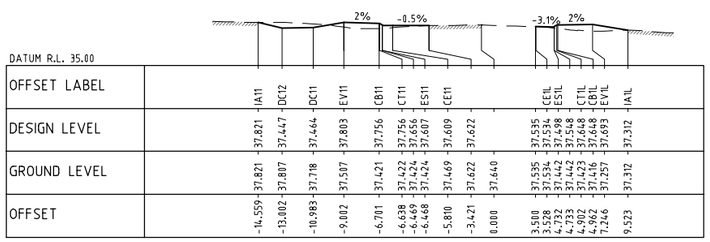

CHA 91.23




CHA 75.00




CHA 50.00




CHA 25.00

DIAL BEFORE YOU DIG www.1100.com.au

WARNING

SERVICES AND CADASTRAL BOUNDARY LOCATIONS SHOWN ARE ONLY INDICATIVE AND MUST NOT BE USED FOR EXCAVATION. THE "ONE CALL 1100" SYSTEM SHALL BE USED TO OBTAIN ACCURATE SERVICE LOCATIONS.

## AMENDMENTS

| No. | DESCRIPTION | APPROVED & DATE |
|---|---|---|
| A | ISSUED FOR 100% CLIENT REVIEW | JM 08.03.2013 |
| B | ISSUED FOR 100% DESIGN REVIEW | JM 07.06.2013 |
| C | ISSUED FOR TENDER | JM |

## NOTES

1. DESIGN LEVELS ARE TO TOP OF PAVEMENT.
2. REFER TO DRG. 201304-0316 FOR TYPICAL SECTION DETAILS.

## METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: GCG94
HEIGHT DATUM: AHD

Government of Western Australia
mainroads WESTERN AUSTRALIA
MID WEST REGION
EASTWARD ROAD Geraldton 6531
Telephone (08) 9956 1200 Fax (08) 9956 1200

GHD
'GHD House', 239 Adelaide Terrace Perth WA 6004
PO Box Y3106 Perth WA 6832 Australia
T (08) 6222 8222 F (08) 6222 8555
E permail@ghd.com.au www.ghd.com.au

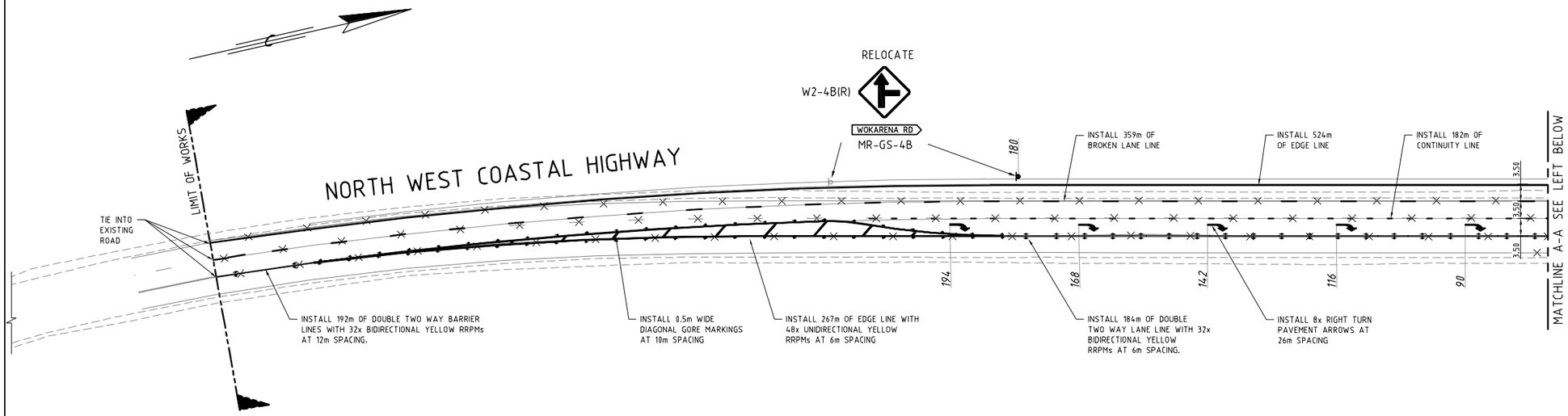
DRAWING NUMBER/DOCUMENT ID
DESIGNED / DRAWN S.TERCENO / K.PALARCA
VERIFIED
DIRECTOR

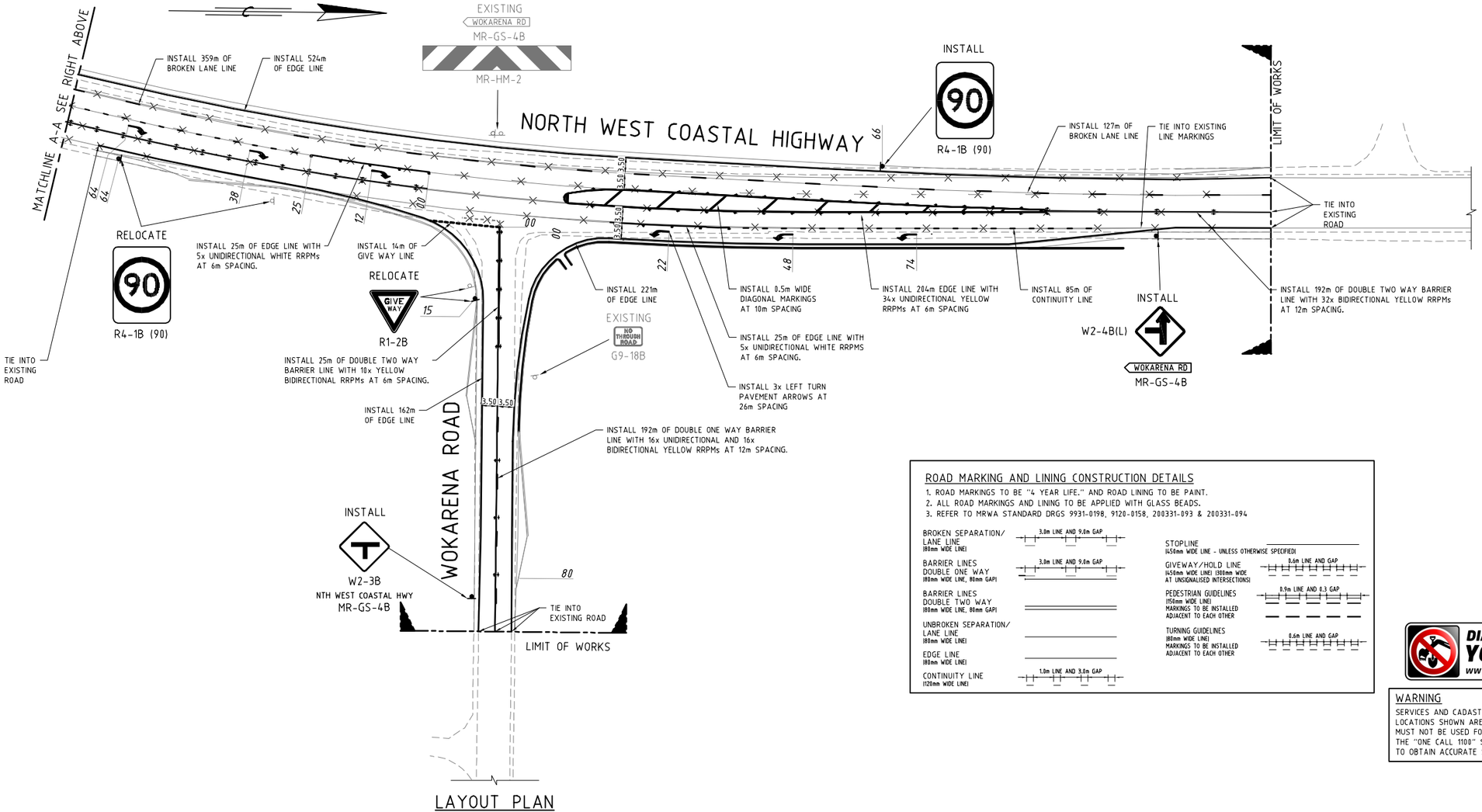
SCALES 1:200
A1

MRWA FILE NUMBER
APPROVED (MRWA)

NORTH WEST COASTAL HIGHWAY
WOKARENA ROAD
14.84 SLK - 15.49 SLK
CROSS SECTIONS
MC01 - CHA. 25 TO CHA. 91.23
LOCAL AUTHORITY (516) SHIRE OF CHAPMAN VALLEY

MRWA DRAWING NUMBER
201304-0320-C




## LAYOUT PLAN
1:500

### ROAD MARKING AND LINING CONSTRUCTION DETAILS

1. ROAD MARKINGS TO BE "4 YEAR LIFE." AND ROAD LINING TO BE PAINT.
2. ALL ROAD MARKINGS AND LINING TO BE APPLIED WITH GLASS BEADS.
3. REFER TO MRWA STANDARD DRGS 9931-0198, 9120-0158, 200331-093 & 200331-094




DIAL BEFORE YOU DIG www.1100.com.au

### WARNING

SERVICES AND CADASTRAL BOUNDARY LOCATIONS SHOWN ARE ONLY INDICATIVE AND MUST NOT BE USED FOR EXCAVATION. THE "ONE CALL 1100" SYSTEM SHALL BE USED TO OBTAIN ACCURATE SERVICE LOCATIONS.

## AMENDMENTS

| No. | DESCRIPTION | APPROVED & DATE |
|---|---|---|
| A | ISSUED FOR 100% CLIENT REVIEW | JM 08.03.2013 |
| B | ISSUED FOR 100% DESIGN REVIEW | JM 07.06.2013 |
| C | ISSUED FOR TENDER | JM |

## NOTES

1. PAVEMENT MARKINGS TO BE ADDED/REMOVED AS SHOWN.
2. SIGNS TO BE ADDED/REMOVED/RELOCATED AS SHOWN.
3. ALL EXISTING PAVEMENT MARKINGS TO BE REMOVED BY WET GRINDING.

