Wokarena Heights Residential R2.5 Structure Plan

Buller, Western Australia

Prepared for the Shire of Chapman Valley by GHD Pty Ltd

Adopted by the Council of the Shire of Chapman Valley 19 September 2012

Modified

CERTIFIED THAT THIS STRUCTURE PLAN WAS ADOPTED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON

9 October 2013

Date

Signed for and on behalf of the Western Australian Planning Commission

an officer of the Commission duly authorised by the Commission pursuant to section ~~16~~ 24 of the Planning and Development Act 2005 for that purpose, in the presence of:

M. Wiecka

Witness

15 November 2013

Date

And by

RESOLUTION OF THE COUNCIL OF THE SHIRE OF CHAPMAN VALLEY ON

21 August 2013 (Minute Reference 8/13-3)

Date

And

PURSUANT TO THE COUNCIL'S RESOLUTION HEREUNTO AFFIXED IN THE PRESENCE OF:

~~Mayor~~ President
Mayor, Shire of Chapman Valley

Chief Executive Officer, Shire of Chapman Valley

20 August 2014

Date

This Structure Plan is prepared under the provision of the Shire of Chapman Valley Local Planning Scheme

TABLE OF MODIFICATIONS TO PART ONE AND STRUCTURE PLAN MAP

No.	Description of Modification	Date endorsed by Council	Date endorsed by WAPC
1	Revision of structure plan map to reflect approved subdivision of Lot 10.	21/08/2013	9/10/2013

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Part One - Statutory Section

1.0 Structure Plan Area

1.1
The Wokarena Heights Residential R2.5 Local Structure Plan ('Structure Plan') shall apply to the area located within the 'Structure Plan Boundary' as depicted on Plan 1 – Structure Plan.

2.0 Structure Plan Content

2.1
This structure plan comprises:

- Part 1: Statutory Section;
- Part 2: Explanatory Section; and
- Technical appendices.

3.0 Structure Plan Objective

3.1
The objective of the structure plan is to provide a statutory planning framework that is responsive to the site's location and environment and facilitates the coordinated development of R2.5 residential dwellings

4.0 Interpretations and Use Class Permissibility

4.1
The words and expressions used in this structure plan shall have the respective meanings given to them in the Shire of Chapman Valley Town Planning Scheme No. 2 (the 'scheme').

4.2
Land use permissibility within zones shown in Plan 1 shall be in accordance with the corresponding zone under the scheme.

5.0 Operation Date

5.1
The structure plan shall come into operation either when it is endorsed by the Western Australian Planning Commission pursuant to clause 5.22.10.2 of the scheme or adopted by Council pursuant to clause 5.22.9.1 of the scheme, whichever is the latter.

6.0 Relationship to the Local Planning Scheme

6.1
Pursuant to clause 5.22.6.3 of the scheme, the provisions, standards and requirements specified in the Structure Plan shall have the same force and effect as if they were a provision, standard or requirement of the scheme.

6.2
Subject to clause 5.22.12.2 of the scheme, in the event of there being any inconsistency or conflict between the provisions, standards or requirements of the scheme and the provisions, standards or requirements of the structure plan, the provisions, standards or requirements of the scheme shall prevail.

7.0 Public Open Space

7.1
Public open space shall be located as per Plan 1, and designed in accordance with the Wokarena Heights Structure Plan Local Water Management Strategy.

8.0 Residential Density

8.1
Plan 1 depicts the residential density codes applicable to the land according to the legend thereon.

8.2
The residential density codes designated on this structure plan apply to the land and scheme except where varied by Clause 8.3 of the 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

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Shire of Chapman Valley
Wokarena Heights Structure Plan

Local Structure Plan

Job Number	71-11105
Revision	B
Date	Oct 2013

Plan 01

GHD House, 239 Adelaide Tce Perth WA 6004 T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com

Plot Date: 22 October 2013 - 2:25 PM Plotted by: Angie Brown

Cad File No: G:\61\30130\Image Files\Manila Drawings\CADD\Richards Road Residential\FIGURES\PLAN1_Local Structure Plan Rev B.dwg

8.3
For any lot directly abutting the Parkfalls Estate, provision 6.3.1 Buildings setback from the boundary, Acceptable Development provision A1 of the Residential Design Codes is varied so that the minimum rear setback is 30 metres

9.0 General Subdivision and Development Requirements

9.1
All provisions, standards and requirements of the Residential Zone as set out in the scheme shall apply.

9.2
The orientation and design of buildings shall be sympathetic to existing landform and landscape elements.

9.3
The use of reflective roof and wall materials which prejudice the landscape amenity of the surrounding landform, will not be permitted.

9.4
Ancillary structures shall be of a design and construction complementary to the design and materials used in the primary residence.

9.5
Boundary fencing shall be permeable. Alternative internal fencing shall only be permitted where it can be demonstrated that it will not reduce passive surveillance of the street.

9.6
No direct vehicular access shall be permitted to the Northwest Coastal Highway or Wokarena Road.

10.0 Detailed Area Plan Requirements

10.1
A Detailed Area Plan shall be prepared as a condition of subdivision for those lots and locations as shown on Plan 1.

10.2
Detailed Area Plans shall include provisions with regard to:

- Minimum setback of buildings to public open space
- Passive surveillance of the public open space
- Orientation of the building to public open space
- Identification of building envelopes with a minimum rear setback of 30 metres for any lot abutting the Parkfalls Estate
- The provision of a minimum 3 metre firebreak and 10 metre landscape buffer at the rear boundary for any lot abutting the Parkfalls Estate.

11.0 Special Provisions

Infrastructure Provisions

11.1
Developers shall be responsible for the upgrade of Richards Road and Wokarena Road, including its intersection with Northwest Coastal Highway ('road upgrades').

11.2
A cost contribution for road upgrade will be placed as a condition of approval of a subdivision application by the Shire of Chapman Valley.

11.3
Each parent lot shall pay a contribution that represents a percentage of the total construction cost, as shown in Table 1.

11.4
A detailed cost estimate for the upgrade of shall be prepared by the Shire and reviewed annually.

11.5
A contingency fee and contract management fees shall be built into the cost estimate to allow for costs associated with unforeseen circumstances or increases to construction costs.

11.6
If the actual cost is lesser than the cost estimate, contributions may be refunded or utilised to further enhance the streetscape.

11.7
To ensure the coordinated upgrade of Wokarena and Richards Roads the Shire will undertake all works associated with construction. The Shire may allow or require as a condition of subdivision a landowner to undertake upgrade works where it is determined that the upgrade works are necessary to support that stage of subdivision.

11.8
The timing of construction will largely depend on when the funding becomes available from Landowners through contributions. The Shire may, however, provide additional funding to bring forward the construction time of Wokarena Road and Richards Road given the increasing need for this road to provide access.

12.0 Operation and Implementation

12.1
The following technical studies and plans will be required to support applications for subdivision:

1. Flora and fauna survey (Lot 1 only, prior to
2. Application for subdivision)
3. Urban Water Management Plan consistent with the Local Water Management Strategy (condition of subdivision)
4. Bush fire Management Plan (condition of subdivision)

12.2
As a condition of subdivision, the following notifications on title will be required:

1. For lots abutting Northwest Coastal Highway: No direct vehicular access shall be permitted to the Northwest Coastal Highway.
2. For lots directly abutting Parkfalls Estate: Controlled stocking is permitted on adjacent rural-residential lots, with possible associated livestock impact on adjacent properties.

Table 1 - Proportionate Contribution to Road Infrastructure Upgrades

Lot	Created Residential Land	Contribution
1	7.12ha	6.4%
2	10.36ha	9.4%
3	10.22ha	9.2%
4	10.43ha	9.4%
5	10.46ha	9.4%
6	9.67ha	8.7%
7	10.3ha	9.3%
8	10.66ha	9.6%
9	9.9ha	8.9%
10	11.22ha	10.1%
11	10.39ha	9.4%

Part Two - Explanatory Section

1.0 Planning Background

1.1 Introduction and Purpose

The Shire of Chapman Valley (SoCV) is currently in the process of drafting Local Planning Scheme No. 2 (LPS2) to replace Town Planning Scheme No. 1 (TPS1). As part of this process, it is intended to rezone the study area from 'General Farming' to 'Residential R2.5'. The Environmental Protection Authority (EPA) has deemed that this proposed rezoning does not warrant an Environmental Review under Part IV of the *Environmental Protection Act 1986.*

As a result, a Local Structure Plan (LSP) is required to guide the future use, subdivision and development of the proposed Wokarena Heights 'Residential R2.5' zone. The purpose of the LSP is:

- To provide a statutory land use plan for the defined area;
- To provide a comprehensive framework for land use to facilitate future subdivision and development of the area;
- To coordinate the provision and planning for local infrastructure and facilities; and
- To 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 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.

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

1.2 Land Description

Location

The Wokarena Heights study area is located approximately 8 km north of Geraldton, adjacent to the North West Coastal Highway (see Figure 1). 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.