## LEGEND:

- NEW PAINTED LINE
- NEW PAINTED GIVE WAY LINE
- NEW PAVEMENT ARROW
- NEW ONE POST SIGN
- EXISTING ONE POST SIGN
- EXISTING TWO POST SIGN
- YELLOW BIDIRECTIONAL RRPM'S
- YELLOW UNIDIRECTIONAL RRPM'S
- WHITE UNIDIRECTIONAL RRPM'S
- EXISTING PAINTED LINE (TO BE REMOVED)

## METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: GCG94
HEIGHT DATUM: AHD


Government of Western Australia
mainroads WESTERN AUSTRALIA
MID WEST REGION
EASTWARD ROAD Geraldton 6531
Telephone (08) 9956 1200 Fax (08) 9956 1200

GHD
'GHD House', 239 Adelaide Terrace Perth WA 6004
PO Box Y3106 Perth WA 6832 Australia
T (08) 6222 8222 F (08) 6222 8555
E permail@ghd.com.au www.ghd.com.au

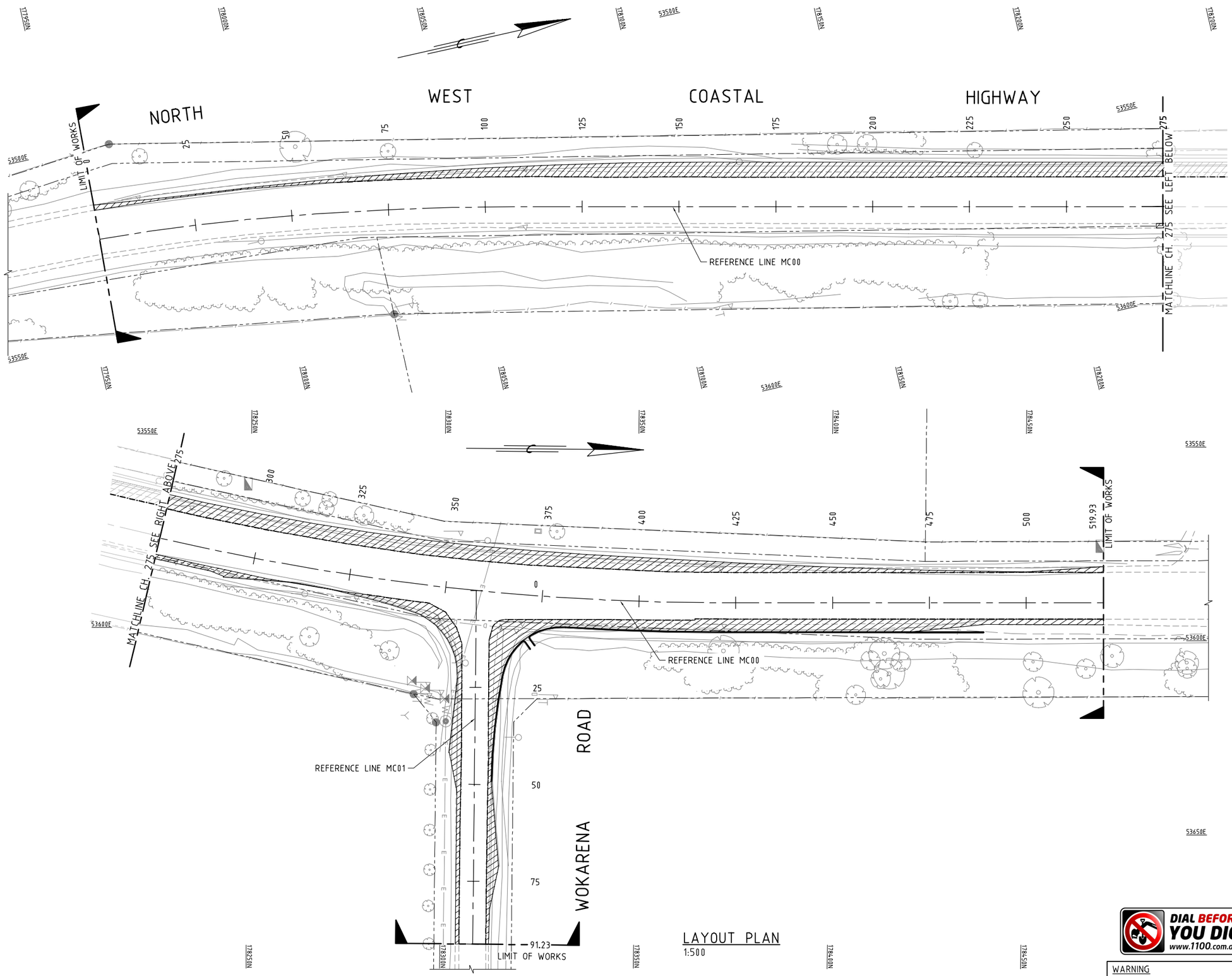

DRAWING NUMBER/DOCUMENT ID
DESIGNED / DRAWN S.TERCENO / K.PALARCA
VERIFIED
DIRECTOR

SCALES 1:500 A1

MRWA FILE NUMBER
APPROVED (MRWA)

# NORTH WEST COASTAL HWY(H007)
WOKARENA ROAD (5160128)
14.84 SLK - 15.49 SLK
PAVEMENT MARKINGS & MINOR SIGNING

LOCAL AUTHORITY (516) SHIRE OF CHAPMAN VALLEY
MRWA DRAWING NUMBER
201304-0321-C




## LAYOUT PLAN
1:500

**DIAL BEFORE YOU DIG** www.1100.com.au

**WARNING**
SERVICES AND CADASTRAL BOUNDARY LOCATIONS SHOWN ARE ONLY INDICATIVE AND MUST NOT BE USED FOR EXCAVATION. THE "ONE CALL 1100" SYSTEM SHALL BE USED TO OBTAIN ACCURATE SERVICE LOCATIONS.

## AMENDMENTS

| No. | DESCRIPTION | APPROVED & DATE |
|---|---|---|
| A | ISSUED FOR 100% CLIENT REVIEW | JM 08.03.2013 |
| B | ISSUED FOR 100% DESIGN REVIEW | JM 07.06.2013 |
| C | ISSUED FOR TENDER | JM |

## NOTES

### LEGEND:
- EXISTING CADASTRAL BOUNDARY
- EXISTING ELECTRICAL LINE
- EXISTING DRAINAGE
- EXISTING FENCE
- EXISTING VEGETATION
- EXISTING TREES
- EXISTING WATER TAP
- EXISTING ELECTRICAL POST
- EXISTING CONCRETE POST
- EXISTING TELEPHONE PIT
- EXISTING ELECTRICAL PIT
- EXISTING TELSTRA PIT
- PROPOSED WIDENING AND PAVEMENT RECONSTRUCTION

## METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: GCG94
HEIGHT DATUM: AHD

Government of Western Australia
mainroads WESTERN AUSTRALIA
MID WEST REGION
EASTWARD ROAD Geraldton 6531
Telephone (08) 9956 1200 Fax (08) 9956 1200

GHD
'GHD House', 239 Adelaide Terrace Perth WA 6004
PO Box Y3106 Perth WA 6832 Australia
T (08) 6222 8222 F (08) 6222 8555
E permail@ghd.com.au www.ghd.com.au

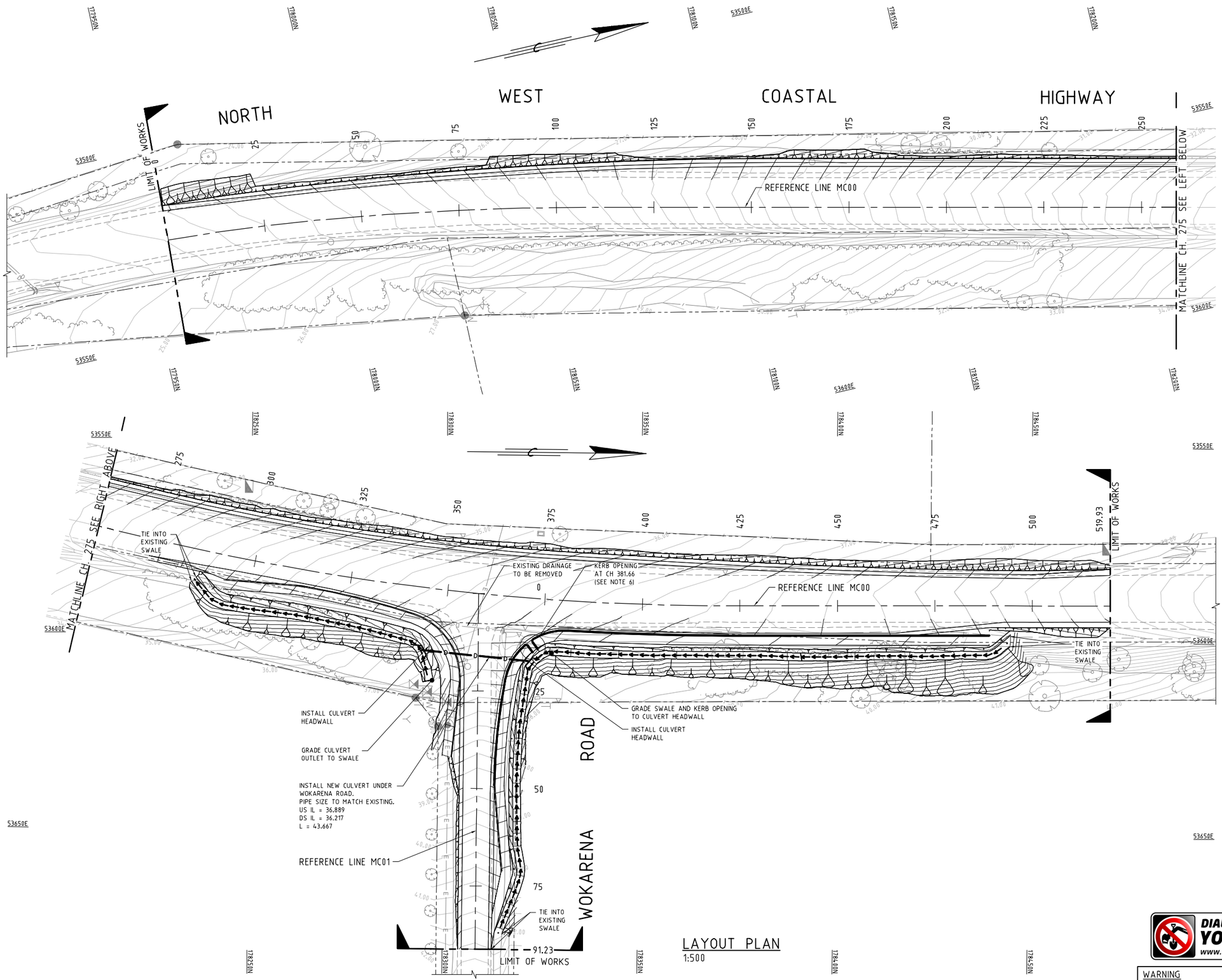
DRAWING NUMBER/DOCUMENT ID
DESIGNED / DRAWN S.TERCENO / K.PALARCA
VERIFIED
DIRECTOR

SCALES 1:500 A1

MRWA FILE NUMBER
APPROVED (MRWA)

# NORTH WEST COASTAL HWY(H007)
WOKARENA ROAD (5160128)
14.84 SLK - 15.49 SLK
PAVEMENT PLAN

LOCAL AUTHORITY (516) SHIRE OF CHAPMAN VALLEY
MRWA DRAWING NUMBER
201304-0322-C




## LAYOUT PLAN
1:500

**WARNING**
SERVICES AND CADASTRAL BOUNDARY LOCATIONS SHOWN ARE ONLY INDICATIVE AND MUST NOT BE USED FOR EXCAVATION. THE "ONE CALL 1100" SYSTEM SHALL BE USED TO OBTAIN ACCURATE SERVICE LOCATIONS.

DIAL BEFORE YOU DIG www.1100.com.au

### AMENDMENTS

| No. | DESCRIPTION | APPROVED & DATE |
|---|---|---|
| A | ISSUED FOR 100% CLIENT REVIEW | JM 08.03.2013 |
| B | ISSUED FOR 100% DESIGN REVIEW | JM 07.06.2013 |
| C | ISSUED FOR TENDER | JM |

### NOTES

1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.
2. KERB TYPE SM-1 TO BE USED ON ALL KERB RETURNS.
3. CULVERT LOCATION AND INVERT LEVELS TO BE CONFIRMED BY SUPERINTENDENT PRIOR TO CONSTRUCTION.
4. PIPE SIZE OF NEW CULVERT TO MATCH PIPE SIZE OF EXISTING DRAINAGE CULVERT TO BE REMOVED.
5. REFER TO MRWA STANDARD DRG. 200131-0061 TO 0066 FOR CULVERT DETAILS.
6. REFER TO MRWA STANDARD DRG. 201131-0069 FOR KERB OPENING DETAILS.

### LEGEND:

- PROPOSED DRAINAGE LINE
- DRAINAGE FLOW ARROW
- DESIGN CONTOUR
- EXISTING CONTOUR
- EXISTING CADASTRAL BOUNDARY
- EXISTING ELECTRICAL LINE
- EXISTING DRAINAGE
- EXISTING FENCE
- EXISTING VEGETATION
- EXISTING TREES
- EXISTING WATER TAP
- EXISTING ELECTRICAL POST
- EXISTING CONCRETE POST
- EXISTING TELEPHONE PIT
- EXISTING ELECTRICAL PIT
- EXISTING TELSTRA PIT
- TADPOLES

### METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: GCG94
HEIGHT DATUM: AHD

Government of Western Australia
mainroads WESTERN AUSTRALIA
MID WEST REGION
EASTWARD ROAD Geraldton 6531
Telephone (08) 9956 1200 Fax (08) 9956 1240

GHD
'GHD House', 239 Adelaide Terrace Perth WA 6004
PO Box Y3106 Perth WA 6832 Australia
T (08) 6222 8222 F (08) 6222 8555
E permail@ghd.com.au www.ghd.com.au

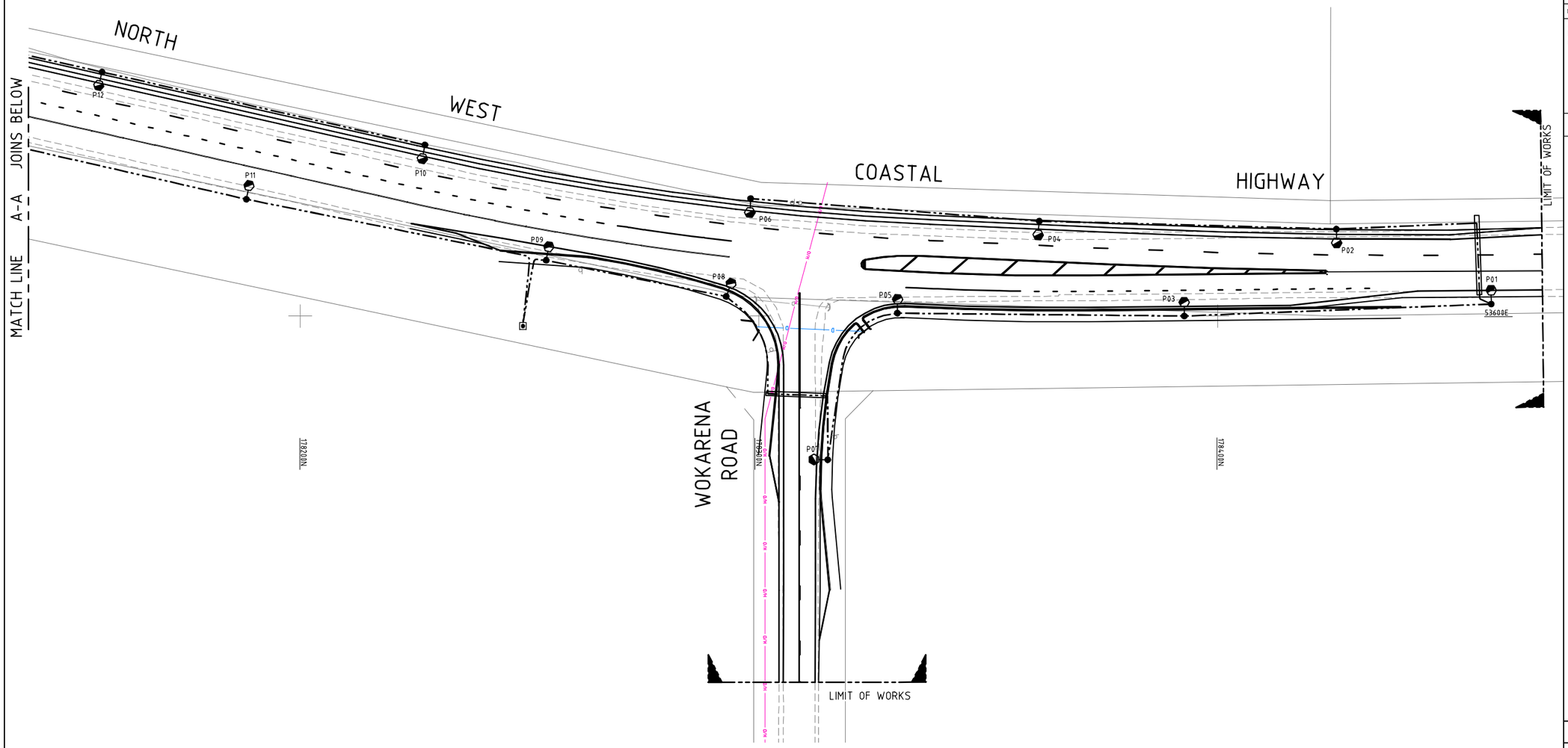
DRAWING NUMBER/DOCUMENT ID
DESIGNED / DRAWN S.TERCENO / K.PALARCA
VERIFIED
DIRECTOR

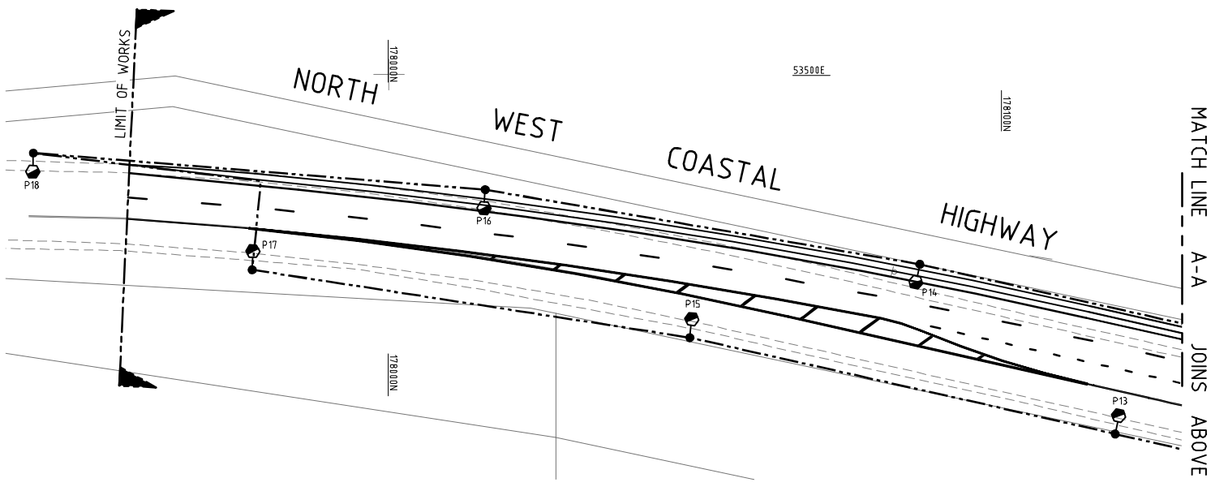
SCALES 1:500
A1

MRWA FILE NUMBER
APPROVED (MRWA)

# NORTH WEST COASTAL HWY(H007)
WOKARENA ROAD (5160128)
14.84 SLK - 15.49 SLK
## DRAINAGE PLAN

LOCAL AUTHORITY (516) SHIRE OF CHAPMAN VALLEY
MRWA DRAWING NUMBER
201304-0323-C




## AMENDMENTS

| No. | DESCRIPTION | APPROVED & DATE |
|---|---|---|
| A | ISSUED FOR 100% CLIENT REVIEW | JM 08.03.2013 |
| B | ISSUED FOR 100% DESIGN REVIEW | JM 07.06.2013 |
| C | ISSUED FOR TENDER | JM |

## NOTES

1. DRAWINGS TO BE READ IN CONJUNCTION WITH CONTRACT SPECIFICATION.
2. REFER TO WESTERN POWER DISTRIBUTION DESIGN CATALOGUE FOR WESTERN POWER DETAILS.
3. NEW POLE TO BE 1.5m FROM FACE OF KERB OR EDGE OF SEALED SHOULDER.
4. ALL WESTERN POWER CABLING & TRENCHING TO BE CARRIED OUT IN ACCORDANCE WITH WESTERN POWER STANDARD & SPECIFICATIONS.
5. STREET LIGHTING DESIGN TO AS/NZS 1158 CATEGORY V3.