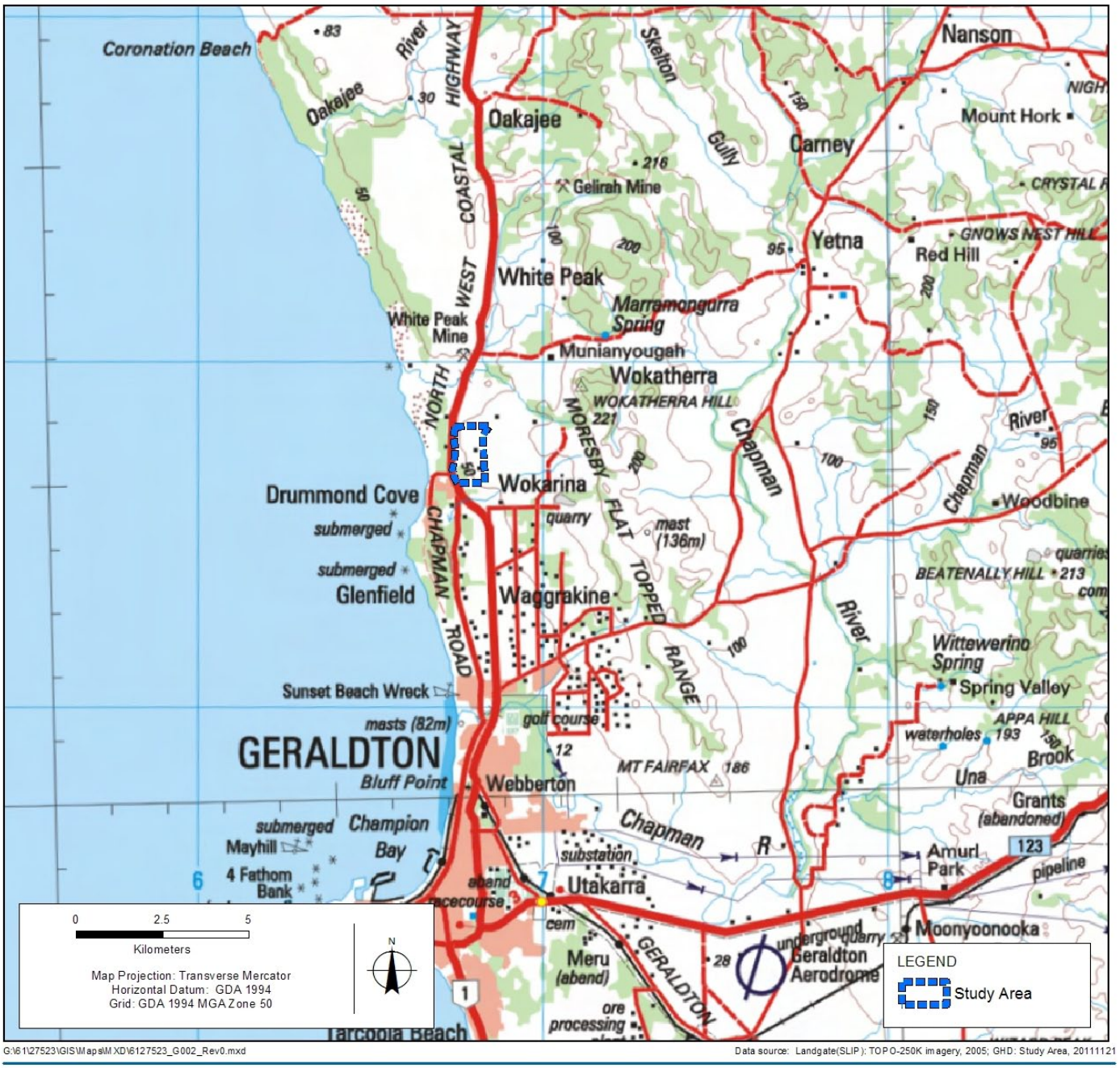


Figure 1 - Location of Wokarena Heights Structure Plan Area

Area and Land Use

The site consists of primarily rural lifestyle land uses, including an orchard, cleared areas, existing houses and remnant bush land. An aerial photo of the site is included as Figure 2.

The total area of the LPS is 142.79 ha

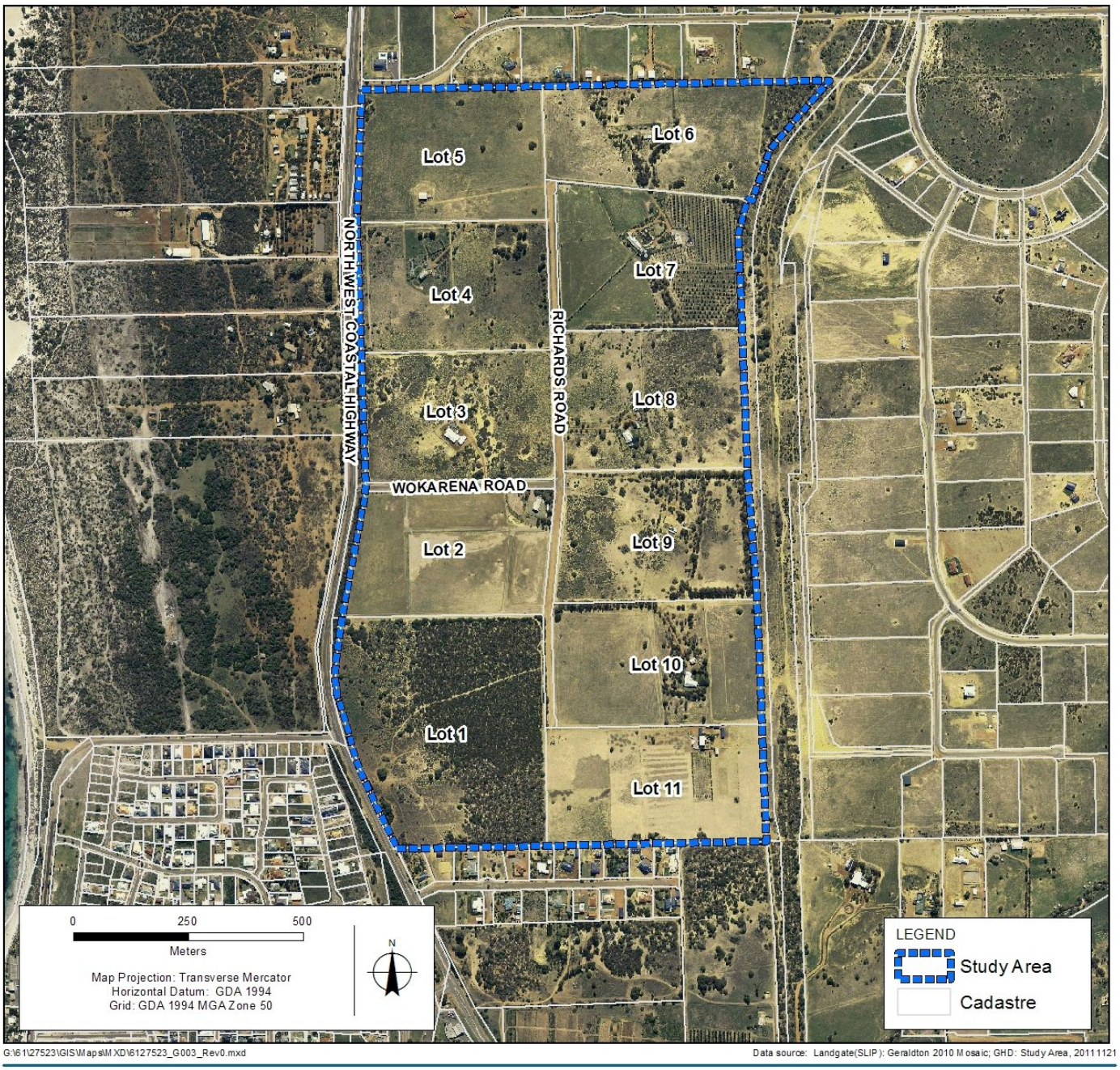


Figure 2 - Wokarena Heights Site Aerial

Legal Description and Ownership

The site consists of 11 freehold lots, all in separate private ownership. The ownership and Certificate of Title details are outlined in Table 2.

Table 2 - Ownership and Certificate of Title Details

Lot	Owner	Certificate of Title (Volume/ Folio)
1	Supardi Hadinoto	1133/226
2	Ross Williamson	1967/127
3	Ken & Bernadette Mitsuda	1741/326
4	Jeremy Henderson and Danielle Austin	1741/327
5	Raymond & Tracey Jakovich	1741/329
6	Gregory & Gwenda Moncrieff	1741/329
7	Berrice & Phillip Lodge	1741/330
8	Jim Bowbridge	1741/331
9	Kerry Pym	1741/332
10	Donald & Lynette Patten	1741/333
11	Alison McCaskie	1741/334

1.3 Planning Framework

Zoning and Reservations

The site is currently zoned 'General Farming' under the SoCV TPS1 (see Figure 3). The following Policy Statement is included within TPS1 for the General Farming zone:

'This zone embraces the broad acre farming areas of the Shire. It is intended to protect the economic viability of those areas generally and to preserve the rural character and appearance of the area. The lot sizes shall be at the discretion of Council based on what is locally accepted as a viable farm unit, or where a non-farming use is proposed on the amount of land required for that purpose.'

An 'Important Regional Road' reservation abuts the eastern boundary of the site and traverses the north east corner of the site, through Lots 6 & 7. This reserve reflects a, potential realignment of North West Coastal Highway. Local Planning Scheme No. 2 illustrates the updated alignment in accordance with Main Roads WA planning and the WAPC's Greater Geraldton Structure Plan (Figure 4).

The Shire of Chapman Valley is currently reviewing TPS1 and subsequently Local Planning Scheme No. 2 (LPS2) was made available for public inspection and comment from 22nd November 2010 until 23rd February 2011. There were no objections received during this time in relation to the rezoning of Wokarena Heights.

The progression and adoption of LPS2 is being affected by appeals associated with recommendations of the EPA with regard to areas outside the Wokarena Heights Precinct. The advice of the EPA and submissions received during advertising of the scheme support the rezoning of the Wokarena Heights Precinct to R2.5. Once finalised, LPS2 will zone the subject land 'Residential R2.5'.