## SERVICES

- EXISTING DRAINAGE
- EXISTING OVERHEAD POWER
- PROPOSED DRAINAGE

## LEGEND

- NEW SINGLE SYLVANIA ROADSTER 250W HPS MOUNTED ON 12.5m HIGH IMPACT ABSORBING STEEL GALVANISED POLE WITH SINGLE 3.0m OUTREACH , AS WESTERN POWER COMPATIBLE UNITS SL11_250
- 16sqmm Cu NEUTRAL SCREENED XLPE CABLE (WESTERN POWER COMPATIBLE UNIT CN41) IN Ø50mm ORANGE HD PVC CONDUIT
- 1Ø50mm ORANGE HD PVC ROAD CROSSING CONDUIT
- WESTERN POWER POINT OF SUPPLY

DIAL BEFORE YOU DIG www.1100.com.au

**WARNING**

SERVICES AND CADASTRAL BOUNDARY LOCATIONS SHOWN ARE ONLY INDICATIVE AND MUST NOT BE USED FOR EXCAVATION. THE "ONE CALL 1100" SYSTEM SHALL BE USED TO OBTAIN ACCURATE SERVICE LOCATIONS.

## POLE SCHEDULE

| POLE NUMBER | EASTING | NORTHING | POLE HEIGHT (m) | OUTREACH (m) | LUMINAIRE | LUMEN OUTPUT | COMMENTS |
|---|---|---|---|---|---|---|---|
| P01 | 53597.387 | 178459.691 | 12.5 | 3 | SYLVANIA ROADSTER 1 X 250W HPS | 28000 | |
| P02 | 53581.036 | 178425.904 | 12.5 | 3 | SYLVANIA ROADSTER 1 X 250W HPS | 28000 | |
| P03 | 53599.391 | 178392.747 | 12.5 | 3 | SYLVANIA ROADSTER 1 X 250W HPS | 28000 | |
| P04 | 53579.284 | 178361.120 | 12.5 | 3 | SYLVANIA ROADSTER 1 X 250W HPS | 28000 | |
| P05 | 53598.777 | 178330.143 | 12.5 | 3 | SYLVANIA ROADSTER 1 X 250W HPS | 28000 | |
| P06 | 53574.383 | 178298.187 | 12.5 | 3 | SYLVANIA ROADSTER 1 X 250W HPS | 28000 | |
| P07 | 53631.317 | 178314.132 | 12.5 | 3 | SYLVANIA ROADSTER 1 X 250W HPS | 28000 | |
| P08 | 53595.160 | 178293.107 | 12.5 | 3 | SYLVANIA ROADSTER 1 X 250W HPS | 28000 | |
| P09 | 53587.333 | 178253.646 | 12.5 | 3 | SYLVANIA ROADSTER 1 X 250W HPS | 28000 | |
| P10 | 53562.696 | 178227.185 | 12.5 | 3 | SYLVANIA ROADSTER 1 X 250W HPS | 28000 | |
| P11 | 53574.523 | 178188.253 | 12.5 | 3 | SYLVANIA ROADSTER 1 X 250W HPS | 28000 | |
| P12 | 53546.774 | 178156.762 | 12.5 | 3 | SYLVANIA ROADSTER 1 X 250W HPS | 28000 | |
| P13 | 53558.540 | 178118.392 | 12.5 | 3 | SYLVANIA ROADSTER 1 X 250W HPS | 28000 | |
| P14 | 53530.904 | 178086.555 | 12.5 | 3 | SYLVANIA ROADSTER 1 X 250W HPS | 28000 | |
| P15 | 53542.847 | 178049.037 | 12.5 | 3 | SYLVANIA ROADSTER 1 X 250W HPS | 28000 | |
| P16 | 53518.756 | 178015.678 | 12.5 | 3 | SYLVANIA ROADSTER 1 X 250W HPS | 28000 | |
| P17 | 53531.795 | 177977.784 | 12.5 | 3 | SYLVANIA ROADSTER 1 X 250W HPS | 28000 | |
| P18 | 53512.784 | 177942.013 | 12.5 | 3 | SYLVANIA ROADSTER 1 X 250W HPS | 28000 | |

## METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: GCG94
HEIGHT DATUM: AHD


Government of Western Australia
mainroads WESTERN AUSTRALIA
MID WEST REGION
EASTWARD ROAD Geraldton 6531
Telephone (08) 9956 1200 Fax (08) 9956 1240

GHD
'GHD House', 239 Adelaide Terrace Perth WA 6004
PO Box Y3106 Perth WA 6832 Australia
T (08) 6222 8222 F (08) 6222 8555
E permail@ghd.com.au www.ghd.com.au


DRAWING NUMBER/DOCUMENT ID 61\28702\CADD\Drawings
DESIGNED / DRAWN J.McLAREN / Y.HU
VERIFIED
DIRECTOR

SCALES 1:500 A1

MRWA FILE NUMBER
APPROVED (MRWA)

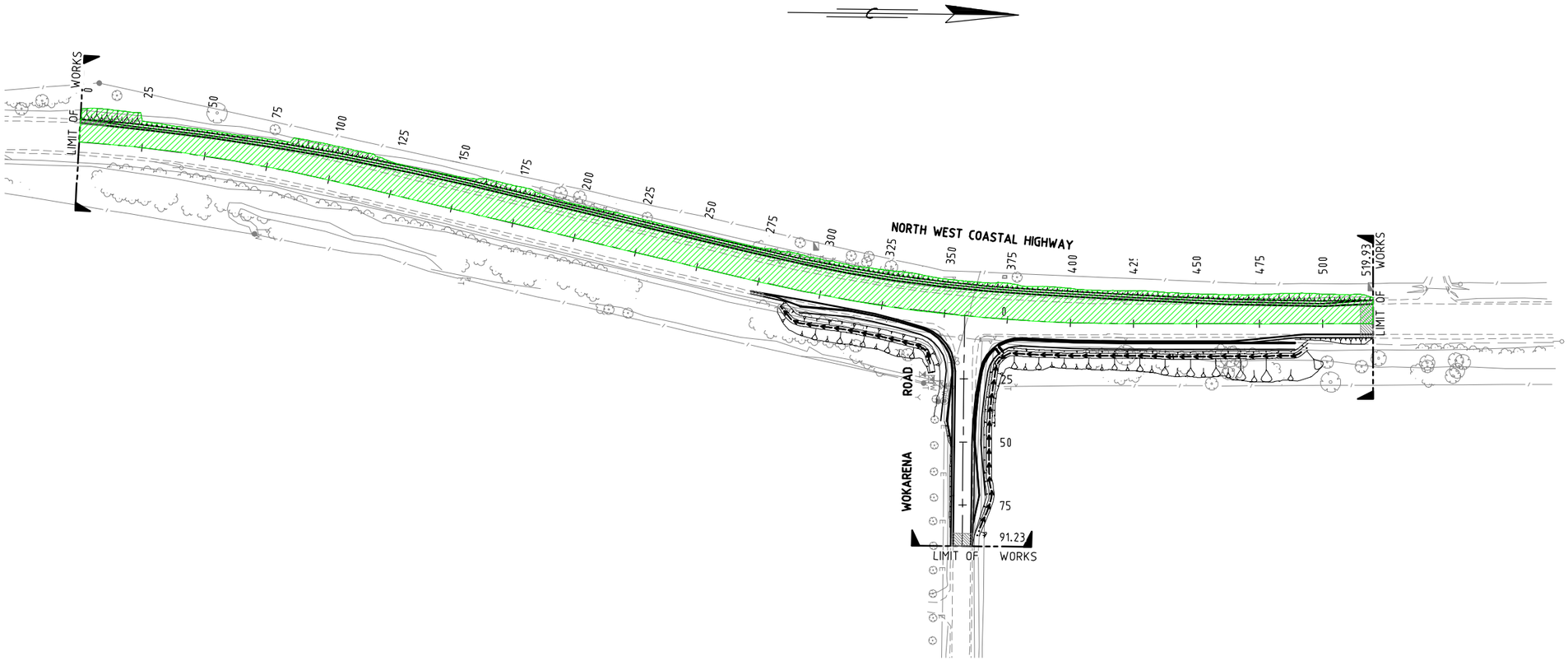
# NORTH WEST COASTAL HWY(H007)

WOKARENA ROAD (5160128)
14.84 SLK - 15.49 SLK

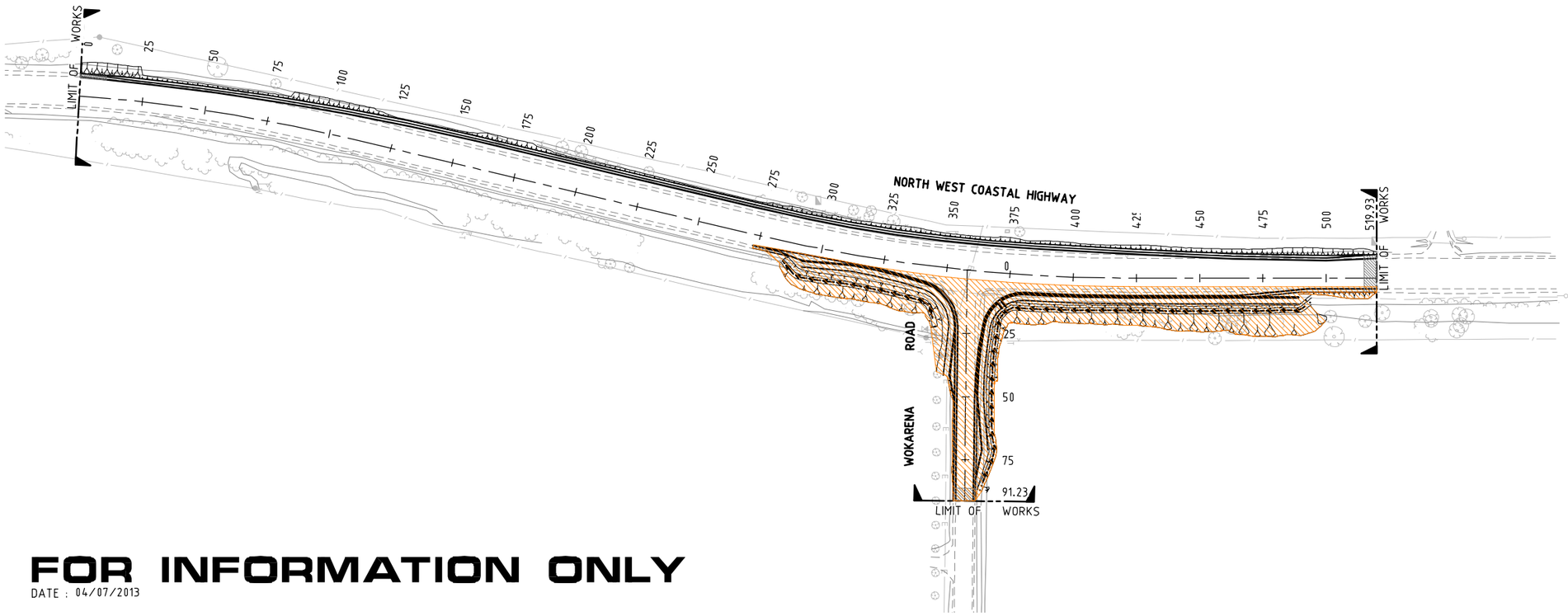
## STREET LIGHTING LAYOUT & POLE SCHEDULE

LOCAL AUTHORITY (516) SHIRE OF CHAPMAN VALLEY
MRWA DRAWING NUMBER
201304-0324-C

# NORTHBOUND STAGE




# SOUTHBOUND STAGE




**FOR INFORMATION ONLY**

DATE : 04/07/2013

## AMENDMENTS

| No. | DESCRIPTION | APPROVED & DATE |
|---|---|---|
| A | FOR INFORMATION ONLY | |

## NOTES

## LEGEND:

- E — EXISTING ELECTRICAL LINE
- D — EXISTING DRAINAGE
- EXISTING FENCE
- EXISTING VEGETATION
- EXISTING TREES
- EXISTING WATER TAP
- EXISTING ELECTRICAL POST
- EXISTING CONCRETE POST
- EXISTING TELEPHONE PIT
- EXISTING ELECTRICAL PIT
- EXISTING TELSTRA PIT

## METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: GCG94
HEIGHT DATUM: AHD

Government of Western Australia
mainroads WESTERN AUSTRALIA

MID WEST REGION
EASTWARD ROAD Geraldton 6531
Telephone (08) 9956 1200 Fax (08) 9956 1240


GHD
'GHD House', 239 Adelaide Terrace Perth WA 6004
PO Box Y3106 Perth WA 6832 Australia
T (08) 6222 8222 F (08) 6222 8555
E permail@ghd.com.au www.ghd.com.au


DRAWING NUMBER/DOCUMENT ID
DESIGNED / DRAWN S.TERCENO / K.PALARCA
VERIFIED
DIRECTOR

SCALES 1:500 A1

MRWA FILE NUMBER
APPROVED (MRWA)

NORTH WEST COASTAL HWY(H007)
WOKARENA ROAD (5160128)
14.84 SLK - 15.49 SLK
CONSTRUCTION STAGES

LOCAL AUTHORITY (516) SHIRE OF CHAPMAN VALLEY

MRWA DRAWING NUMBER
61-28702-SK001

# Appendix C – Project Cost Estimate

GOVERNMENT OF WESTERN AUSTRALIA

mainroads WESTERN AUSTRALIA

# COST INDICATION

## INTERSECTION IMPROVEMENTS
## NORTH WEST COASTAL HIGHWAY - WOKARENA ROAD

Contract No:

**Job No.: A2619**

July 2013

Davson+Ward
QUANTITY SURVEYORS & CONSTRUCTION COST CONSULTANTS

GHD

Davson+Ward
QUANTITY SURVEYORS & CONSTRUCTION COST CONSULTANTS

## INTERSECTION IMPROVEMENTS
## NORTH WEST COASTAL HIGHWAY - WOKARENA ROAD

## CONDITIONS & EXCLUSIONS

**1.00 <u>This Cost Indication is conditioned as follows:</u>**

1.01 These prices are current as at July 1, 2013 and are based on the rate currently used in similar work for MRWA

1.02 No Escalation of cost has been incorporated from the date stated in 1.01 above and the date of tender

1.03 This estimate is accurate within the following range: *** See Below**

**2.00 <u>This Cost Indication excludes the cost of the following:</u>**

2.01 Removal of asbestos

2.02 The value of Principal supplied items including searching for and stockpiling of embankment construction and pavement construction materials

2.03 Allowances of accelerated construction periods

2.04 Holding Costs and interest charges

2.05 Time extension costs

2.06 Legal fees

2.07 Allowances for charges and costs levied by Authorities, Councils and Service Bodies

2.08 Aboriginal heritage, cultural and native title issues

2.09 Environmental obligations and clearances

2.10 Geotechnical investigations

2.11 Worsley Alumina Pty Ltd administrative charges including corporate overheads, etc

2.12 Redevelopment work of surplus land prior to disposal

Davson+Ward
QUANTITY SURVEYORS & CONSTRUCTION COST CONSULTANTS

## INTERSECTION IMPROVEMENTS
## NORTH WEST COASTAL HIGHWAY - WOKARENA ROAD

## CONDITIONS & EXCLUSIONS

2.13 Loss of business claims

2.14 Increased costs due to labour shortages in the Region

2.15 Increase in tender prices due to the current over supply of work for Contractors

* **Please note:** It is no longer Davson+Ward Company Policy to nominate limits of accuracy due to the current economic climate

**INTERSECTION IMPROVEMENTS**
**NORTH WEST COASTAL HIGHWAY - WOKARENA ROAD**

## COST INDICATION

## CONTENTS



67-05-3018 .xls version 05/00

**INTERSECTION IMPROVEMENTS**
**NORTH WEST COASTAL HIGHWAY - WOKARENA ROAD**

**SUMMARY**

## A. SOUTHBOUND PHASE

| | | | | |
|---|---|---|---|---|
| **SCHEDULE No. 1 - GENERAL ITEMS** | | | See Below | |
| **SCHEDULE No. 2 - SOUTHBOUND** | | | | |
| SERIES 300 - EARTHWORKS | | | $114,940.00 | |
| SERIES 400 - DRAINAGE | | | $45,340.00 | |
| SERIES 500 - PAVEMENT & SURFACING | | | $80,550.00 | |
| SERIES 600 - TRAFFIC FACILITIES | | | $4,485.00 | |
| | | | $245,315.00 | |
| **ADD** Preliminary items (**Includes:** Insurances, Contractor's Superintendence, site establishment, Contractors site offices and area, Superintendent's Office Survey and traffic costs and all other items included in the normal Schedule No. 1 - General Items) | % | 29 | **$71,141.35** | |
| **ADD** Contingencies | % | 15 | **$49,063.00** | |
| GST EXCLUSIVE AMOUNT | | | **$365,519.35** | |
| LAND ACQUISITION | Item | 1 | **Not Applicable** | |
| SURVEY, DESIGN AND DOCUMENTATION | % | 8 | **$29,241.55** | |
| ETHNOGRAPHIC SURVEYS AND CLEARANCES | % | 1 | **$3,655.19** | |
| TENDER AND CONTRACT ADMINISTRATION (MRWA) | % | 5 | **$18,275.97** | |
| PROJECT MANAGEMENT (MRWA) | % | 4 | **$14,620.77** | |
| | | | **$431,312.83** | |
| ESTIMATED GST PAYABLE | | | **$36,551.94** | |
| **SOUTHBOUND-TOTAL OF COST INDICATION - July 2013** | | | **$467,864.77** | **$467,864.77** |

**INTERSECTION IMPROVEMENTS**
**NORTH WEST COASTAL HIGHWAY - WOKARENA ROAD**

**SUMMARY**

## B. NORTHBOUND PHASE

| | | | | |
|---|---|---|---|---|
| **SCHEDULE No. 1 - GENERAL ITEMS** | | | | See Below |
| **SCHEDULE No. 2 - NORTHBOUND** | | | | |
| SERIES 300 - EARTHWORKS | | | $64,682.50 | |
| SERIES 500 - PAVEMENT & SURFACING | | | $125,300.00 | |
| SERIES 600 - TRAFFIC FACILITIES | | | $11,640.00 | |
| | | | $201,622.50 | |
| **ADD** Preliminary items (**Includes:** Insurances, Contractor's Superintendence, site establishment, Contractors site offices and area, Superintendent's Office Survey and traffic costs and all other items included in the normal Schedule No. 1 - General Items) | % | 29 | **$58,470.53** | |
| **ADD** Contingencies | % | 15 | **$30,243.38** | |
| GST EXCLUSIVE AMOUNT | | | **$290,336.40** | |
| LAND ACQUISITION | Item | 1 | **Not Applicable** | |
| SURVEY, DESIGN AND DOCUMENTATION | % | 8 | **$23,226.91** | |
| ETHNOGRAPHIC SURVEYS AND CLEARANCES | % | 1 | **$2,903.36** | |
| TENDER AND CONTRACT ADMINISTRATION (MRWA) | % | 5 | **$14,516.82** | |
| PROJECT MANAGEMENT (MRWA) | % | 4 | **$11,613.46** | |
| | | | **$342,596.95** | |
| ESTIMATED GST PAYABLE | | | **$29,033.64** | |
| **NORTHBOUND-TOTAL OF COST INDICATION - July 2013** | | | **$371,630.59** | **$371,630.59** |

**INTERSECTION IMPROVEMENTS**
**NORTH WEST COASTAL HIGHWAY - WOKARENA ROAD**

**SUMMARY**

## C. ROADWAY LIGHTING

**SCHEDULE No. 4 - ROADWAY LIGHTING**

| | | | | |
|---|---|---|---|---|
| SERIES 700 - ELECTRICAL & STREET LIGHTING | | | $233,750.00 | |
| **ADD** Preliminary items (**Includes:** Insurances, Contractor's Superintendence, site establishment, Contractors site offices and area, Superintendent's Office Survey and traffic costs and all other items included in the normal Schedule No. 1 - General Items) | % | 29 | **$67,787.50** | |
| **ADD** Contingencies | % | 15 | **$35,062.50** | |
| GST EXCLUSIVE AMOUNT | | | **$336,600.00** | |
| LAND ACQUISITION | Item | 1 | **Not Applicable** | |
| SURVEY, DESIGN AND DOCUMENTATION | % | 8 | **$26,928.00** | |
| ETHNOGRAPHIC SURVEYS AND CLEARANCES | % | 1 | **$3,366.00** | |
| TENDER AND CONTRACT ADMINISTRATION (MRWA) | % | 5 | **$16,830.00** | |
| PROJECT MANAGEMENT (MRWA) | % | 4 | **$13,464.00** | |
| | | | **$397,188.00** | |
| ESTIMATED GST PAYABLE | | | **$33,660.00** | |
| **LIGHTING-TOTAL OF COST INDICATION - July 2013** | | | **$430,848.00** | **$430,848.00** |