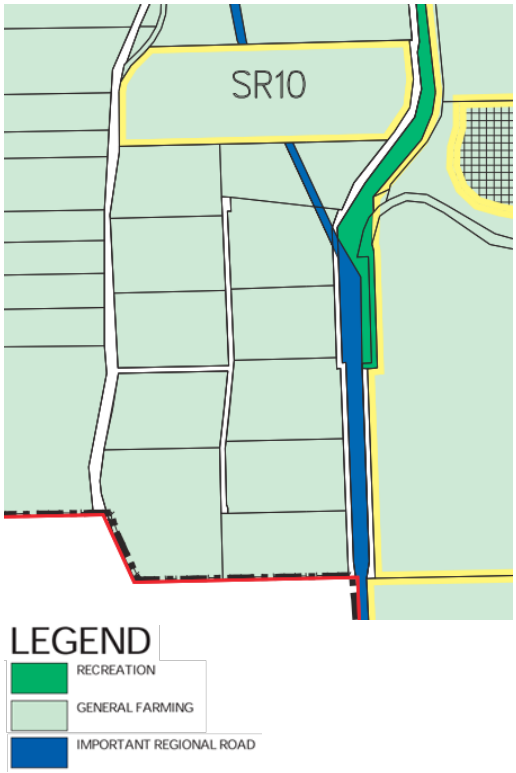


Figure 3 - TPS1

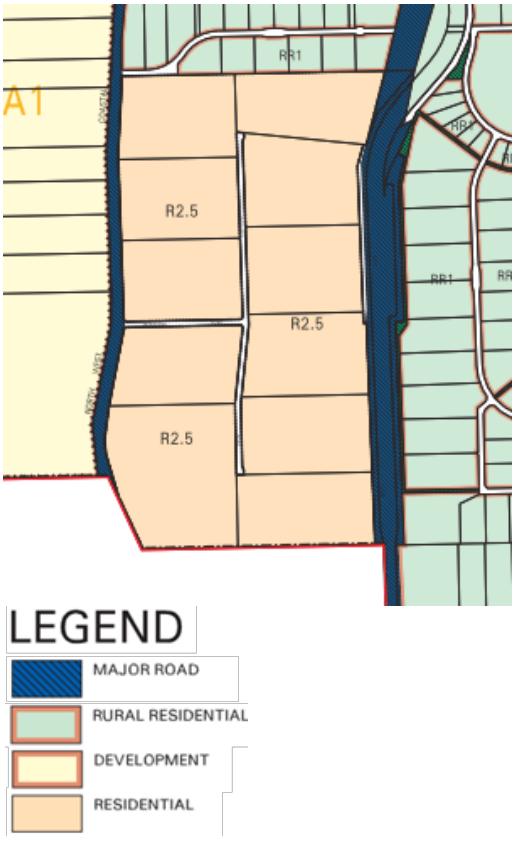


Figure 4 - Local Planning Scheme No.2 Zoning

Regional and Sub-Regional Structure Plan

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

The LSP area is identified within the GGSP as 'Future Urban' (in pink), with an 'indicative rapid public transport alignment' (in yellow) 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.

Figure 5 - Greater Geraldton Structure Plan

- 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 LSP provides the framework for urban development of the precinct consistent with the recommendations of the GGSP.

The *Draft Northern Geraldton District Structure Plan* (NGDSP) was released in 2006, with the purpose of providing a district structure plan that progresses key elements of the original GGSP (1999) and identifies principles that will guide future development within the study area. The structure plan provides an overall guide for the future development of the area and reflects and refines key recommendations of the GGSP in terms of identifying land for urban and residential uses.

The NGDSP identified Wokarena Heights as 'Future rural residential'. Land to the west of the future highway was identified as future rural residential in the NGDSP with a lot size range of 1 ha to 4 ha. The NGDSP requires that development in the area with a requirement to prepare local structure plans that consider among other matters, visual impacts of development on the Moresby Range.

There are no commercial or community services (other than the special uses) identified within the locality and as such, local distributor road connections will be important in providing residents with convenient access to services.

The NGDSP remains in draft form and many of its functions have been superseded by the GGSP.

Policies

The Wokarena Heights LSP has been prepared in compliance with the following key existing policies and strategies:

- Geraldton Region Plan 1999;
- Greater Geraldton Structure Plan 2011;
- Draft Northern Geraldton District Structure Plan 2006;
- 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 Strategy 2007;
- State Planning Policy 3.6 Development Contributions for Infrastructure;
- Planning Bulletin 92 Urban Water Management; and
- Draft Structure Plan Preparation Guidelines 2011.

Other Approvals and Decisions

A component of LPS 2 separate to the Wokarena Heights site required Environmental Review by the EPA, which is currently under appeal by SoCV and several landowners. Once a decision is made by the Environment Minister, LPS2 can be returned to Council for further consideration and endorsement before being forwarded to the Western Australian Planning Commission for final endorsement.

2.0 Site Conditions and Environment

2.1 Environmental Assets and Constraints

Vegetation

The majority of the subject land is cleared, with some scattered trees and an area of remnant vegetation within the southeast part of the Wokarena Heights precinct.

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.

Fauna

The conservation status of fauna species is assessed under State and Commonwealth Acts; in particular the Western Australia *Wildlife Conservation Act 1950*; *Wildlife Conservation* (Specially Protected Fauna) *Notice 2006*, and the Commonwealth *EPBC Act.*

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 3.

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.

2.2 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 meters of the ground surface. This area is approximately 1.48 km long and is 160 meters wide at its broadest and located outside of the study area.

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

Table 3 - Threatened Fauna

Species / Details	General Information (provided by DEC search, unless referenced otherwise)	Likelihood of Occuring 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 specimen of this species of snail have been collected in more than 50 years.	This secies 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, Carnaby's Black Cockatoo Protection Status: S1, Endangered - EPBC Act 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 platations. 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 ste 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 north east 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 a long-lived species that is very sensitive to disturbance.	The understorey of the site has been disturbed. It is considered unlikely that the species would exist at the Site.

Species / Details	General Information (provided by DEC search, unless referenced otherwise)	Likelihood of Occuring at the Site
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 secies has not been identifiied in the WA Museum database as know 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 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 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 meters below ground level.

2.4 Bushfire Hazard

The presence of a large stand of remnant vegetation combined with a steep grade and strong prevailing winds from its coastal aspect presents an extreme bushfire risk, and fires have been experienced in the study area in the past.

2.5 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 Northwest Coastal Highway. The site is not listed as a formal heritage area.

2.6 Context and Constraints Analysis

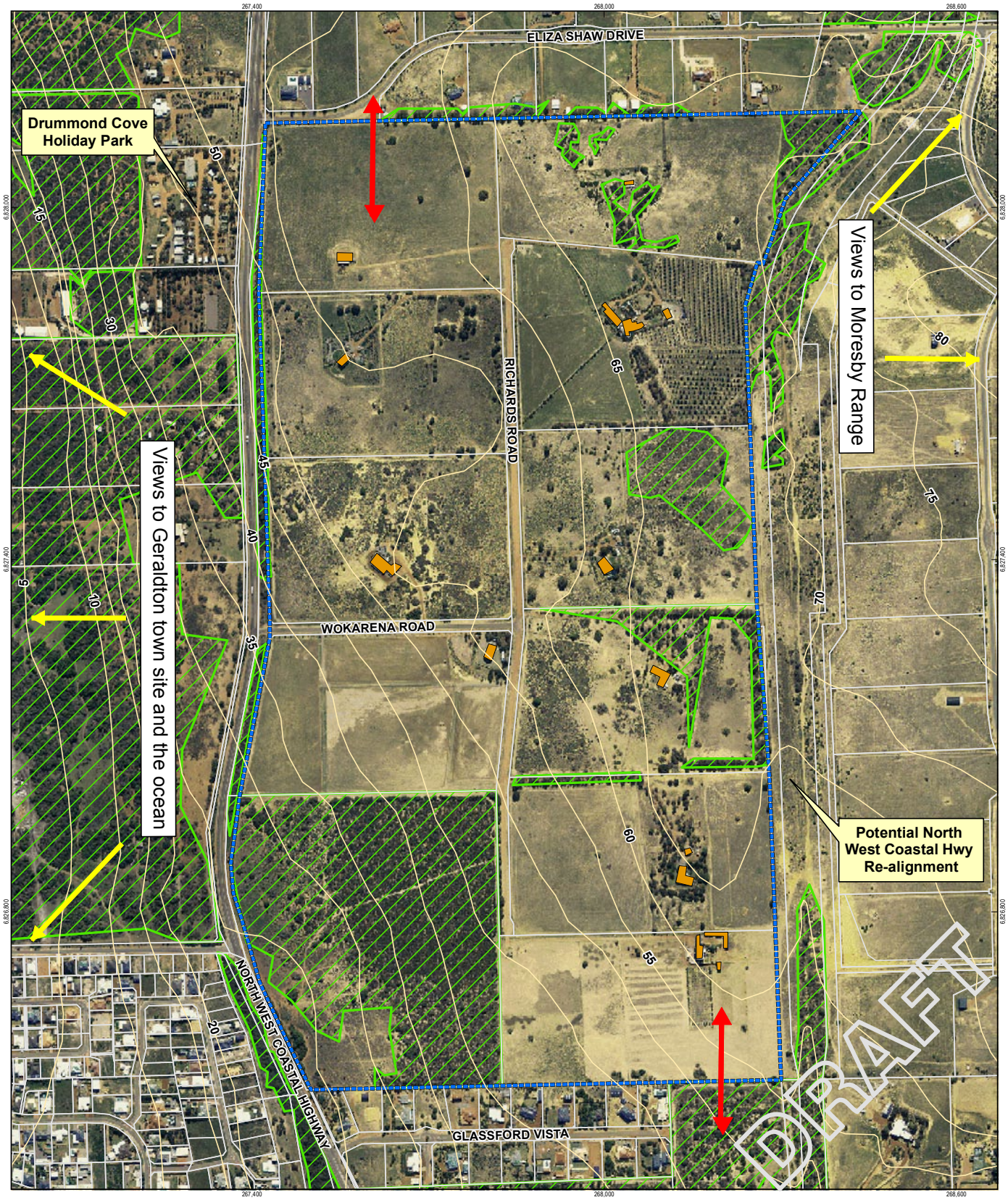
Figure 6 illustrates the key opportunities and constraints for the Wokarena Heights Precinct.

Key opportunities:

- Unique and extensive views to the coast, Geraldton port, and the Moresby Ranges
- Few environmental constraints
- Opportunity to enhance access to the Northwest 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 Northwest Coastal Highway and future possible realignment of the Highway to the eastern boundary of the site
- Future realignment of the Northwest Coastal Highway requiring additional ceding of road reserve



LEGEND

Contours (5m) | Existing Buildings | Remnant Native Vegetation

Study Area | Cadastre | Potential Road Connections

Paper Size A3

0 30 60 120 180 240

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD CLIENTS|PEOPLE|PERFORMANCE

Shire of Chapman Valley Love the Rural Life

Shire of Chapman Valley
Wokarena Heights Structure Plan

Job Number 61-27523
Revision A
Date 22 Nov 2011

Opportunities and Constraints

Figure 6

\\per05nas\projects\61\27523\GIS\Maps\MXD\6127523_G001_Rev0.mxd

Hazelwood Drive (cnr Lignite Court) Morwell VIC 3840 Australia T 61 3 5136 5800 F 61 3 5136 5888 E mwlmail@ghd.com W www.ghd.com

3.0 Local Structure Plan

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 7. Lot orientation is designed to take maximum advantage of views experienced within the precinct.

The proposed density, with lot sizes of 4,000 m2, will complement the adjacent existing urban developments of Drummond Cove and Glenfield, and the rural residential development of Parkfalls. The proposed density provides an appropriate grading of density from urban development areas, reducing in scale to rural residential uses.

The residential use and proposed density provides an opportunity for alternative dwelling choice for those wanting large lot accommodation and reflection of a rural lifestyle in close proximity to the major regional centre of Geraldton.

Likely lot yield across the precinct is shown in Table 5.

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. The retail and community needs of future residents in the Wokarena Heights Precinct will be met through adjacent development areas.

Table 4 - Structure Plan Summary

Item	
Total area covered by the structure plan:	142.79 ha
Area of specific land uses:	Residential: 110.73ha (excluding roads)
List of land uses proposed by the structure plan	Residential Public open space
Estimated lot yield:	253 lots
Estimated number of dwellings:	253 dwellings
Estimated population:	653 people
Number and area of public open space -	14.18 hectares
:district open space	1 district park: 12.6 hectares
:neighbourhood parks	2 neighbourhood parks: 1.58 hectares

Table 5 - Indicative lot yield

Parent Lot	Area Residential Land (excluding road reserves and open space)	Number of lots
1	7.12	17
2	10.36	25
3	10.22	22
4	10.43	25
5	10.46	24
6	9.67	22
7	10.30	23
8	10.66	25
9	9.9	22
10	11.22	25
11	10.39	23
Total	110.73	253

LEGEND:

- LOCAL STRUCTURE PLAN AREA
- PUBLIC OPEN SPACE
- (A) DRAINAGE RESERVE
- (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

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Shire of Chapman Valley
Wokarena Heights Structure Plan

Indicative Lot Layout Plan

Job Number 71-11105
Revision B
Date Oct 2013
Figure 07

GHD House, 239 Adelaide Tce Perth WA 6004 T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com

Plot Date: 22 October 2013 - 2:16 PM Plotted by: Angie Brown

Cad File No: G:\61\30130\Image Files\Manila Drawings\CADD\Richards Road Residential\FIGURES\FIG7_Indicative Lot Layout Rev B.dwg

3.2 Movement Network

Road network hierarchy

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

New connections to Northwest 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 8). 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 connectors 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 LSP 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 provide 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

View along north west coastal highway

Wokarena Road

LEGEND:

- NEIGHBOURHOOD CONNECTOR B (MINOR) - 20 METRE RESERVE
- ACCESS STREET C - 16 METRE RESERVE
- ACCESS STREET D - 16 METRE RESERVE
- LOCAL STRUCTURE PLAN AREA
- FOOTPATH
- (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

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Shire of Chapman Valley
Wokarena Heights Structure Plan

Movement Network

Job Number 71-11105
Revision B
Date Oct 2013

Figure 08

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Cad File No: G:\61\30130\Image Files\Manila Drawings\CADD\Richards Road Residential\FIGURES\FIG8_Movement Network Rev B.dwg

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 9 show how the function of road corridors supports 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. Lots 8 and 10 do not have formal links to Wokarena Heights in the LSP; development ahead of lots 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, these accessways can be decommissioned and the additional lots subdivided. 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.

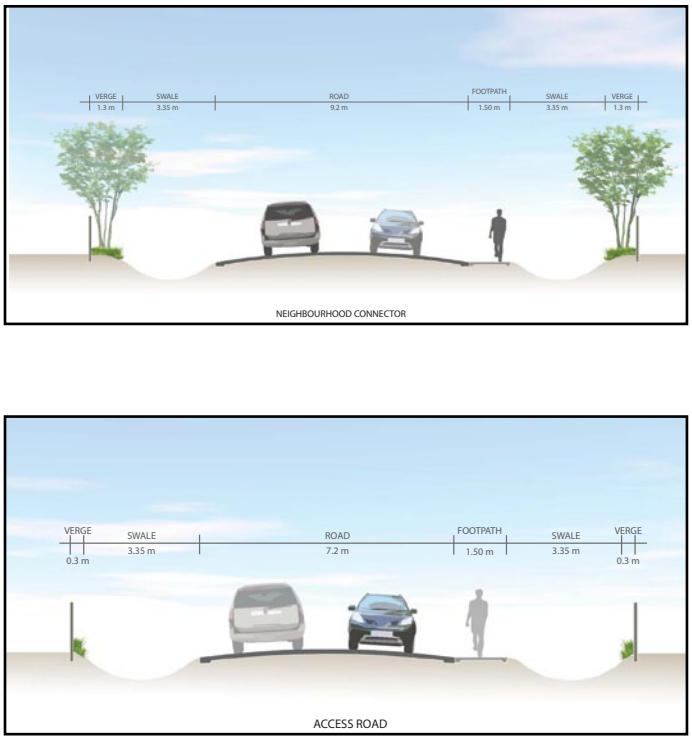


Figure 9: Indicative Road Cross Section

Traffic Generation and Management

The existing intersection of Wokarena Road with Northwest Coastal Highway is likely unsuitable to support traffic generated from the development of the precinct.

Traffic generation of 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 Northwest 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 channelized 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 Northwest 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 Northwest 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.

Pedestrian network

All roads within the precinct, as shown by cross-sections, will include footpaths to facilitate pedestrian access throughout the site.

3.3 Open Space

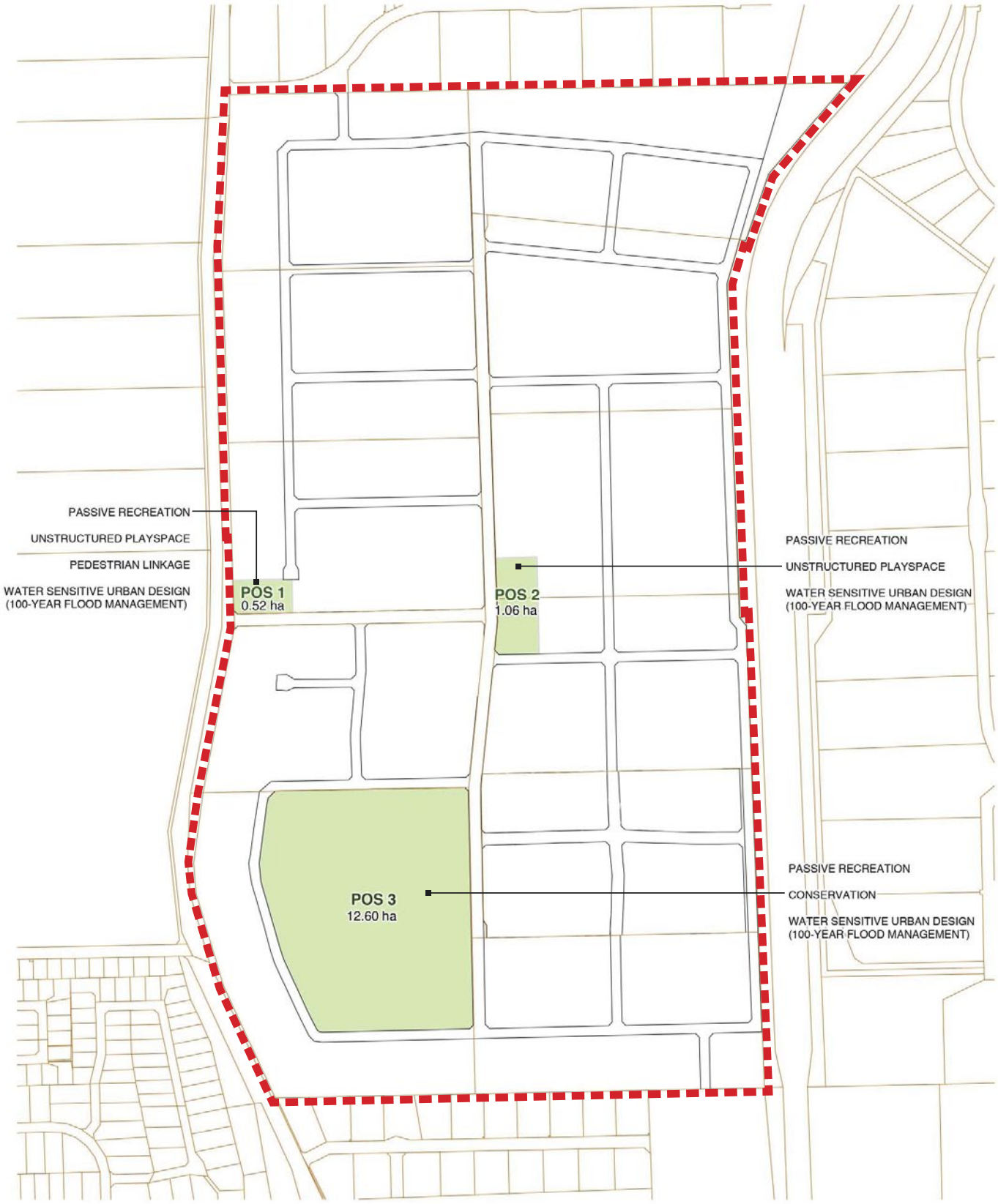
Consistent with the requirements of Liveable Neighbourhoods, the structure plan proposes ten percent of the subdivisible area for public open space. A schedule of public open space (POS) is shown in Table 6. The district and neighbourhood parks provide a range of passive and unstructured active recreational opportunities, incorporating protection and activation of conservation areas and water sensitive urban design.

As part of the design process, POS planning at Wokarena Heights will ensure universial access to benefit all members of the community.

Figure 10 illustrates the locations and key functions of public open space.

Table 6 - Public Open Space Schedule

	Hectares
Total LSP area	142.79ha
Deductions	
Regional road reserve	1.0ha
Total developable area	141.8ha
Required POS (10%)	14.18ha
Public Open Space	
District Park	12.6ha
Neighbourhood Parks	1.58ha
Total	14.18ha (10%)



LEGEND:

LOCAL STRUCTURE PLAN AREA

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

N

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Shire of Chapman Valley
Wokarena Heights Structure Plan

Public Open Space

Job Number 71-11105
Revision B
Date Oct 2013

Figure 10

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Plot Date: 22 October 2013 - 2:24 PM Plotted by: Angie Brown

Cad File No: G:\61\30130\Image Files\Manila Drawings\CADD\Richards Road Residential\FIGURES\FIG10_Public Open Space Rev b.dwg

POS 1 - Neighbourhood Park

POS 1, located at the primary entry to the development area, is proposed to be a passive recreational space that works as an entry statement to the Wokarena Heights Precinct.