## TOTAL OF COST INDICATION - TOTAL PROJECT **$1,270,343.36**

# SCHEDULE No. 2 - SOUTHBOUND

| Item | Description | Unit | Qty | Rate | Amount |
|---|---|---|---|---|---|
| | **SERIES 300 - EARTHWORKS** | | | | |
| | **301 - CLEARING** | | | | |
| 301.01 | Clear the designated areas for roadworks and mulch vegetation for inclusion into the imported topsoil. Contractor to stockpile on site. | m2 | 4,050 | $4.20 | $17,010.00 |
| 301.02 | Removal of trees | No. | 8 | $975.00 | $7,800.00 |
| | **302 - EARTHWORKS** | | | | |
| | TOPSOILING | | | | |
| | Topsoil Removal | | | | |
| 302.01 | Topsoil removal, nominally 100mm deep, from the designated areas for roadworks and stockpile on site for re-use | m2 | 1,050 | $1.85 | $1,942.50 |
| 302.02 | Topsoil removal, 100mm deep, and disposal of to Contractor's spoil area off-site | m2 | 900 | $6.50 | $5,850.00 |
| | Topsoil Spreading | | | | |
| 302.03 | Respread 70mm depth of imported topsoil mixed with stockpiled mulch on embankment and cut slopes | m2 | 1,050 | $2.75 | $2,887.50 |
| | REMOVAL OF EXISTING PAVEMENTS | | | | |
| 302.04 | Removal of redundant kerbs | m | 420 | $17.50 | $7,350.00 |
| 302.05 | Marking out and cutting edge along junction between new pavement and existing pavement including trimming existing pavement layers as required to bond to new pavement | m | 420 | $8.75 | $3,675.00 |
| | DISPOSAL OF SURPLUS EXCAVATED MATERIAL | | | | |
| 302.06 | Excavate and dispose of surplus soil material to contractors spoil area off site (Cut to Spoil) (ESTIMATED ONLY) | m3 | | $17.50 | |
| | EXCAVATION | | | | |
| 302.07 | Excavation to form boxing out of pavement (350mm depth) and disposal of surplus material to contractors spoil area off site | m3 | 1,050 | $38.50 | $40,425.00 |

| Item | Description | Unit | Qty | Rate | Amount |
|---|---|---|---|---|---|
| | EMBANKMENT CONSTRUCTION | | | | |
| 302.08 | Embankment construction for roadworks using site excavated material and imported material including embankment foundation (ESTIMATED ONLY) | m3 | 270 | $65.00 | $17,550.00 |
| | SUBGRADE | | | | |
| 302.09 | Subgrade preparation in road widening | m2 | 1,900 | $5.50 | $10,450.00 |
| | To Summary | | | | $114,940.00 |
| | **SERIES 400 - DRAINAGE** | | | | |
| | **402 - SURFACE DRAINS AND LEVEES** | | | | |
| 402.01 | Regrade drainage channel | m2 | 530 | $56.00 | $29,680.00 |
| | **407 - KERBING** | | | | |
| 407.01 | Kerb type SM-1 | m | 270 | $58.00 | $15,660.00 |
| | To Summary | | | | $45,340.00 |
| | **SERIES 500 - PAVEMENT & SURFACING** | | | | |
| | **501 - PAVEMENTS** | | | | |
| | SUBBASE | | | | |
| 501.01 | 220mm Thick crushed limestone subbase in widenings | m² | 900 | $25.00 | $22,500.00 |
| | BASECOURSE | | | | |
| 501.02 | 180mm crushed rock basecourse in widenings | m2 | 900 | $32.00 | $28,800.00 |
| | **503 - BITUMINOUS SURFACING** | | | | |
| | ROADWORKS | | | | |
| | Prime | | | | |
| 503.01 | Prime coat with BAR of 0.8 litres/m² | m² | 900 | $5.50 | $4,950.00 |
| | Seal | | | | |
| 503.05 | First coat seal with BAR of ? litres/m² and 14mm aggregate | m² | 900 | $14.50 | $13,050.00 |

| Item | Description | Unit | Qty | Rate | Amount |
|---|---|---|---|---|---|
| 503.06 | Second coat seal with BAR of ? litres/m² and 10mm aggregate | m² | 900 | $12.50 | $11,250.00 |
| | To Summary | | | | $80,550.00 |
| | **SERIES 600 - TRAFFIC FACILITIES** | | | | |
| | **601 - SIGNS** | | | | |
| | RELOCATION OF EXISTING SIGNS | | | | |
| 601.01 | Single post sign | No. | 2 | $750.00 | $1,500.00 |
| | **602 - GUIDE POSTS** | | | | |
| 602.01 | Guide post | No. | 2 | $165.00 | $330.00 |
| | **604 - PAVEMENT MARKING** | | | | |
| | ROAD PAVEMENT MARKINGS | | | | |
| 604.01 | Painted line markings | km | 1 | $650.00 | $650.00 |
| 604.03 | Theromplastic Left Turn arrow | No. | 3 | $125.00 | $375.00 |
| 604.04 | Removal of redundant road pavement markings | m | 520 | $2.50 | $1,300.00 |
| | RAISED PAVEMENT MARKERS | | | | |
| 604.05 | Raised pavement marker type - White Unidirectional | No. | 22 | $15.00 | $330.00 |
| | To Summary | | | | $4,485.00 |

# SCHEDULE No. 3 - NORTHBOUND

| Item | Description | Unit | Qty | Rate | Amount |
|---|---|---|---|---|---|
| | **SERIES 300 - EARTHWORKS** | | | | |
| | **301 - CLEARING** | | | | |
| 301.01 | Clear the designated areas for roadworks and mulch vegetation for inclusion into the imported topsoil. Contractor to stockpile on site. | m2 | 2,650 | $4.20 | $11,130.00 |
| 301.02 | Removal of trees | No. | 2 | $975.00 | $1,950.00 |
| | **302 - EARTHWORKS** | | | | |
| | TOPSOILING | | | | |
| | Topsoil Removal | | | | |
| 302.01 | Topsoil removal, nominally 100mm deep, from the designated areas for roadworks and stockpile on site for re-use | m2 | 1,400 | $1.85 | $2,590.00 |
| 302.02 | Topsoil removal, 100mm deep, and disposal of to Contractor's spoil area off-site | m2 | 500 | $6.50 | $3,250.00 |
| | Topsoil Spreading | | | | |
| 302.03 | Respread 70mm depth of imported topsoil mixed with stockpiled mulch on embankment and cut slopes | m2 | 1,400 | $2.75 | $3,850.00 |
| | REMOVAL OF EXISTING PAVEMENTS | | | | |
| 302.04 | Removal of redundant kerbs | m | 530 | $17.50 | $9,275.00 |
| 302.05 | Marking out and cutting edge along junction between new pavement and existing pavement including trimming existing pavement layers as required to bond to new pavement | m | 530 | $8.75 | $4,637.50 |
| | DISPOSAL OF SURPLUS EXCAVATED | | | | |
| 302.06 | Excavate and dispose of surplus soil material to contractors spoil area off site (Cut to Spoil) (ESTIMATED ONLY) | m3 | | $17.50 | |
| | EXCAVATION | | | | |
| 302.07 | Excavation to form boxing out of pavement (350mm depth) and disposal of surplus material to contractors spoil area off site | m3 | | $38.50 | |
| | EMBANKMENT CONSTRUCTION | | | | |
| 302.08 | Embankment construction for roadworks using site excavated material and imported material including embankment foundation (ESTIMATED ONLY) | m3 | 270 | $65.00 | $17,550.00 |

| Item | Description | Unit | Qty | Rate | Amount |
|---|---|---|---|---|---|
| | **SERIES 300 - EARTHWORKS** | | | | |
| | SUBGRADE | | | | |
| 302.08 | Subgrade preparation in road widening | m2 | 1,900 | $5.50 | $10,450.00 |
| | To Summary | | | | $64,682.50 |
| | **SERIES 500 - PAVEMENT & SURFACING** | | | | |
| | **501 - PAVEMENTS** | | | | |
| | SUBBASE | | | | |
| 501.01 | 220mm Thick crushed limestone subbase in widenings | m² | 1,400 | $25.00 | $35,000.00 |
| | BASECOURSE | | | | |
| 501.02 | 180mm crushed rock basecourse in widenings | m2 | 1,400 | $32.00 | $44,800.00 |
| | **503 - BITUMINOUS SURFACING** | | | | |
| | ROADWORKS | | | | |
| | Prime | | | | |
| 503.01 | Prime coat with BAR of 0.8 litres/m² | m² | 1,400 | $5.50 | $7,700.00 |
| | Seal | | | | |
| 503.05 | First coat seal with BAR of ? litres/m² and 14mm aggregate | m² | 1,400 | $14.50 | $20,300.00 |
| 503.06 | Second coat seal with BAR of ? litres/m² and 10mm aggregate | m² | 1,400 | $12.50 | $17,500.00 |
| | To Summary | | | | $125,300.00 |
| | **SERIES 600 - TRAFFIC FACILITIES** | | | | |
| | **601 - SIGNS** | | | | |
| | SINGLE POST SIGNS | | | | |
| 601.01 | Traffic sign R1-2A (Give way) | No. | 1 | $1,550.00 | $1,550.00 |
| | RELOCATION OF EXISTING SIGNS | | | | |
| 601.08 | Single post sign | No. | 1 | $750.00 | $750.00 |

| Item | Description | Unit | Qty | Rate | Amount |
|---|---|---|---|---|---|
| | **SERIES 300 - EARTHWORKS** | | | | |
| | **604 - PAVEMENT MARKING** | | | | |
| | ROAD PAVEMENT MARKINGS | | | | |
| 604.01 | Painted line markings | km | 2 | $650.00 | $1,300.00 |
| 604.02 | Thermoplastic give way lines | m | 15 | $30.00 | $450.00 |
| 604.03 | Theromplastic Left Turn arrow | No. | 8 | $125.00 | $1,000.00 |
| 604.04 | Removal of redundant road pavement markings | m | 1,700 | $2.50 | $4,250.00 |
| | RAISED PAVEMENT MARKERS | | | | |
| 604.05 | Raised pavement marker type - White Unidirectional | No. | 156 | $15.00 | $2,340.00 |
| | To Summary | | | | $11,640.00 |

# SCHEDULE No. 4 - ROADWAY LIGHTING

| Item | Description | Unit | Qty | Rate | Amount |
|---|---|---|---|---|---|
| | **SERIES 700 - ELECTRICAL & LIGHTING** | | | | |
| | **701 - ROADWAY LIGHTING** | | | | |
| | LIGHTING POLES | | | | |
| 701.01 | Concrete base for single outreach arm pole | No. | 18 | $1,200.00 | $21,600.00 |
| 701.02 | Galvanised steel light pole (Type ?) ?m high overall complete with ?m outreach arm | No. | 18 | $3,500.00 | $63,000.00 |
| 701.03 | Roadway lighting luminaire fixed to lighting pole outreach arm | No. | 18 | $1,500.00 | $27,000.00 |
| | SWITCHBOARDS | | | | |
| 701.04 | Switchboard No. 1 | No. | 1 | $5,600.00 | $5,600.00 |
| | CONDUITS AND CABLING | | | | |
| | Conduits | | | | |
| 701.05 | ? Diameter heavy duty PVC conduit in trench | m | 1,100 | $50.00 | $55,000.00 |
| 701.08 | Cable pit type ? | No. | 18 | $875.00 | $15,750.00 |
| | Cabling | | | | |
| 701.09 | Cabling | m | 1,100 | $38.00 | $41,800.00 |
| 701.11 | Connection to consumer mains | Item | 1 | $4,000.00 | $4,000.00 |
| | To Summary | | | | $233,750.00 |

GHD

GHD House, 239 Adelaide Tce. Perth, WA 6004
P.O. Box 3106, Perth WA 6832
T: 61 8 6222 8222 F: 61 8 6222 8555 E: permail@ghd.com.au



\\ghdnet\ghd\AU\Perth\Projects\61\28702\WP\130583.docx

Document Status

| Rev No. | Author | Reviewer | | Approved for Issue | | |
|---|---|---|---|---|---|---|
| | | Name | Signature | Name | Signature | Date |
| A | R Romualdez | T Tucak | | J McNeill | | 02/08/13 |
| | | | | | | |
| | | | | | | |

www.ghd.com

**Foreshore Business Centre, Level 1, 209 Foreshore Drive**
**Geraldton, Western Australia 6530**
**Australia**
**ghd.com**

**Your ref:**
**Our ref:** 12671927

**18 June 2025**

**Simon Lancaster**
**Shire of Chapman Valley**
**3270 Chapman Valley Road**
**Nabawa WA 6532**

**North west coastal highway & Wokarena Road Intersection Upgrade – updated cost estimate.**

Dear Simon

Please find attached hereto the updated cost estimate prepared by McGarry Associates, dated 12.06.2025.

We trust this meets your requirements.

Regards

**Antoinette Krause**
Manager - Mid West WA

+61 8 99209403
antoinette.krause@ghd.com

Attachment: Cost Estimate Limitations

## Cost Estimate Limitations

*This report has been prepared by GHD (including subcontractors) for Shire of Chapman Valley and may only be used and relied on by Shire of Chapman Valley for the purpose agreed between GHD and Shire of Chapman Valley..*

*GHD otherwise disclaims responsibility to any person other than Shire of Chapman Valley arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.*

*The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.*

*The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.*

*The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.*

*GHD has prepared the preliminary cost estimate using information reasonably available to the GHD employee(s) and subcontractors who prepared this report; and based on assumptions and judgments made by GHD – refer 2021 cost estimate document for assumptions and clarifications.*

*The Cost Estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the project can or will be undertaken at a cost which is the same or less than the Cost Estimate.*

*Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.*

## SUMMARY

## NORTH WEST COASTAL HWY & WOKARENA ROAD INSTERSECTION UPGRADE

## SUMMARY

| | | |
|---|---|---|
| SCHEDULE No. 1 - GENERAL ITEMS | | $783,120.75 |
| SCHEDULE No. 2 - ROADWORKS | | |
| SERIES 300 - EARTHWORKS | $195,119.93 | |
| SERIES 400 - DRAINAGE | $44,510.13 | |
| SERIES 500 - PAVEMENT & SURFACING | $216,367.54 | |
| SERIES 600 - TRAFFIC FACILITIES | $33,996.55 | |
| SERIES 700 - ELECTRICAL & LIGHTING | $282,061.19 | $772,055.35 |
| SCHEDULE No. 3 - PROVISIONAL SUMS | | $0.00 |
| SCHEDULE No. 4 - DAYWORK | | $0.00 |
| Contingency at 10% of Construction Cost | | $155,517.61 |
| GST EXCLUSIVE AMOUNT | | $1,710,693.72 |
| ESTIMATED GST PAYABLE | | $171,069.37 |
| **TOTAL OF TENDER** | | **$1,881,763.09** |

## SCHEDULE No. 1 - GENERAL ITEMS

| Item | Description | Unit | Qty | Rate | Price |
|---|---|---|---|---|---|
| | **CONDITIONS OF CONTRACT** | | | | |
| | **GENERAL CONDITIONS OF CONTRACT** | | | | |
| GCC.01 | Insurances in accordance with the General Conditions of Contract | Item | 1 | $13,977.60 | $13,977.60 |
| GCC.02 | Contractor's superintendence during the execution of the Works | Item | 1 | $211,706.19 | $211,706.19 |
| GCC.03 | All charges, costs and obligations relating to the General Conditions of Contract not provided for elsewhere | Item | 1 | $6,988.80 | $6,988.80 |
| | **SPECIAL CONDITIONS OF CONTRACT** | | | | |
| SCC.01 | All charges, costs and obligations relating to the Special Conditions of Contract not provided for elsewhere | Item | 1 | | INC |
| | **SERIES 100 - GENERAL REQUIREMENTS** | | | | |
| | **101 - DESCRIPTION OF WORKS** | | | | |
| 101.01 | Provision of access for others to undertake works | Item | 1 | | EXC |
| 101.02 | Contractor's programs | Item | 1 | | INC |
| 101.03 | Project works sign | No | 2 | $2,800.00 | $5,600.00 |
| | **102 - SURVEY INFORMATION** | | | | |
| 102.01 | Survey information, control and setting out of the works | Item | 1 | $60,793.60 | $60,793.60 |
| | **103 - SITE FACILITIES** | | | | |
| | CONTRACTORS SITE FACILITIES | | | | |
| 103.01 | Provision of Contractor's site facilities | Item | 1 | $49,544.20 | $49,544.20 |
| 103.02 | Maintenance of Contractor's site facilities | Item | 1 | $65,115.33 | $65,115.33 |
| 103.03 | Removal of Contractor's site facilities | Item | 1 | $35,843.70 | $35,843.70 |
| 103.04 | Mobilisation and demobilisation of Contractor's plant | Item | 1 | | INC |

| | | | | | |
|---|---|---|---|---|---|
| | SUPERINTENDENT'S SITE FACILITIES | | | | |
| 103.05 | Provision of the Superintendent site facilities | Item | 1 | $3,474.40 | $3,474.40 |
| 103.06 | Maintenance of the Superintendent site facilities | Item | 1 | $6,249.60 | $6,249.60 |
| 103.07 | Removal of the Superintendent site facilities | Item | 1 | $3,504.97 | $3,504.97 |
| | **104 - ENTRY TO LAND** | | | | |
| 104.01 | Entry to land | Item | 1 | | EXC |
| | **106 - UTILITIES AND SERVICES** | | | | |
| 106.01 | Liaison, programming, location and protection of utilities and services | Item | 1 | $6,000.53 | $6,000.53 |
| 106.02 | Relocation of utilities and services | Item | 1 | | EXC |
| | **SERIES 200 - MANAGEMENT REQUIREMENTS** | | | | |
| | **202 - TRAFFIC MANAGEMENT** | | | | |
| 202.01 | Traffic management | Item | 1 | $6,272.00 | $6,272.00 |
| 202.02 | Traffic control devices | Item | 1 | $29,618.40 | $29,618.40 |
| 202.03 | Traffic controllers | Item | 1 | $243,734.40 | $243,734.40 |
| 202.04 | Construction, maintenance and removal of sidetracks, temporary driving surfaces and temporary pedestrian | Item | 1 | | EXC |
| 202.05 | Maintenance of existing roads | Item | 1 | | EXC |
| | **203 - HEALTH AND SAFETY MANAGEMENT** | | | | |
| 203.01 | Health and safety management including health and safety plans and health and safety audits | Item | 1 | $10,491.26 | $10,491.26 |
| | **204 - ENVIRONMENTAL MANAGEMENT** | | | | |
| 204.01 | Construction environmental management plan | Item | 1 | $24,205.78 | $24,205.78 |
| | To Summary | | | | $783,120.75 |