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

The space will be a visual link between the Wokarena Heights precinct and the Buller Development Zone. Following realignment of the Northwest 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.

Entry statement set within a passive recreational space.

Permeable POS, which may allow for view corridors to the Buller Development Zone area

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.

View from public open space area.

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.

Unstructured public open space

Recreational space alongside a conservation area

3.4 Bushfire Management

The LSP 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 installation of fire hydrants and preparation of bushfire management plans will be required to provide detailed bushfire management planning at the time of subdivision.

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 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 integrated within public open space 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; and
- 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 will be maximised using WSUD and best management practices (BMPs) to ensure that stormwater is infiltrated as close to the source as practical.

3.6 Educational Facilities

No school facilities are required within the Wokarena Heights Precinct. Several schools have been planned in Drummond Cove and Glenfield that will service the development.

3.7 Infrastructure Coordination

Water

Water planning for the Wokarena Heights precinct has not yet been commenced by the Water Corporation. The Water Corporation have indicated that some improvements to existing water supply scheme will be provided to accommodate the proposed development in the area.

Currently this area is served by temporary water supply system. The system is located in Eliza Shaw Drive and incorporates a 50 m3 water storage tank, a booster pump, 150P-12 water reticulation at the inlet, and 100P-12 water main at the outlet.

Water Corporation has advised that the existing water main into the Wokarena Heights precinct will be connected to 2 ML storage tank planned to be constructed by the end of 2012 within the adjacent Parkfalls Estate. The inlet water reticulation located in Eliza Shaw Drive coming from Parkfalls is considered to be sufficient to supply the precinct without impacting on water servicing to the Parkfalls Estate. The existing storage tank in

Eliza Shaw Drive and the booster pump are being decommissioned. It is envisaged that a Pressure Reducing Valve will be installed on the reticulation main serving the precinct once connected to the new storage tank.

The existing water supply into the study area is temporary and not in accordance with standards, consisting of 100P-12 pipes located within easements within Lots 5 and 6 before entering the Wokarena Heights reserve.

Development of the precinct will require the existing infrastructure being upgrading to 150 P-12 pipes, and the relocation of upgraded infrastructure to within road reserves in the precinct. These upgrades 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 from Eliza Shaw Drive to the lot being subdivided based on advice from and negotiation with the Water Corporation.

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 Department of Health's '*Draft Country Sewerage Policy (2003)'* and *'Draft Government Sewerage Policy (2012').*

Power

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

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.

3.8 Development Contribution Arrangements

No formal development contribution scheme is proposed for the Wokarena Heights Precinct. However, the LSP does provide for sharing of some infrastructure costs.

Public open space costs will be shared across the development area through implementation of cash-in-lieu provisions provided by the Planning and Development Act 2005.

Water management costs are being shared through the preparation of a Local Water Management Strategy that provides a coordinated approach to drainage locations. The use of roadside swales rather than traditional pit and pipe networks will facilitate the onsite infiltration of most rainfall events. The location of drainage swales for the 100 year flood within public open space facilitates the sharing of drainage land costs through public open space cash-in-lieu processes.

Road infrastructure upgrades to Wokarena Road and Richards Road will be required to facilitate

development. As all lots will contribute to the need, a cost sharing arrangement through the provisions of the structure plan are proposed. Cost contributions have been apportioned across all parent lots based on the area of residential land that will be created on each lot, excluding public open space and roads as shown by Figure 11, 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 = Area of residential land on the lot
L= Total area of residential land in the LSP area
P= Percentage of total contribution required from landowner
C = Cost of road upgrades
A = Amount payable

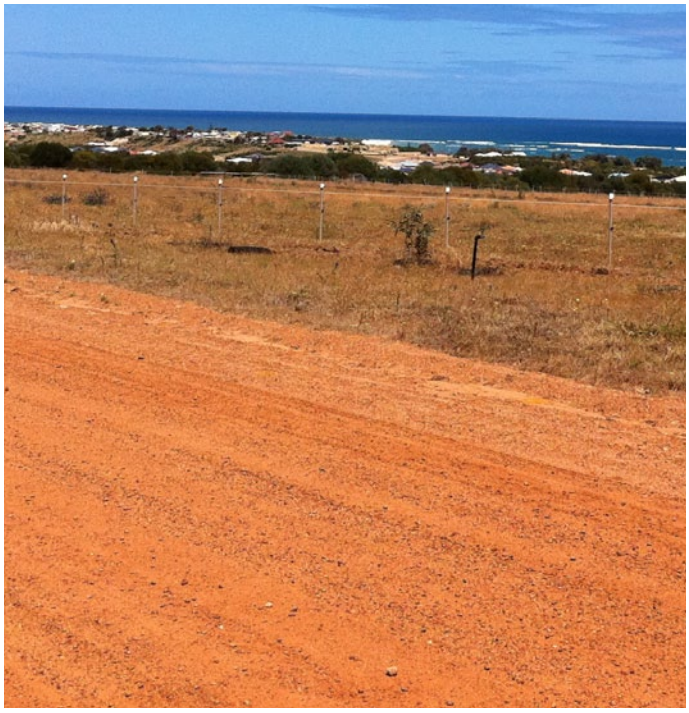
R / L x 100 = P (Table 7)

C x P = A

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 7 - Method of Cost Apportionment

Lot	Area Residential Land (excluding road reserves and open space)	Percentage Contribution to Road Infrastructure Upgrades
1	7.12	6.4%
2	10.36	9.4%
3	10.22	9.2%
4	10.43	9.4%
5	10.46	9.4%
6	9.67	8.7%
7	10.30	9.3%
8	10.66	9.6%
9	9.9	8.9%
10	11.22	10.1%
11	10.39	9.4%
Total	110.73	-



The surface of Wokarena Road will require upgrade

4.0 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)
- Bushfire Management Plan (condition of subdivision)

Each parent lot will represent a stage of subdivision; however it is not expected that each lot will subdivide to the ultimate development layout through a single subdivision stage. Staged subdivision may retain large lots around existing houses and improvements, whilst providing for part development as an interim measure.

Figure 13 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 planing, 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 public open space. Subdivision stages occurring ahead of the development of public open space 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 Wokarena Heights Local Structure Plan will require further detailed planning to resolve. These include:

1. Noise impacts associated with the Northwest 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 Parkfalls Estate, particularly at the northern boundary, and
3. Managing the interface between public open space and abutting private lots.

To manage these impacts, specific provisions for lots in these locations will be required. Detailed Area Plans, which provide additional development standards for particular circumstances, will be required to be developed for lots identified by the structure plan to manage potential impacts. Key issues to be considered and resolved in the preparation and adoption of Detailed Area Plans include:

1. Lots abutting highway:
- Increased rear setbacks and landscape buffering to assist noise attenuation;
- 'Quiet building design'.

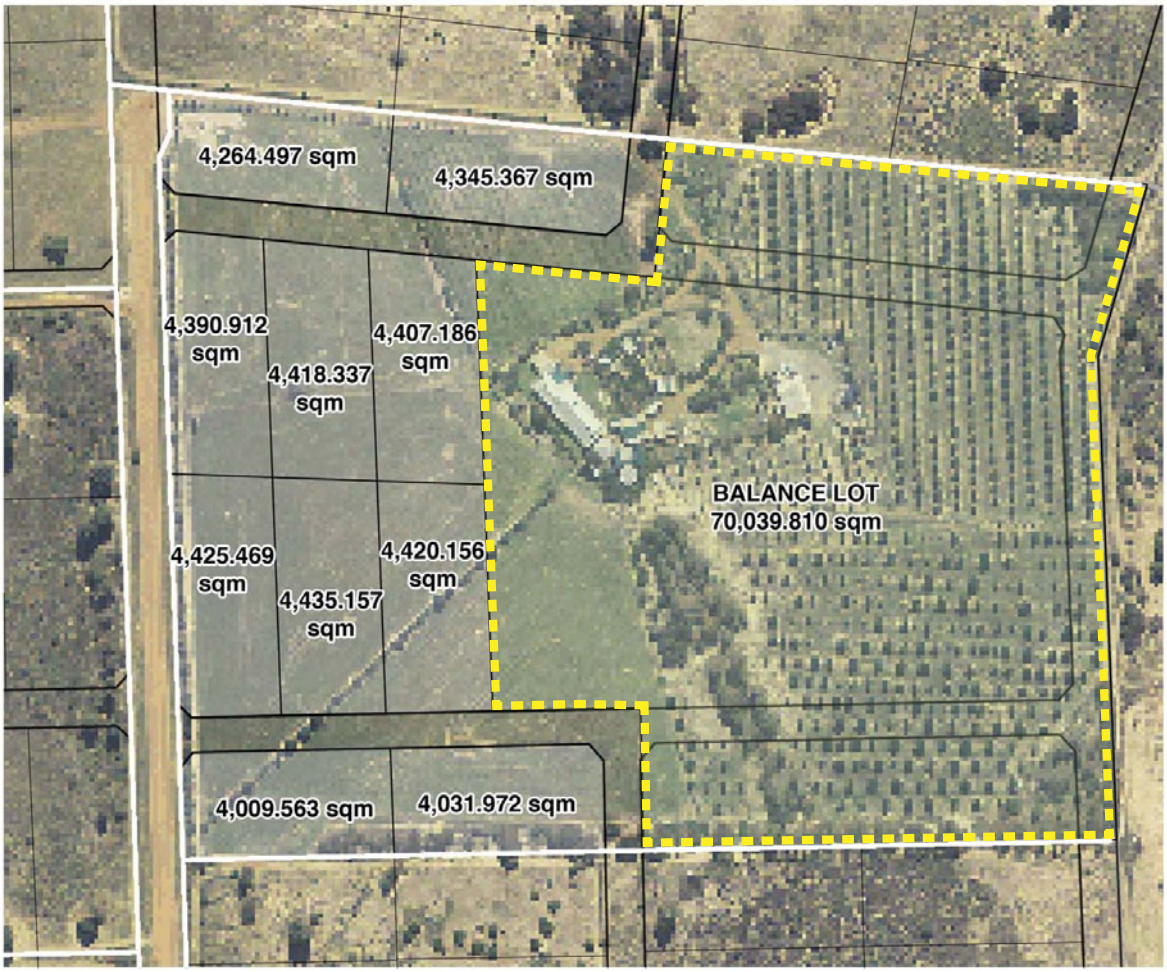
2. Lots abutting Parkfalls Estate:
- Increased rear setbacks and landscape buffers

to provide visual buffer for residents in Parkfalls Estate
- Specified building envelopes and site coverage requirements to maintain the amenity of residents in Parkfalls Estate.