## SCHEDULE No. 2 - ROADWORKS

| Item | Description | Unit | Qty | Rate | Price |
|---|---|---|---|---|---|
| | **SERIES 300 - EARTHWORKS** | | | | |
| | **301 - VEGETATION CLEARING AND DEMOLITION** | | | | |
| 301.01 | Vegetation clearing | m2 | 4,711 | $1.99 | $9,390.22 |
| 301.02 | Topsoil removal, ?mm deep | m2 | 4,711 | $2.00 | $9,406.40 |
| | **302 - EARTHWORKS** | | | | |
| | REMOVAL OF REDUNDANT ITEMS | | | | |
| 302.01 | Preparation of retained pavement to receive overlay | m2 | 267 | $0.75 | $200.16 |
| 302.02 | Marking out and cutting edge of existing pavement | m | 872 | $6.69 | $5,836.15 |
| | UNSUITABLE MATERIAL | | | | |
| 302.03 | Excavation and removal of unsuitable material | m3 | 1,399 | $71.69 | $100,267.03 |
| | EMBANKMENT CONSTRUCTION | | | | |
| 302.04 | Embankment foundation compaction in widenings | m2 | 4,759 | $2.61 | $12,441.08 |
| 302.05 | Embankment construction in widenings | m3 | 540 | $46.68 | $25,207.36 |
| | SUBGRADE | | | | |
| 302.06 | Subgrade in road widenings | m2 | 3,496 | $5.69 | $19,904.72 |
| | **303 - MATERIAL AND WATER SOURCES** | | | | |
| | WATER SUPPLIES | | | | |
| 303.01 | Water supplies | Item | 1 | | INC |
| | **304 - LANDSCAPING AND REVEGETATION / REVEGETATION / REHABILITATION OF DISTURBED AREAS** | | | | |
| | TOPSOILING | | | | |
| 304.01 | Respread topsoil, ?mm thick | m2 | 2,211 | $5.64 | $12,466.81 |
| | To Summary | | | | $195,119.93 |

| | | | | | |
|---|---|---|---|---|---|
| | **SERIES 400 - DRAINAGE** | | | | |
| | **402 - SURFACE DRAINS AND LEVEES** | | | | |
| | SURFACE DRAINS AND LEVEES | | | | |
| 402.01 | Grade existing swale | m | 273 | $16.22 | $4,423.95 |
| | **404 - CULVERTS** | | | | |
| | CULVERTS | | | | |
| | Reinforced Concrete Pipes Class 4 | | | | |
| 404.01 | Pipe culvert, 450mm diameter | m | 28 | $387.53 | $11,021.31 |
| | All Culverts | | | | |
| 404.02 | Selected bedding material | m3 | 2 | $196.63 | $466.02 |
| 404.03 | Extra over culverts for cement stabilised backfill | m3 | 14 | $352.60 | $5,017.53 |
| 404.04 | Reinforced concrete insitu end treatment | m3 | 4 | $3,036.13 | $12,265.98 |
| | Redundant Culverts | | | | |
| | Removal of redundant culvert and backfilling excavations | | | | |
| 404.05 | Pipe culvert, Unknown diameter | m | 17 | $186.34 | $3,100.77 |
| 404.06 | Culvert end treatment (All sizes) | No | 2 | $378.12 | $756.24 |
| | **406 - ROCK PROTECTION** | | | | |
| 406.01 | Rock protection, facing class to kerb opening | m2 | 6 | $185.35 | $1,151.00 |
| | **407 - KERBING** | | | | |
| 407.01 | Kerb type SM1 | m | 299 | $19.32 | $5,783.44 |
| 407.02 | Extra over kerb for kerb opening | No | 1 | $523.88 | $523.88 |
| | To Summary | | | | $44,510.13 |
| | **SERIES 500 - PAVEMENT AND SURFACING** | | | | |
| | **501 - PAVEMENTS** | | | | |
| | SUBBASE | | | | |
| 501.01 | Subbase in widenings, 220mm thick crushed limestone | m2 | 2,769 | $38.65 | $107,008.82 |
| | BASECOURSE | | | | |
| 501.02 | Basecourse in widenings, 180mm thick crushed rock | m2 | 2,270 | $34.00 | $77,192.11 |
| | **503 - BITUMINOUS SURFACING** | | | | |
| | ROADWORKS | | | | |
| | Prime | | | | |
| 503.01 | Prime coat with BAR of 0.6 litres/m2 | m2 | 2,537 | $1.71 | $4,325.33 |
| | Seal | | | | |
| 503.02 | First coat seal with 14mm aggregate | m2 | 2,537 | $5.77 | $14,630.88 |
| 503.03 | Second coat seal with 7mm aggregate | m2 | 2,537 | $5.21 | $13,210.40 |
| | To Summary | | | | $216,367.54 |

| | | | | | |
|---|---|---|---|---|---|
| | **SERIES 600 - TRAFFIC FACILITIES** | | | | |
| | **601 - SIGNS** | | | | |
| | SINGLE POST SIGNS | | | | |
| 601.01 | Traffic sign R4-1B | No | 1 | $636.79 | $636.79 |
| 601.02 | Traffic signs W2-3B and MR-GS-4B on same post | No | 1 | $732.07 | $732.07 |
| 601.03 | Traffic signs W2-4B and MR-GS-4B on same post | No | 1 | $732.07 | $732.07 |
| | RELOCATION OF EXISTING | | | | |
| 601.04 | Single post sign | No | 3 | $279.42 | $838.25 |
| | **602 - GUIDE POSTS** | | | | |
| 602.01 | Allowance for guide posts | Item | 1 | $3,600.00 | $3,600.00 |
| 602.02 | Allowance for removal of redundant guide posts | Item | 1 | $840.00 | $840.00 |
| | **604 - PAVEMENT MARKING** | | | | |
| | ROAD PAVEMENT MARKINGS | | | | |
| 604.01 | Edge line | m | 1,428 | $2.24 | $3,198.72 |
| 604.02 | Barrier line, double one-way | m | 60 | $3.92 | $236.65 |
| 604.03 | Barrier line, double two-way | m | 277 | $4.48 | $1,239.84 |
| 604.04 | Broken lane line | m | 486 | $1.68 | $816.48 |
| 604.05 | Continuity line | m | 267 | $1.68 | $448.56 |
| 604.06 | Holding line, give-way | m | 14 | $50.40 | $705.60 |
| 604.07 | Diagonal gore marking | m2 | 22 | $84.00 | $1,854.72 |
| 604.08 | "D" Bullnose | No | 1 | $280.00 | $280.00 |
| 604.09 | Turn arrow | No | 11 | $336.00 | $3,696.00 |
| 604.10 | Removal of redundant road pavement markings | Item | 1 | $11,200.00 | $11,200.00 |
| | RAISED PAVEMENT MARKERS | | | | |
| 604.11 | Raised pavement marker, bi-directional | No | 54 | $12.32 | $665.28 |
| 604.12 | Raised pavement marker, uni-directional | No | 98 | $12.32 | $1,207.36 |
| 604.13 | Removal of redundant raised pavement marker | Item | 1 | $468.16 | $468.16 |
| 604.14 | Temporary raised pavement markers | Item | 1 | $600.00 | $600.00 |
| | To Summary | | | | $33,996.55 |

| | | | | | |
|---|---|---|---|---|---|
| | **SERIES 700 - ELECTRICAL AND INTELLIGENT TRANSPORT SYSTEMS** | | | | |
| | **701 - ROADWAY LIGHTING** | | | | |
| | LIGHTING POLES | | | | |
| | Roadway | | | | |
| | Bases | | | | |
| 701.01 | Concrete base for single outreach arm pole | No | 18 | $2,812.85 | $50,631.31 |
| | Galvanised Steel Impact Absorbing Roadway Lighting Pole 12.5m Mounting Height | | | | |
| 701.02 | Lighting pole with single 3.0m outreach arm | No | 18 | $5,701.50 | $102,627.05 |
| | Luminaires | | | | |
| 701.03 | Sylvania Roadster 1 x 250W HPS | No | 18 | $1,720.77 | $30,973.93 |
| | SWITCHBOARDS | | | | |
| 701.04 | Switchboard | No | 1 | $10,080.00 | $10,080.00 |
| | CONDUITS AND CABLING | | | | |
| | Conduits | | | | |
| 701.05 | Conduit (Orange), 1 No. x 50mm diameter heavy duty PVC in trench | m | 1,075 | $34.25 | $36,808.46 |
| 701.06 | Extra over conduit in trench for directional drilling under existing roadway | m | 30 | $397.60 | $11,780.89 |
| 701.07 | Cable pit | No | 8 | $780.32 | $6,242.54 |
| | Cabling | | | | |
| 701.08 | 16mm2 Cu XLPE/PVC lighting circuit cable | m | 1,415 | $19.94 | $28,213.01 |
| 701.09 | Connection to consumer mains | Item | 1 | $4,704.00 | $4,704.00 |
| | To Summary | | | | $282,061.19 |
| | **Total** | | | | **$772,055.35** |

## SCHEDULE No. 3 - PROVISIONAL SUMS

| Item | Description | Unit | Qty | Rate | Amount |
|---|---|---|---|---|---|
| | **PROVISIONAL SUMS** | | | | |
| | **EARTHWORKS** | | | | |
| PS.01 | Allow the Provisional Sum of $? (? Thousand Dollars) for the removal and replacement of unsuitable material | P.S. | | | |
| PS.02 | Allow the Provisional Sum of $? (? Thousand Dollars) for the excavation of rock | P.S. | | | |
| PS.03 | Allow the Provisional Sum of $? (? Thousand Dollars) for landscaping | P.S. | | | |
| | **DRAINAGE** | | | | |
| PS.04 | Allow the Provisional Sum of $? (? Thousand Dollars) for the removal and replacement of unsuitable insitu bedding material | P.S. | | | |
| | **PAVEMENTS AND SURFACING** | | | | |
| PS.05 | Allow the Provisional Sum of $? (? Thousand Dollars) for backrolling of sealed sections of pavement | P.S. | | | |
| | **MISCELLANEOUS** | | | | |
| PS.06 | Allow the Provisional Sum of $? (? Thousand Dollars) for fencing | P.S. | | | |
| | **SERVICES** | | | | |
| PS.07 | Allow the Provisional Sum of $? (? Thousand Dollars) for the relocation of existing ?? Mains | P.S. | | | |
| | To Summary | | | | |

## SCHEDULE No. 4 - DAYWORK

| Item | Description | Unit | Rate | Amount |
|---|---|---|---|---|
| | **DAYWORK** | | | |
| | **LABOUR** | | | |
| DW.01 | Allow the Provisional Sum of $? (? Thousand Dollars) for labour of the Contractor only expended on persons employed on daywork | P.S. | | |
| DW.02 | Labour on-costs | % | | |
| | **MATERIALS** | | | |
| DW.03 | Allow the Provisional Sum of $? (? Thousand Dollars) for the net cost of delivered materials of the Contractor only expended on daywork including delivery to site | P.S. | | |
| DW.04 | Materials on-costs | % | | |
| | **PLANT** | | | |
| DW.05 | Allow the Provisional Sum of $? (? Thousand Dollars) for the cost of plant of the Contractor only expended on daywork | P.S. | | |
| DW.06 | Subcontractors on-costs | % | | |
| | **SUBCONTRACTORS** | | | |
| DW.07 | Allow the Provisional Sum of $? (? Thousand Dollars) for the cost of labour, materials and plant of Subcontractors expended on daywork | P.S. | | |
| DW.08 | Subcontractors on-costs | % | | |
| | To Summary | | | |


ghd.com

→ The Power of Commitment