3. Lots abutting Public Open Space:
- Passive surveillance of Public Open Space areas
- Activated frontages along Public Open Space and roadways

Figure 13 provides a conceptual example of a Detailed Area Plan for lots abutting Parkfalls Estate at 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 within Parkfalls Estate.

KEY PLAN



0 20 40 60m
SCALE 1:2000 AT ORIGINAL SIZE

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Shire of Chapman Valley
Wokarena Heights Structure Plan

Example Staged Subdivision
For Lot 7

Job Number 71-11105
Revision A
Date June 2012

Figure 12

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: 27 March 2012 - 2:27 PM Plotted by: Arianne Marisse G Manandic/Manila/GHD/AU Cad File No: G:\71\11105\CADD\Drawings\Richards Road Residential\71-11105_FIG11_Example Staged Subdt.dwg

SUBDIVISIONAL/DEVELOPMENT STANDARDS

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

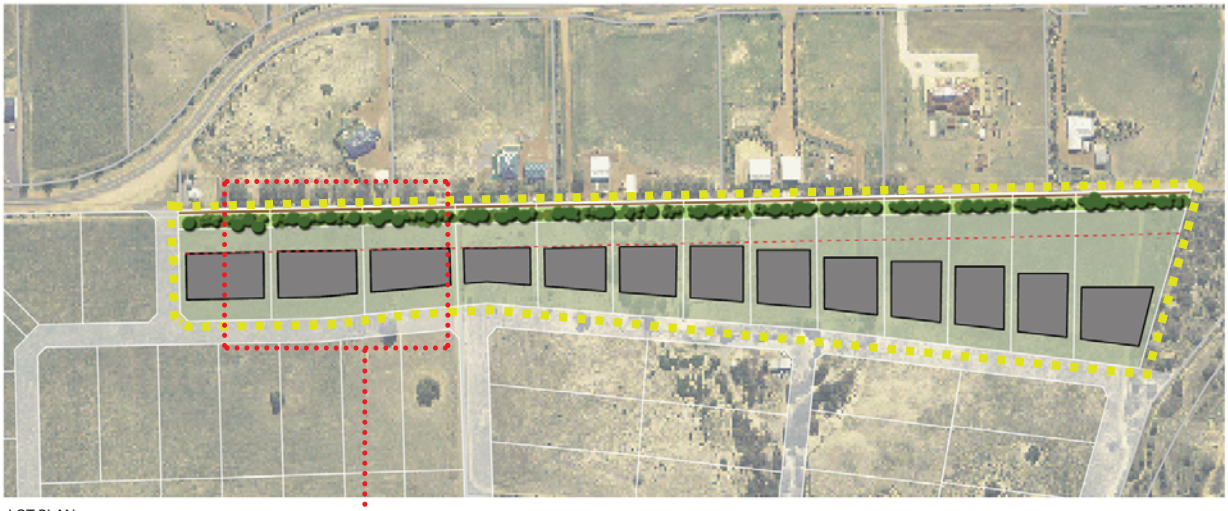
1. Dwellings and all incidental development is to be contained within the prescribed building envelope.

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



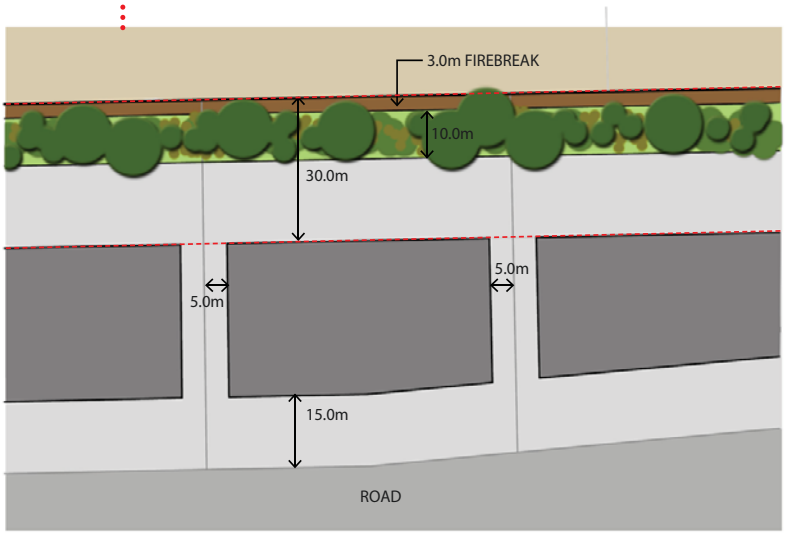
LOT PLAN

LEGEND:

BUILDING ENVELOPE

3.0m FIREBREAK

10.0m LANDSCAPE BUFFER



DETAIL PLAN *(Not to scale)*

0 20 40 60m
SCALE 1:3000 AT ORIGINAL SIZE

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Shire of Chapman Valley
Wokarena Heights Development

Example Detailed Area Plan for lots abutting Parkfalls Estate

Job Number 71-11105
Revision A
Date June 2012

Figure 13

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Plot Date: 27 June 2012 - 9:17 AM Plotted by: James Paxton Cad File No: G:\61\27523\Images\Manila Drawings\CADD\Richards Road Residential\FIGURES\FIG13_Example Staged Subd - northern lots.dwg

LEGEND:

LOCAL STRUCTURE PLAN AREA

Ⓐ DRAINAGE RESERVE

0 1 2 3m
SCALE 1:100 AT ORIGINAL SIZE

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Shire of Chapman Valley
Wokarena Heights Structure Plan

Development Yields

Job Number 71-11105
Revision B
Date June 2012

Figure 11

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Plot Date: 22 October 2013 - 2:21 PM Plotted by: Angie Brown

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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.

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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.

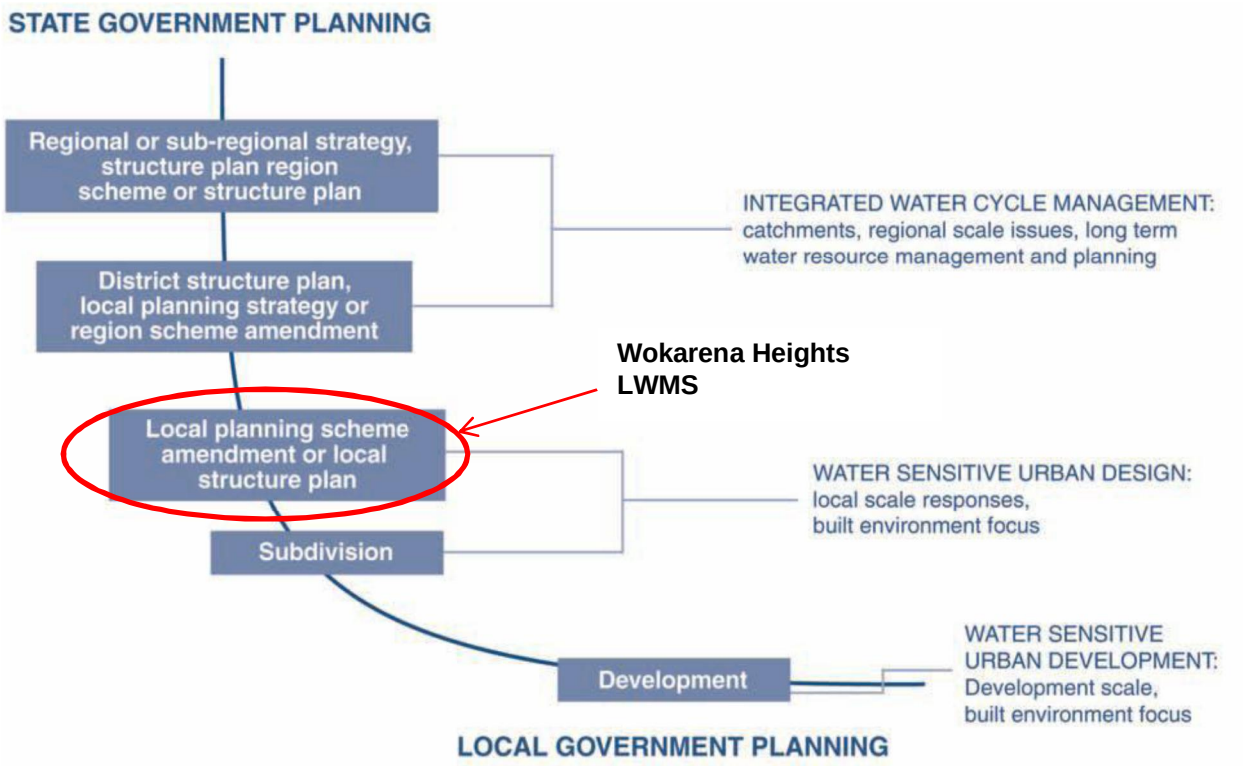

Figure 1: F**ramework for integrating drainage with land planning**

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

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Shire of Chapman Valley
Wokarena Heights Structure Plan

Locality plan

Job Number 61-27523
Revision E
Date 15 03 2012

Figure 2

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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: Richards Road Development site, 20111201 . Created by: S Glasson

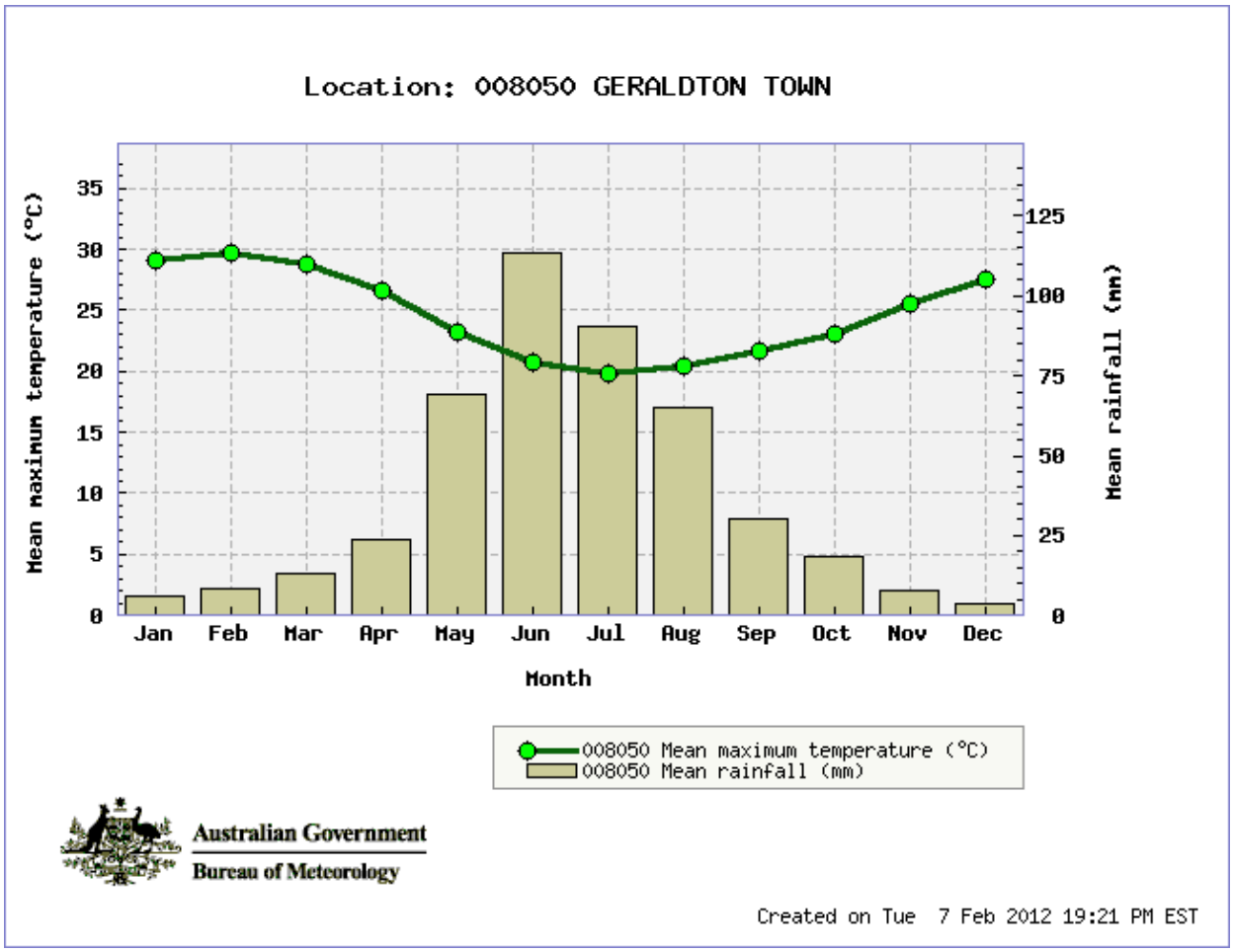


Figure 3: Climate

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.

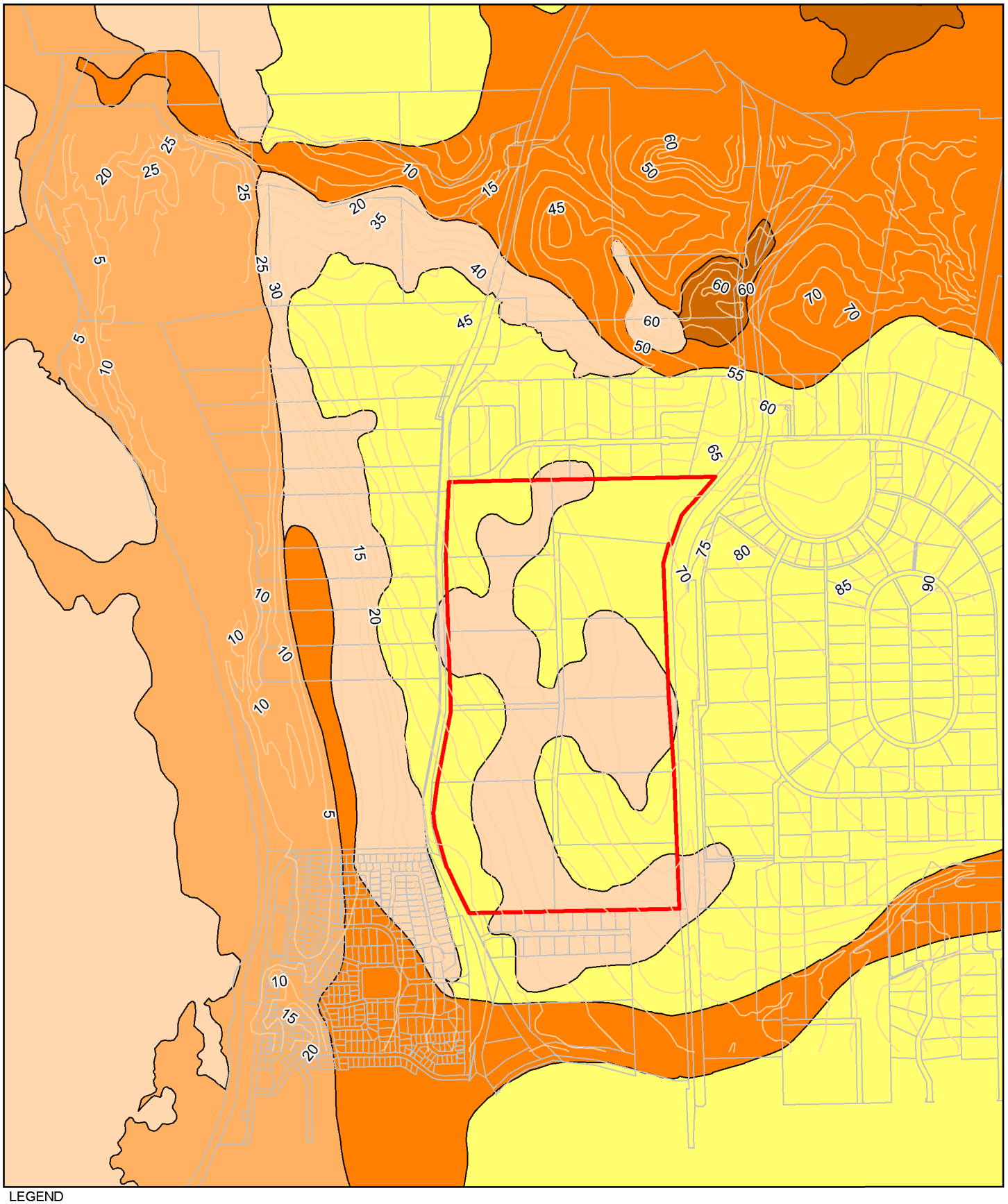
Bores located to the north and south of the area indicated that groundwater level is likely to be deeper than 10 m below ground level (refer Figure 6), and due to the elevation of the site, ranging from 25 up to 70m AHD, it is unlikely depth to groundwater would be less than 5m.

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).



LEGEND

Contours (5m)

Cadastre

Wokarena Heights Development site

Geology

Ferruginous gravel
Limesand
Limestone
Other
Red and yellow sand
Sand and gravel

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

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Shire of Chapman Valley
Wokarena Heights Structure Plan

Local geology

Job Number 61-27523
Revision E
Date 15 03 2012

Figure 4

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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

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Shire of Chapman Valley

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Shire of Chapman Valley
Wokarena Heights Structure Plan

Environmental constraints

Job Number 61-27523
Revision E
Date 15 03 2012

Figure 5

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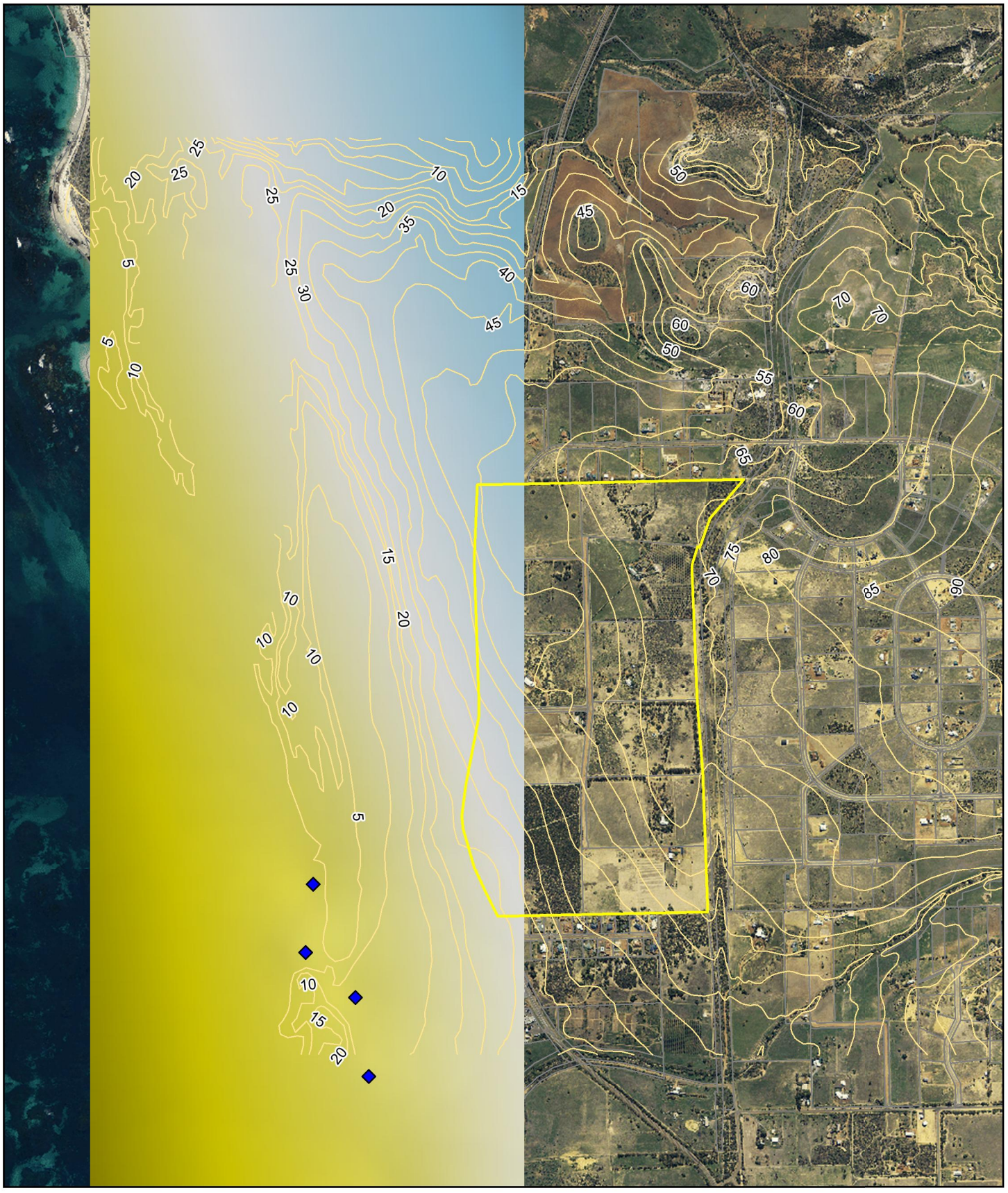
Data source: LGate: Aerial Image, 20111201. Contours (5m), 20111201. Cadastre, 20111201. Environmentally sensitive area, 20111201. Aboriginal heritage area, 20111201. Acid sulfate soils, 20111201. GHD: Richards Road Development site, 20111201 . Created by: S Glasson



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

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Shire of Chapman Valley
Wokarena Heights Structure Plan

Job Number 61-27523
Revision A
Date 15 03 2012

Groundwater levels

Figure 6

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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:

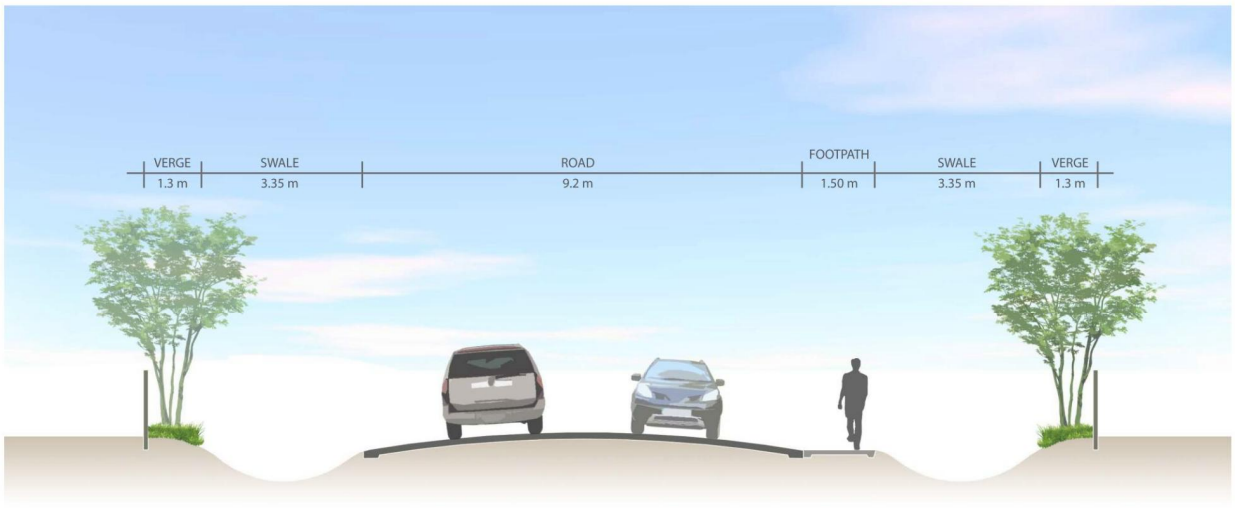
- To manage flows for ecological protection and manage the serviceability of roads and other infrastructure, lot and road runoff for minor rainfall events will be either captured in rainwater tanks or infiltrated as close to the source as practical.
- The post-development area should retain all catchment 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



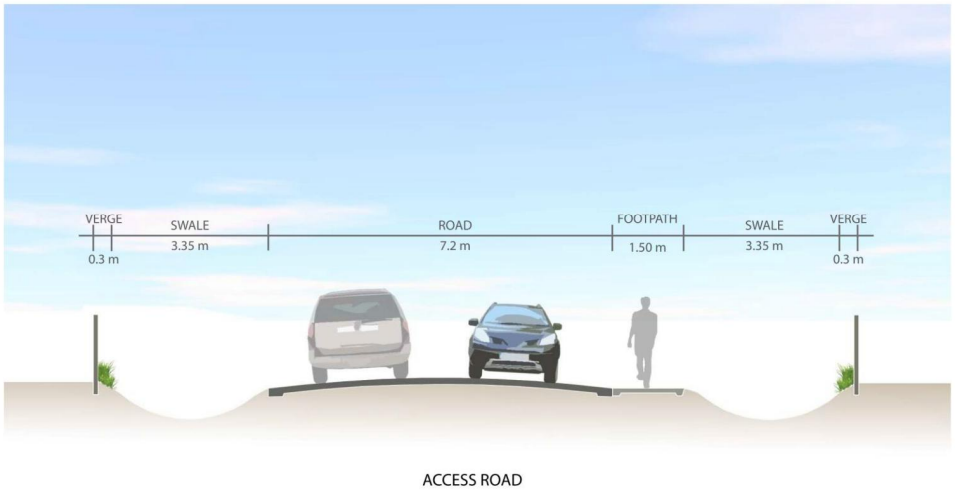


Figure 7: Road side swales within indicative road cross sections

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

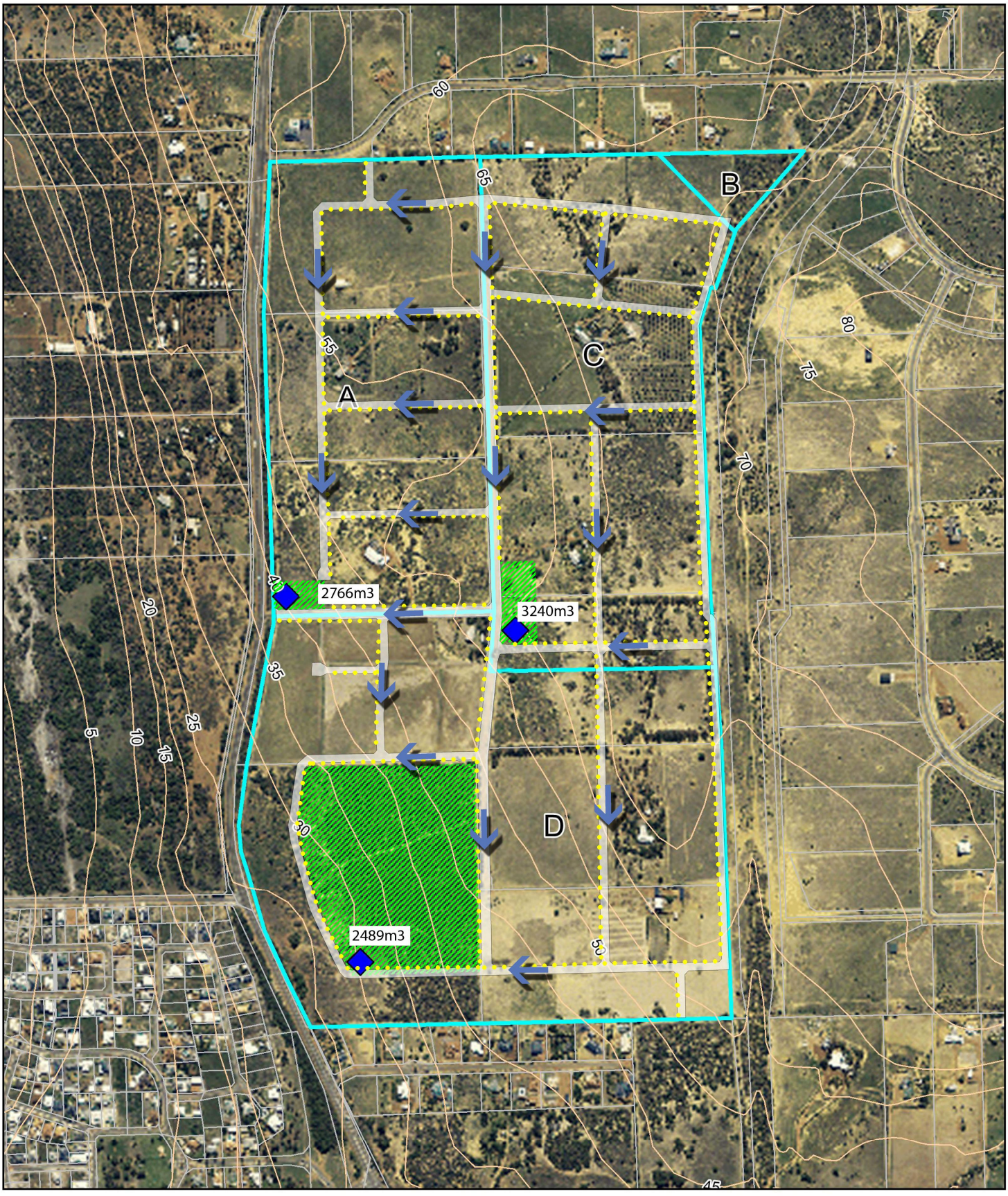
- Implement the swales relatively early to avoid temporary facilities and allow new vegetation to establish before housing construction of the developed lots is completed**.**

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

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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: *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.

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

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

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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

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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 local 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.

Local structure plans focus on the neighbourhood scale and provide a comprehensive land use framework for subdivision and development applications. Local 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.

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

What is the purpose of a local 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 local structure plan provides a comprehensive framework for land use to facilitate future subdivision and development of an area. Local 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 Local Structure Plan?

The Wokarena Heights Local 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 12 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 'Plan 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 7 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 DepartmentofEnvironmentrequirementspertaining 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 Council 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 12 in Part Two of the Local 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).

GHD Pty Ltd

T: 61 8 6222 8222 F: 61 8 6222 8555 E: permail@ghd.com.au

Document Status

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		Name	Signature	Name	Signature	Date
0	Colleen Murphy	Anna Kelderman		Anna Kelderman		4/4/2012
1	Matt Morgan	Colleen Murphy		Anna Kelderman		28/06/2012
2	Colleen Murphy	Anna Kelderman		Anna Kelderman		12/10/2012
3	Colleen Murphy	Anna Kelderman		Anna Kelderman		24/10/2013

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